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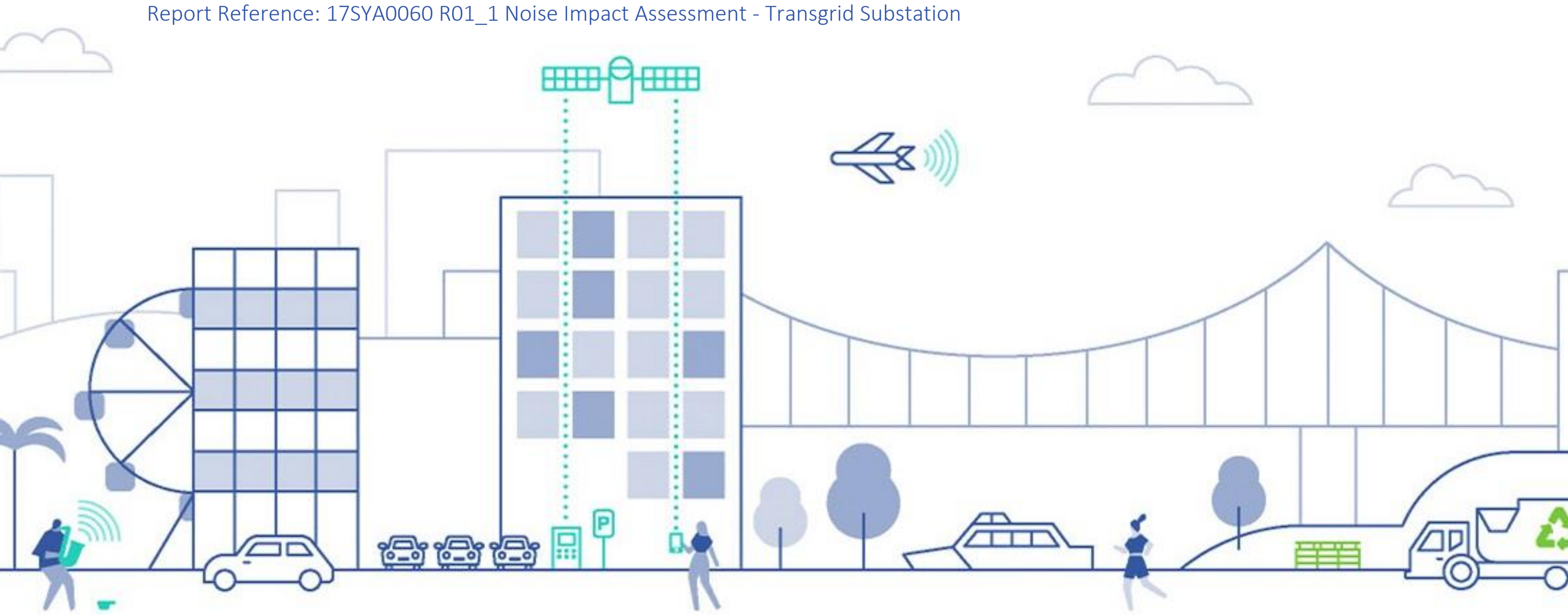
Acoustic Consulting

Ralston Avenue, Belrose

Proposed Residential Development

Noise Impact Assessment of TransGrid Substation

Prepared for Matthews Civil Pty Ltd
Report Reference: 17SYA0060 R01_1 Noise Impact Assessment - Transgrid Substation



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About TTM

For 30 years, we've been at the centre of the Australian development and infrastructure industry. Our unique combination of acoustics, data, traffic and waste services is fundamental to the success of any architectural or development project.

We have over 50 staff, with an unrivalled depth of experience. Our industry knowledge, technical expertise and commercial insight allow us to deliver an exceptional and reliable service.

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Revision Record

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5.				

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Executive Summary

TTM conducted a noise impact assessment of the Sydney East TransGrid substation adjacent the proposed Belrose Residential Development, located at Ralston Avenue, Belrose.

The proposed residential subdivision is expected to comply the relevant guidelines and standards with no additional noise mitigation measures required.

Contents

Table Index

Figure Index

1 Introduction

TTM was engaged by Matthews Civil Pty Ltd to undertake a noise impact assessment for the proposed Belrose Residential Development, located at Ralston Avenue, Belrose. The assessment investigates the impact of the adjacent TransGrid Substation onto the proposed development. The report is required to determine the extent of the noise impact and any noise mitigation required to meet noise criteria.

1.1 Background

The Belrose Residential subdivision consists of 156 residential lots, adjacent to the existing TransGrid, Sydney East Substation. The shortest distance between the boundary of the substation and the boundary of the closest residential lot is approximately 40 metres.

TransGrid operates the NSW high voltage transmission line network, which constrains the subject site via, the Sydney North – Sydney East 330 kV transmission lines and easements that are located to the north, and the Sydney East substation. TransGrid's network and key assets are essential for supplying electricity to NSW and consideration must be given to any developments that are proposed to occur adjacent to those assets.

TransGrid has raised objections to the proposal of rezoning the land adjacent to the Sydney East substation to residential. One of the objections relates to noise and the potential restrictions that may be placed on TransGrid to mitigate any adverse noise impact from their substation onto the proposed adjacent residential, public recreation and environmental management zones.

1.2 Scope

The noise impact assessment is based on the following:

- NSW Industrial Noise Policy[1]
- Internal sound design levels in accordance with AS 2107[2]
- Subdivision plans drafted by LTS Lockley, as presented in Appendix A
- Noise measurements, modelling, analysis and calculations conducted by TTM.

The assessment includes the following:

- Description of the development site and proposal.
- Measurement of existing ambient and TransGrid substation noise levels.
- Statement of assessment criteria relating to industrial noise emissions.

[1] NSW Environment Protection Authority (2000), NSW Industrial Noise Policy

[2] AS NZS 2107:2016. Acoustics - Recommended design sound levels and reverberation times for building interiors

- Assess potential noise impact of the substation onto the subdivision.
- Analysis of predicted noise levels.
- Details of noise control recommendations to be incorporated to achieve predicted compliance.

2 Site Description

2.1 Site Location

The Belrose Residential subdivision is located at Ralston Avenue, Belrose, formally described as Lot 1 in DP1139826. The site is located approximately 16 km north of the Sydney CBD. Directly to the east of the site is the Sydney East substation, operated by TransGrid.

The site location and surrounding land uses are shown in Figure 1.

Figure 1: Location of Belrose subdivision and surrounding land uses

2.2 Description of Acoustic Environment

The site is typical of a rural area with typical natural sounds, such as insects, birds, wind, etc., with little to no road traffic noise.

Close to the TransGrid substation, distinguishable crackling noise from the transmission lines is audible. Further away from the substation, noise from the transmission lines attenuates due to distance loss. Adjacent to the substation fence is a dirt road and a berm. The berm is approximately three metres high and provides some noise shielding to the future development. The land generally slopes down, away from the substation. Due to the topography of the site and the berm, noise levels are noticeably lower on the development site.

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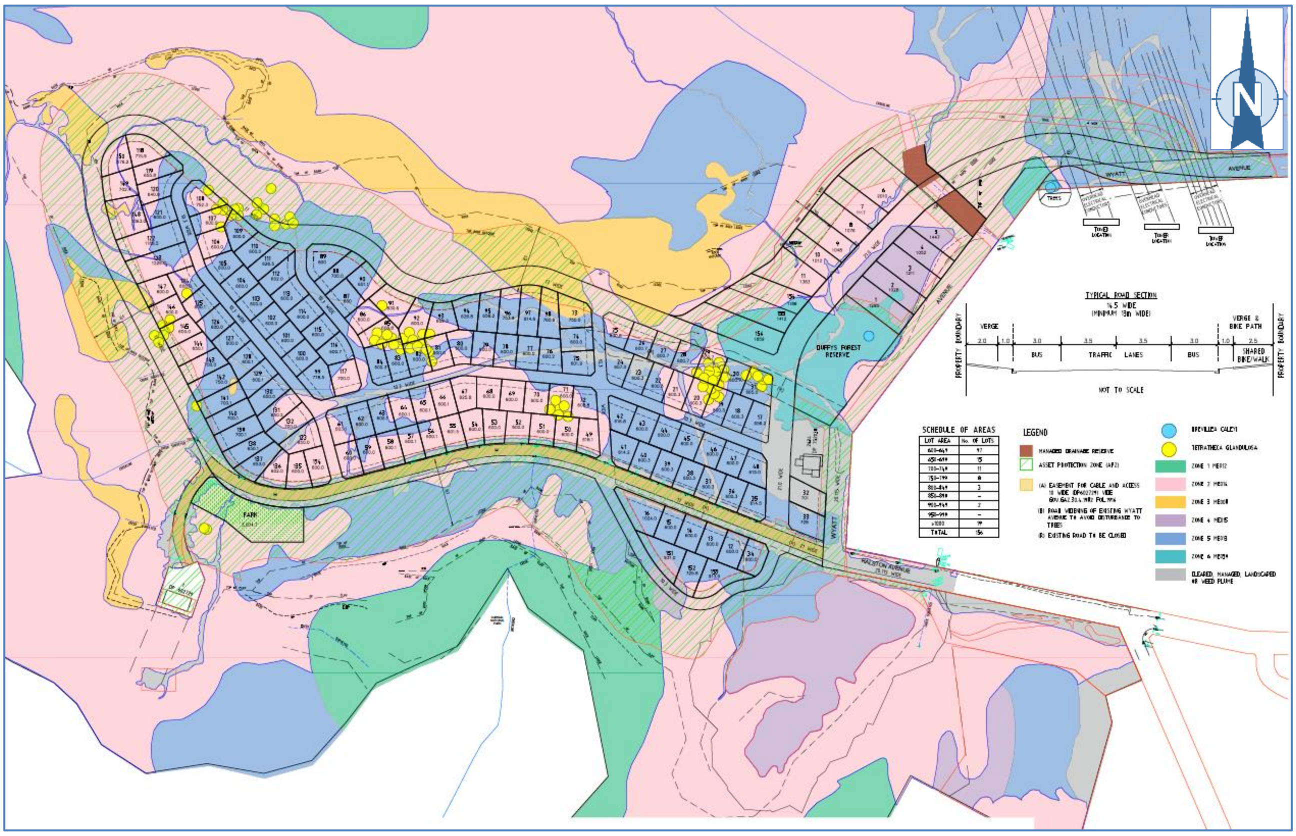
3 Proposed Development

The Belrose residential development comprises of 156 residential lots, located directly to the west of the Sydney East substation. A new road, Wyatt Avenue, is also proposed at the eastern boundary of the site, to service the proposed development.

The location and lot layout of the development is shown in Figure 2.

Figure 2: Development Site



4 Noise Survey

Ambient noise measurements and noise source levels of the TransGrid substation were undertaken on site at the Belrose Development between Wednesday the 4th and Tuesday the 10th October 2017. Both attended and unattended noise measurements were conducted in accordance with the recommendations outlined in Australian Standard AS 1055[3].

4.1 Equipment

The following equipment was used to measure existing noise levels:

- Unattended ambient and road traffic noise:
  - Norsonic Nor140, Noise Logger (S/N 1406506)
  - Brüel & Kjær Type 2250 Light, Noise Logger (S/N 3006261)
- Attended ambient and road traffic noise:
  - Type 2250, Type 1 Sound Level Meter (S/N 3004473)
- Calibrator:
  - Type 4231, Sound Calibrator (S/N 3009809)

All equipment was calibrated by a National Association of Testing Authorities (NATA) accredited laboratory. The equipment was calibrated before and after the measurement session. No significant drift from the reference signal was recorded.

4.2 Noise Monitoring

4.2.1 Unattended Ambient and Substation Noise

Unattended noise monitoring was undertaken to measure existing ambient and substation noise levels. The noise monitoring locations are shown in Figure 3.

One noise monitor was placed as close as possible to the substation considering access and safety of equipment to capture noise source levels, shown as Location 1 on . The monitor was approximately six metres from the safety fence of the substation.

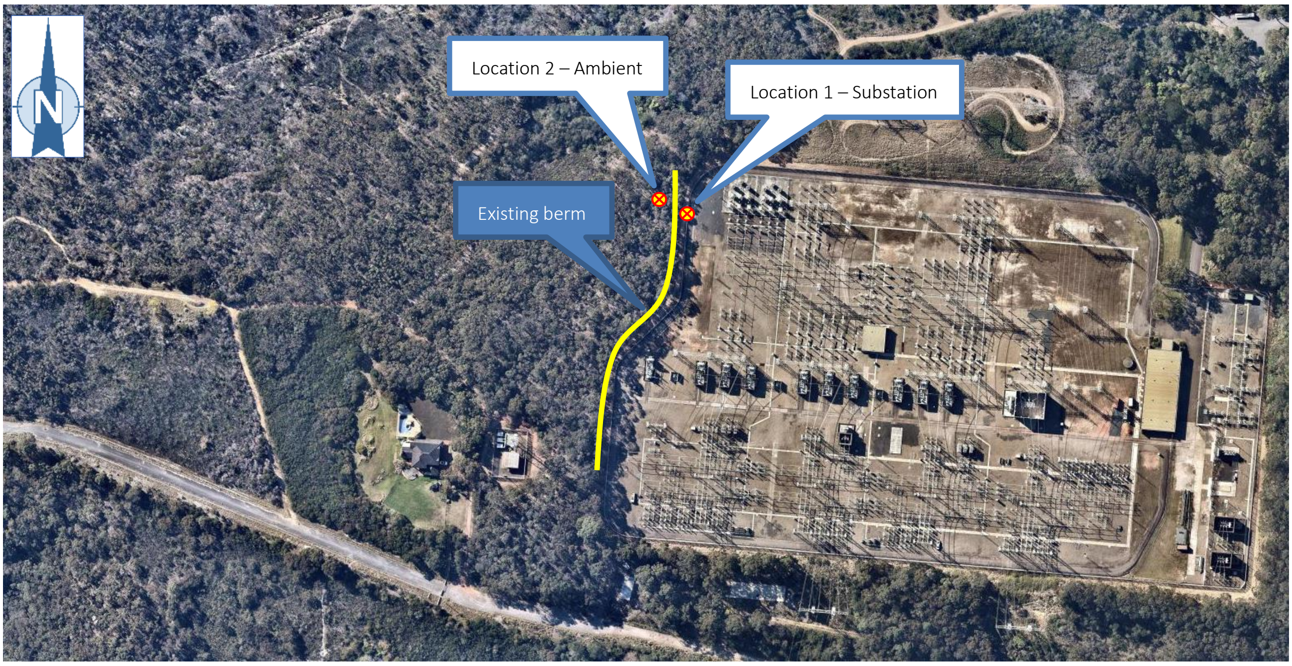
A second monitor was placed further away from the substation on the other side of the berm to capture typical ambient noise levels in the area, shown as Location 2 on . The monitor was approximately 14 metres away from the safety fence of the substation. Access further away from the substation was limited.

Both microphones were in a free-field position at a height of 1.5 metres above ground level.

[3] AS 1055.1:1997. Acoustics - Description and measurement of environmental noise - General procedures

Average, maximum and statistical noise parameters were recorded by the noise monitors at 15-minute intervals in fast response. The weather throughout the monitoring period was described as fine with light breeze.

Figure 3: Noise Monitoring Locations



4.2.2 Attended noise measurements

Attended one third-octave band noise source measurements were also undertaken onsite at Location 1 during logger installation and collection. The measurements were taken using a Brüel & Kjær Type 2250, Type 1 Sound Level Meter (S/N 3004473). The measurements are used to verify the characteristics of the noise source and confirm any applicable noise source adjustments in the assessment.

The Sound Level Meter was secured on a tripod and its microphone was positioned next to the microphone of the noise logger. Average, maximum and statistical noise parameters were recorded for a duration of 15 minutes in fast response. The weather throughout the attended measurements was described as fine with a light breeze. Humidity was approximately 60-70% on the days of measurements. The sound level meter was checked for calibration before and after the measurement and no significant drift was observed.

4.3 Results of Noise Survey

4.3.1 Substation and Ambient Noise Monitoring Results

Table 1 presents the measured substation and ambient noise levels at Locations 1 and 2 respectively (Refer to Table 1). The noise monitoring results are represented graphically in Appendix B. The monitoring results were used to determine the noise source levels and assessment criteria for the development.

Table 1: Noise Monitoring Results

Period	Existing Noise Levels in dB(A)			
	Rating Background Noise Levels, RBL L_{90}	L_{eq}	L_{10}	L_1
Location 1 – Substation				
Day	38	48	50	68
Evening	40	46	49	60
Night	41	44	47	56
Location 2 – Ambient				
Day	33	45	49	64
Evening	33	42	46	57
Night	33	38	44	55
Note: - Day-time period is from 0700 to 1800 (Monday to Saturday) and 0800 to 1800 (Sundays and Public Holidays) - Evening period is from 1800 to 2200 - Night-time period is from 2200 to 0700 (Monday to Saturday) and 2200 to 0800 (Sundays and Public Holidays)				

At Location 1, the existing L_{Aeq}, L_{A10} and L_{A1} noise levels reduce slightly throughout the day, evening and night periods. Background noise levels slightly increases due to cicada noise in the evening and night periods.

At Location 2, the background noise levels are similar throughout the day, evening and night periods, showing that natural sounds dominate the acoustic environment in the area.

4.3.2 Attended Noise Source Measurements

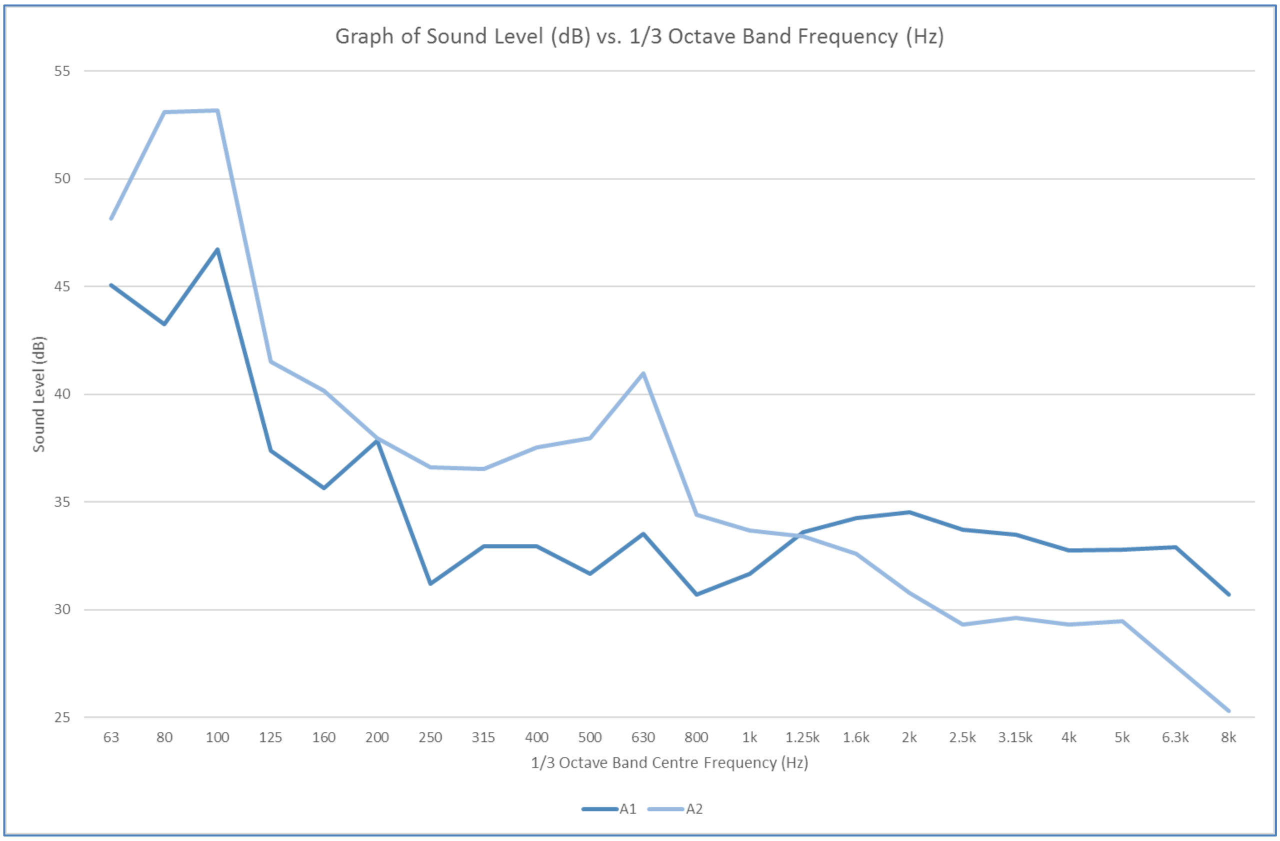
The results of the attended noise source measurements at Location 1 are summarised in Table 2.

Table 2: Summary of attended one-third octave band noise source measurements

Ref.	Approx. Start Date/Time	Measured one-third octave band Noise Levels in dB																						Sum L_{eq} in dB(A)	Sum L_{eq} in dB
		63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k		
A1	04/10/17 09:51	45	43	47	37	36	38	31	33	33	32	34	31	32	34	34	35	34	33	33	33	33	31	**45**	**54**
A2	10/10/17 10:57	48	53	53	42	40	38	37	37	38	38	41	34	34	33	33	31	29	30	29	29	27	25	**46**	**58**

The results are represented graphically in Figure 4.

Figure 4: Graphical representation of attended noise measurements



The measurements show that the noise source has no tonal characteristics. The cracking sound of the source was neither impulsive nor intermittent. The noise source was constant throughout the measurement period.

The difference between the C and A weighted levels is 8-9 dB. As defined in Table 4.1 of the NSW INP, no correction factor is applicable for low frequency component of the source for differences less than 15 dB. No other corrections are applicable for tonality, impulsiveness and intermittency of the source.

5 Noise Criteria

The noise criteria for the assessment have been based on the following guidelines and standards:

1. NSW Industrial Noise Policy.
2. NSW SEPP Infrastructure, and

5.1 NSW Industrial Noise Policy

To protect the community from excessive intrusive noise and preserve the amenity of the future residential development, the relevant noise criteria are defined in the NSW Industrial Noise Policy (INP).

The policy offers guidelines to minimise industrial noise impact to Noise Sensitive Receivers (NSRs). Project-specific noise levels (PSNLs) are determined and set at the boundary of relevant NSRs which are not to be exceeded.

The policy states that the most stringent of the intrusive and amenity criteria, described below, sets the PSNL.

5.1.1 Intrusiveness criterion

The INP states:

> *The intrusiveness of an industrial noise may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period does not exceed the background noise level measured in absence of the source by more than 5dB.*

The INP recommends methods for determining background noise level. At the planning and approval stage, the long-term method is used which is designed to ensure that the criterion for intrusive noise will be achieved for at least 90% of the time periods (day/evening/night), known as the Rating Background Level (RBL).

The intrusiveness criterion can thus be summarised by:

$$L_{Aeq,\ 15\ minute} \leq \text{Rating Background Level plus 5dB}$$

5.1.2 Amenity criterion

The INP sets Acceptable Noise Levels (ANLs) for areas impacted by industrial noise that should ideally not be exceeded to protect against impacts such as speech interference and community annoyance. Any new industrial noise sources should not increase overall industrial noise in an area and cause ‘background creep’, where background noise levels rise overtime as each new noise source is introduced. Where all practical and reasonable noise mitigation has been applied and still the ANL cannot be achieved, the INP suggests a Recommended Maximum noise level which is 5 dB above the ANL.

Where there is an existing level of industrial noise affecting the NSRs, modifications to the ANL are required as defined in Section 2.2 of the INP.

5.1.3 Project-specific noise levels

The Project-specific noise level (PSNL) is the target noise emission level from the new noise source as a result of the new development at the boundaries of the identified NSRs. The PSNL is taken to be the lowest and most stringent of the intrusiveness and amenity noise criteria.

5.1.4 Evaluated INP Criteria

Based on the unattended noise monitoring results at Location 2 given in Table 1, the applicable criteria have been evaluated and are summarised in Table 3.

Table 3: NSW INP Evaluated criteria

Type of receiver	Assessment period	Intrusiveness Criterion, $L_{eq,15min}$ dB(A)	Amenity Criterion $L_{eq,15min}$ dB(A)*	Project-Specific Noise Levels (PSNLs) $L_{eq,15min}$ dB(A)
Residential	Day	38	50	**38**
	Evening	38	45	**38**
	Night	38	40	**38**

Note:
- Day-time period is from 0700 to 1800 (Monday to Saturday) and 0800 to 1800 (Sundays and Public Holidays)
- Evening period is from 1800 to 2200
- Night-time period is from 2200 to 0700 (Monday to Saturday) and 2200 to 0800h (Sundays and Public Holidays)

* The amenity criterion has been based on the recommended acceptable noise levels for Rural Noise Amenity Area as given in Table 2.1 of the INP. No modifications are applicable in this situation.

Table 3 shows that the intrusiveness criterion is the most stringent for the all time periods, and are therefore the PSNLs for the future residential properties on the development.

The PSNLs are required to be met at the closest property boundary to the industrial noise source. Compliance at the closest property boundary ensures all other properties located further away from the noise source also complies with INP noise requirements.

5.2 Australian Standard AS 2107

Internal sound design levels for residential properties are recommended by AS 2107, which are required to be met to preserve the acoustic amenity of the internal space.

The internal design sound levels have been summarised for the different types of occupancy and are presented in Table 4.

Table 4: Summary of internal design sound levels for each type of occupancy

Type of occupancy	Recommended design sound level, L_{eq} in dB(A)
Houses in rural areas with negligible transportation— Sleeping areas (night time)	25-30

6 Noise Impact Assessment

The Belrose residential subdivision is impacted by noise emissions from the Sydney East TransGrid substation.

The impact of the substation has been modelled using the noise measurements and site elevation data provided to TTM for the purpose of this assessment.

6.1 Noise Prediction Model

Industrial noise emissions from the substation were predicted using the ISO noise algorithm model on SoundPLAN. The parameters used in the model are summarised in Table 5.

Table 5: Parameters used in SoundPLAN model

Parameter		Value
Façade correction		+2.5 dB
Ground effect		1 (Soft ground – grass)
Noise source (Substation) modelled as area source	Area	57 m^2
	L_W	102 dB(A)
	Height	3 metres

Current digital elevation survey data of the development site were provided by the client and was used in the SoundPLAN model for represent current topography of the site for model verification purposes and noise predictions.

6.1.1 Verification of noise model

The measured long-term noise monitoring results (day-time) and predicted free-field noise levels at Location 1 (Refer to) are shown in Table 6.

Table 6: Comparison of measured and predicted free-field noise levels

Measurement location (Refer to)	Sound Pressure Levels, L_{Aeq} in dB(A)		
	Measured	Predicted	Difference
Location 1	48.0 (Day-time)	47.3	-0.7

The predicted road traffic noise level using SoundPLAN is 0.7 dB lower (underprediction) than the measured noise level. The model is within the accepted model variance of ±2 dB and is therefore validated.

The predicted noise levels will be adjusted by +0.7 dB to account for the underprediction of the model.

6.1.2 Model Parameter Offsets

Offsets have been applied to the predicted noise levels from the model to account for noise variations during the day, evening and night-time periods. The offsets are summarised in Table 7.

Table 7: Offsets for different time periods

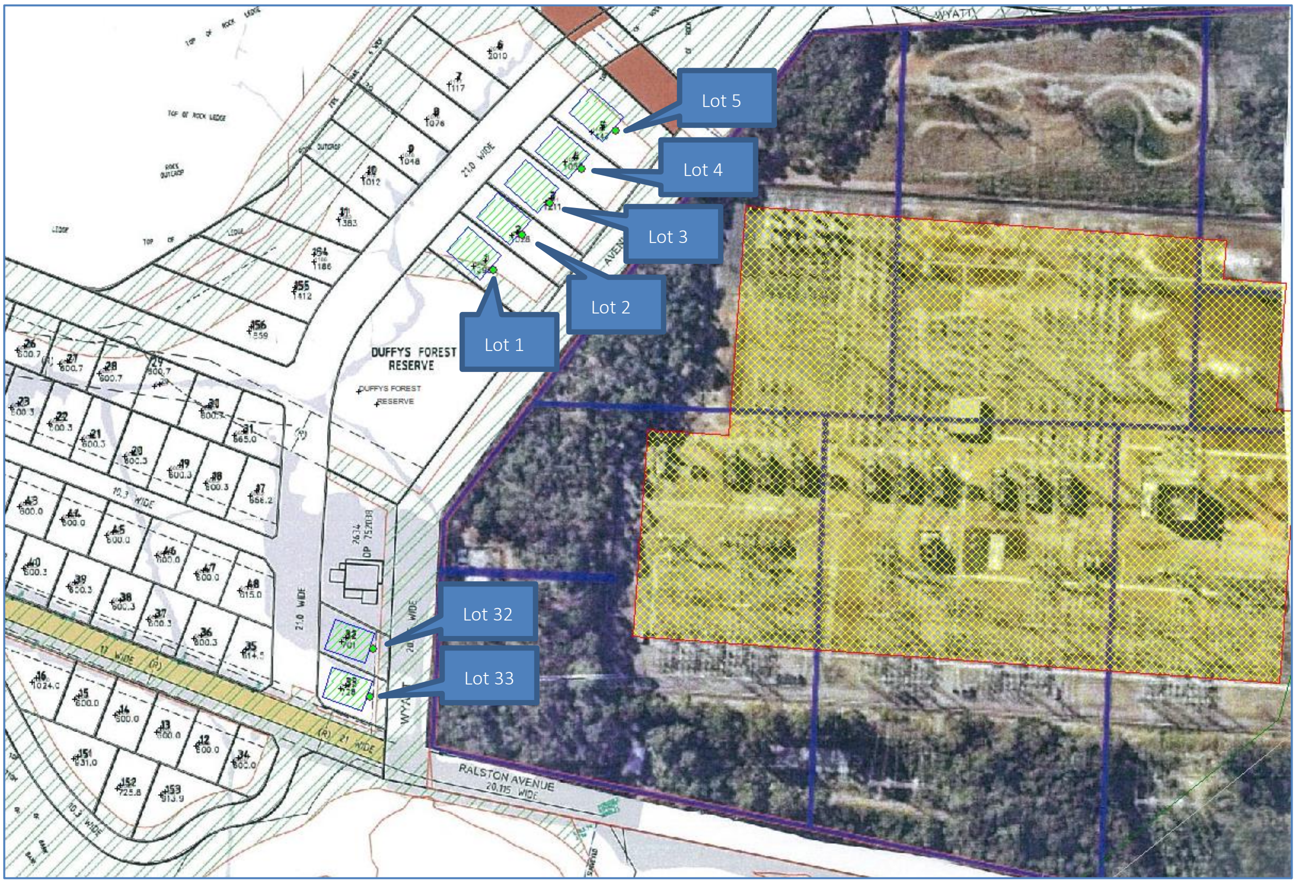
Period (T)*	Offset in measured noise levels, in dB
Day	0
Evening	-2
Night	-4
Note: * - Day-time period is from 0700 to 1800 (Monday to Saturday) and 0800 to 1800 (Sundays and Public Holidays) - Evening period is from 1800 to 2200 - Night-time period is from 2200 to 0700 (Monday to Saturday) and 2200 to 0800h (Sundays and Public Holidays)	

6.2 Prediction Results

The free-field and façade-corrected industrial noise levels have been predicted across the development site using the SoundPLAN model, to represent the impact of the substation onto the residential subdivision.

Lowset nominal buildings have also been modelled on the lots closest to the substation to assess noise impact to the closest residential dwellings. The noise levels have been predicted at the facades of the nominal buildings. The locations of the modelling receivers are shown in Figure 5.

Figure 5: Location of modelling receivers



The predicted results at the modelling receivers are summarised in Table 8.

Table 8: Prediction results at modelling receivers

Lot No.	Predicted noise levels, in dB(A)	
	Free-field	Façade-corrected external – Corrected for night-time period
1	30	32
2	28	29
3	27	29
4	26	28
5	26	28
32	33	35
33	32	34

6.2.1 Compliance with NSW INP

Based on the predicted free-field results, at the closest dwellings to the substation, compliance with the NSW INP PSNL criteria of **38 dB(A)** is achieved.

6.2.2 Compliance with AS 2107

A 15 dB noise reduction is typically achieved from standard residential building envelopes where the windows are slightly open. Additional noise reduction greater than a total of 20 dB is achieved when the windows are closed. This means that predicted façade-corrected external noise levels are typically 15 dB more than the internal noise levels. Based on this assumption, the predicted internal noise levels have been summarised in Table 9, as well as, a comparison with AS 2107 recommended internal design levels.

Table 9: Internal noise levels vs. AS 2107 recommended internal design levels

Lot No.	Predicted noise levels, in dB(A)		Compliance with AS NZ 2107 Bedroom internal design level of 25-30 dB(A)
	Façade-corrected external – Corrected for night-time period	Internal noise levels (Bedroom)	
1	32	17	✓
2	29	14	✓
3	29	14	✓
4	28	13	✓
5	28	13	✓
32	35	20	✓
33	34	19	✓

As shown in Table 9, based on the noise predictions, the recommended internal design sound levels for bedrooms will be achieved.

7 TTM Recommendations

Based on the noise assessment results, no additional noise mitigation is required to the proposed residential subdivision. The noise emissions from the Sydney East TransGrid substation are expected to comply with the NSW INP criteria at the proposed boundary of the houses closest to the substation. The internal design sound levels of the future dwellings are also expected to be met with no specific or additional acoustic measures.

Nevertheless, to minimise noise from the substation the future residential dwellings on Lots 1-5, 32 and 33 are recommended to be built closer to the western lot boundary to maximise the setback distance between the substation and the dwelling.

8 Conclusion

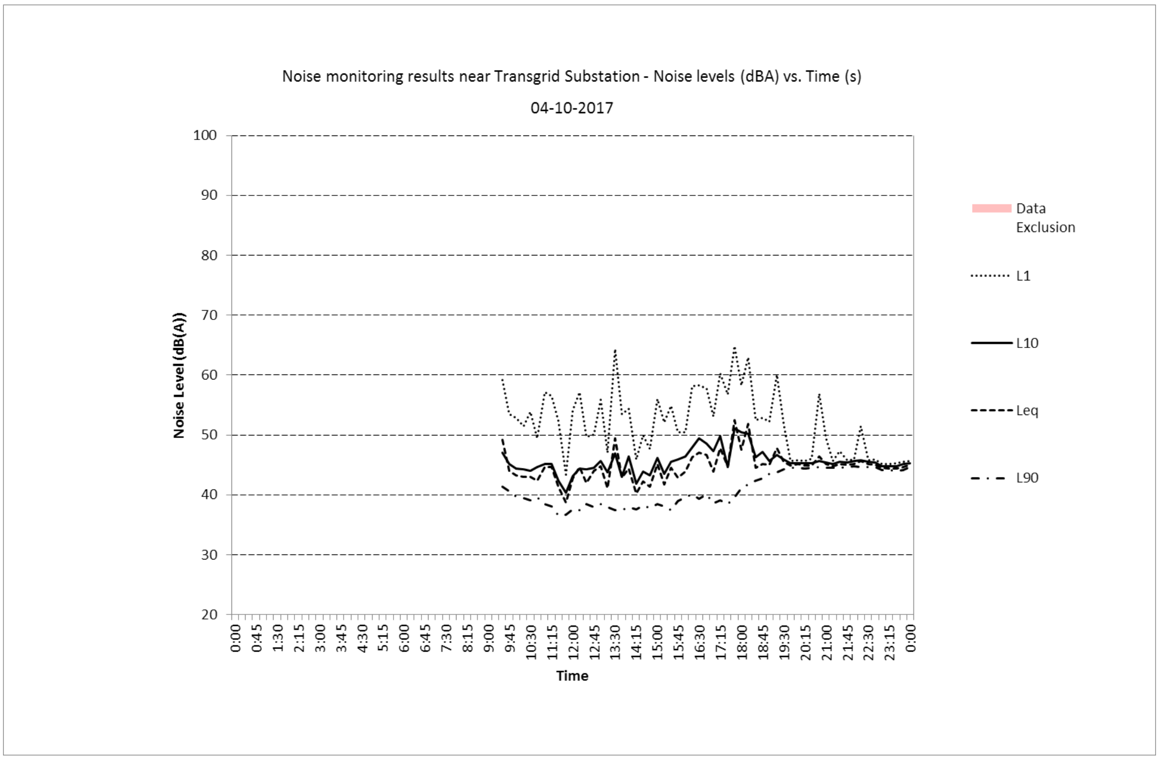
The noise impact assessment report, has been prepared for Matthews Civil Pty Ltd, and the proposed Belrose Residential Development, located at Ralston Avenue, Belrose. The assessment has concluded that no additional noise mitigation measures are required to be applied to the proposed residential subdivision, to meet the external NSW INP, and the internal AS 2107 design sound levels for sleeping areas.

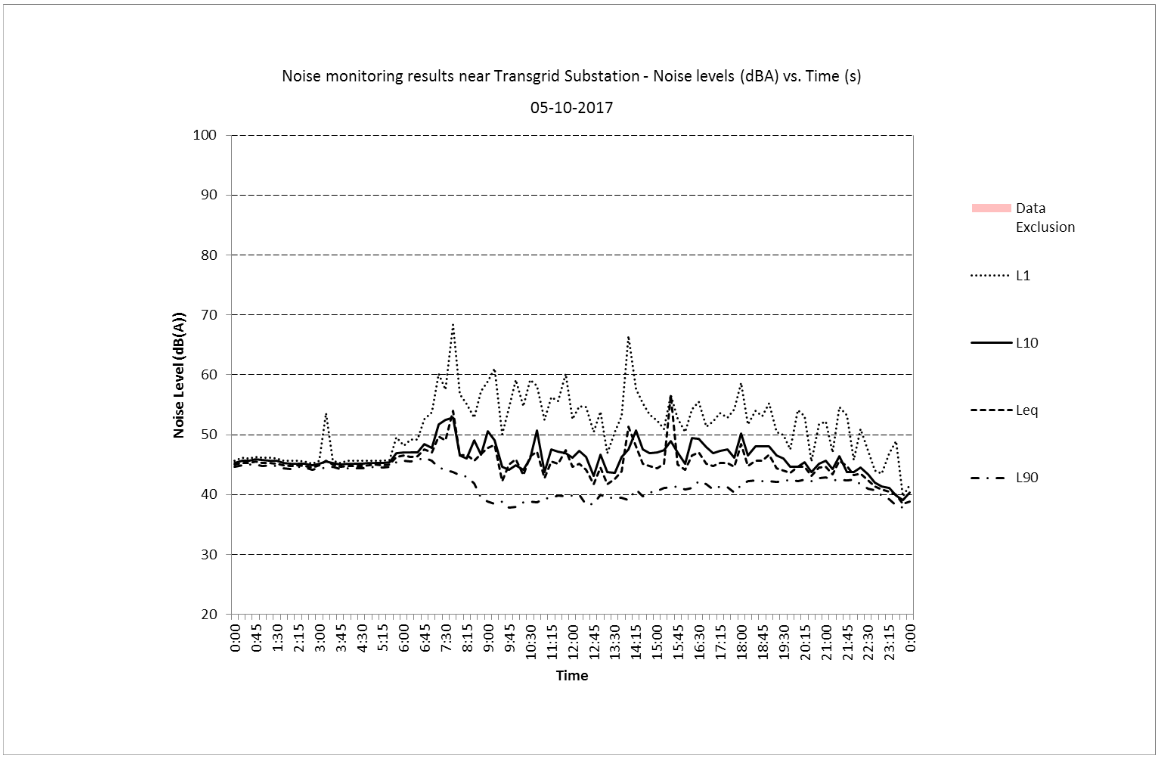
Appendix A Relevant Development Plans

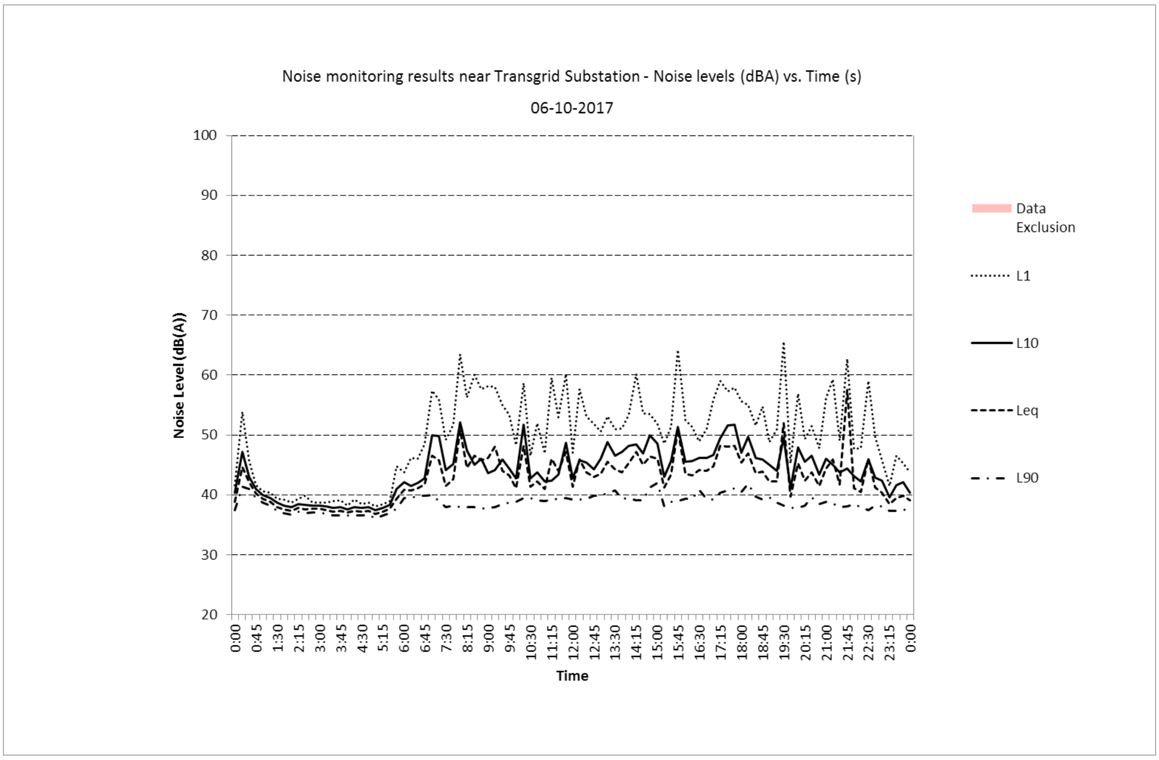

SHEET 2
SHEET 4
SHEET 3
SHEET 5
DUFF'S FOREST RESERVE
WYATT
AVENUE
RALSTON
N
MCPL ON BEHALF OF METROPOLITAN LALC
PLAN OF PROPOSED SUBDIVISION OF LOT 1 IN DP1139826 AT RALSTON AVENUE, BELROSE
30401 009DT
WARRINGAH

Appendix B Unattended Noise Monitoring Graphs

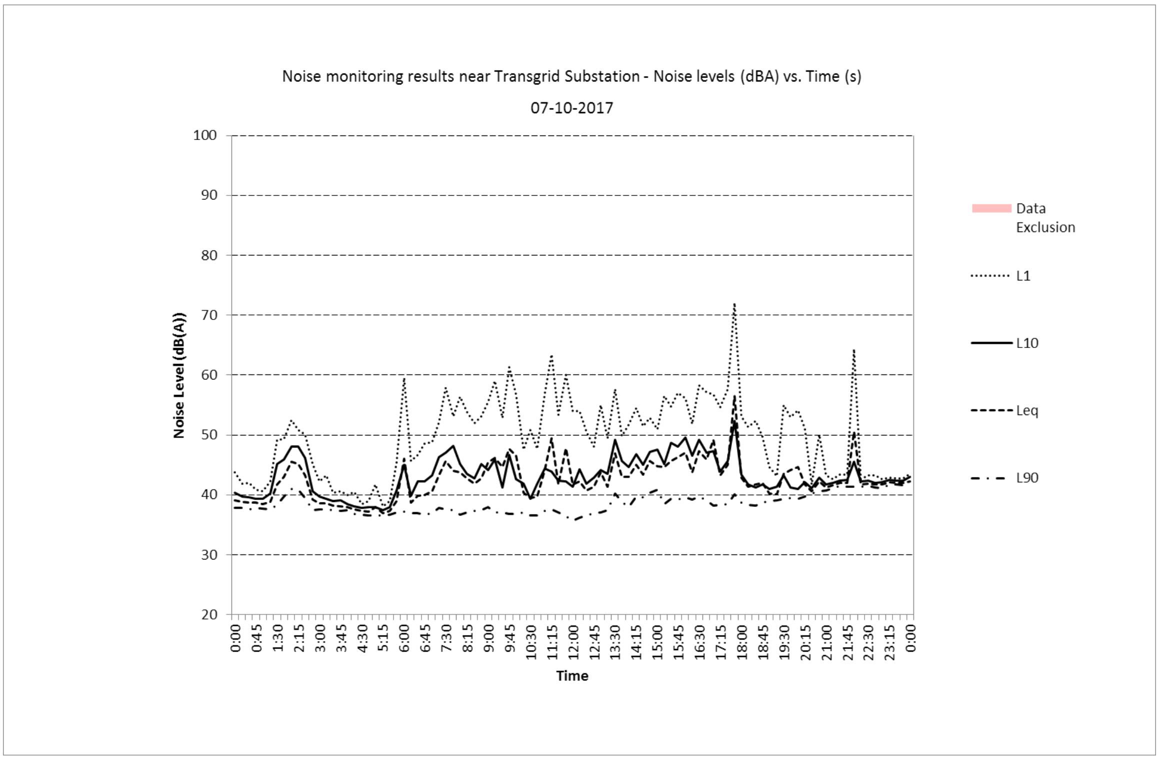
Noise monitoring results near TransGrid Substation – Location 1



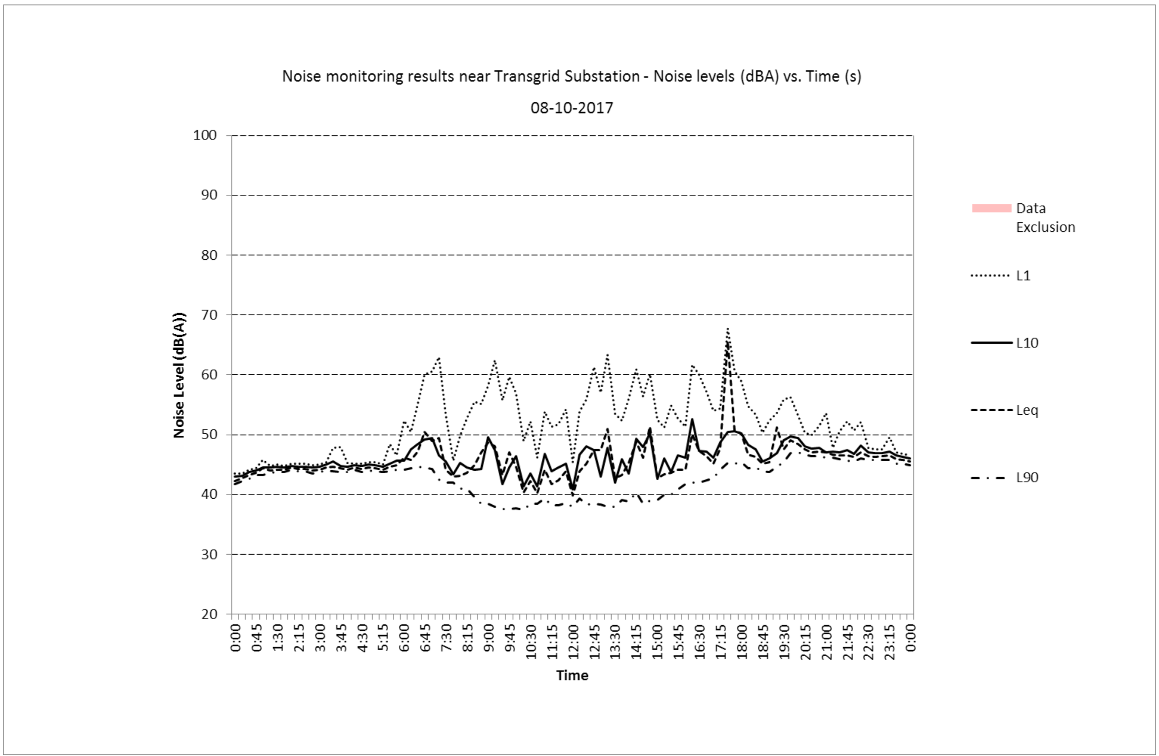




Noise monitoring results near Transgrid Substation - Noise levels (dBA) vs. Time (s)
06-10-2017
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90



Noise monitoring results near Transgrid Substation - Noise levels (dBA) vs. Time (s)
07-10-2017
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90


Noise monitoring results near Transgrid Substation - Noise levels (dBA) vs. Time (s)
08-10-2017
Noise Level (dB(A))
Time
Data Exclusion
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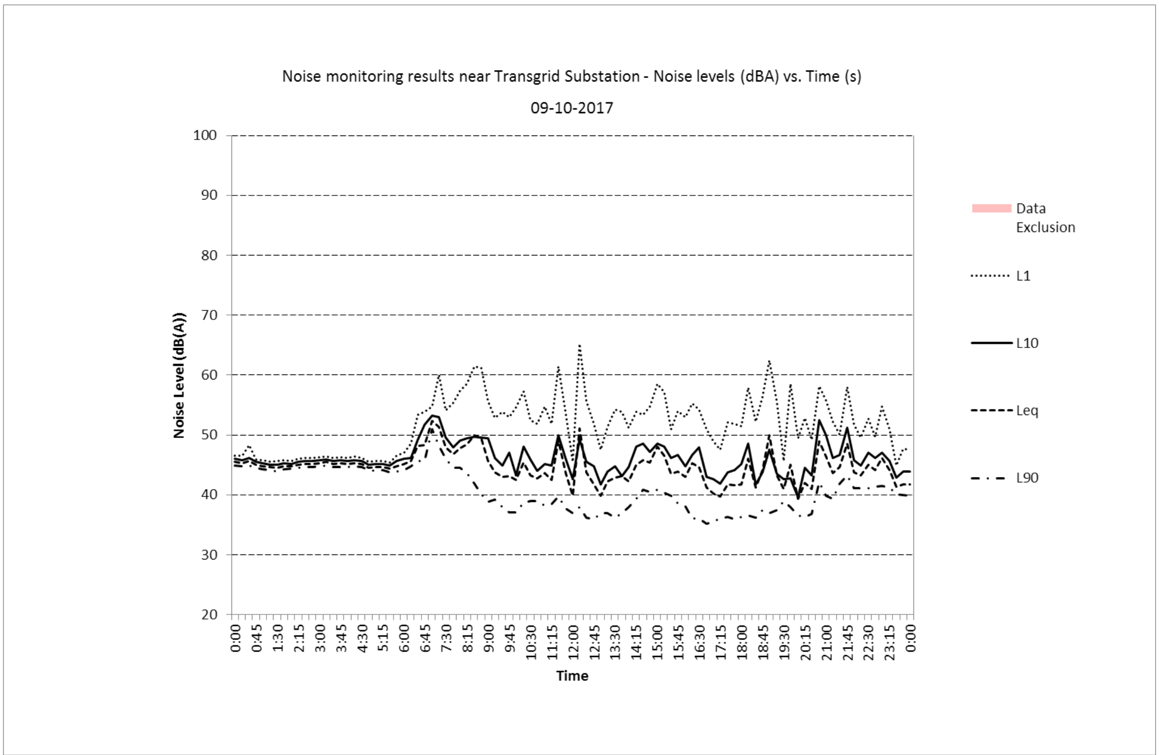
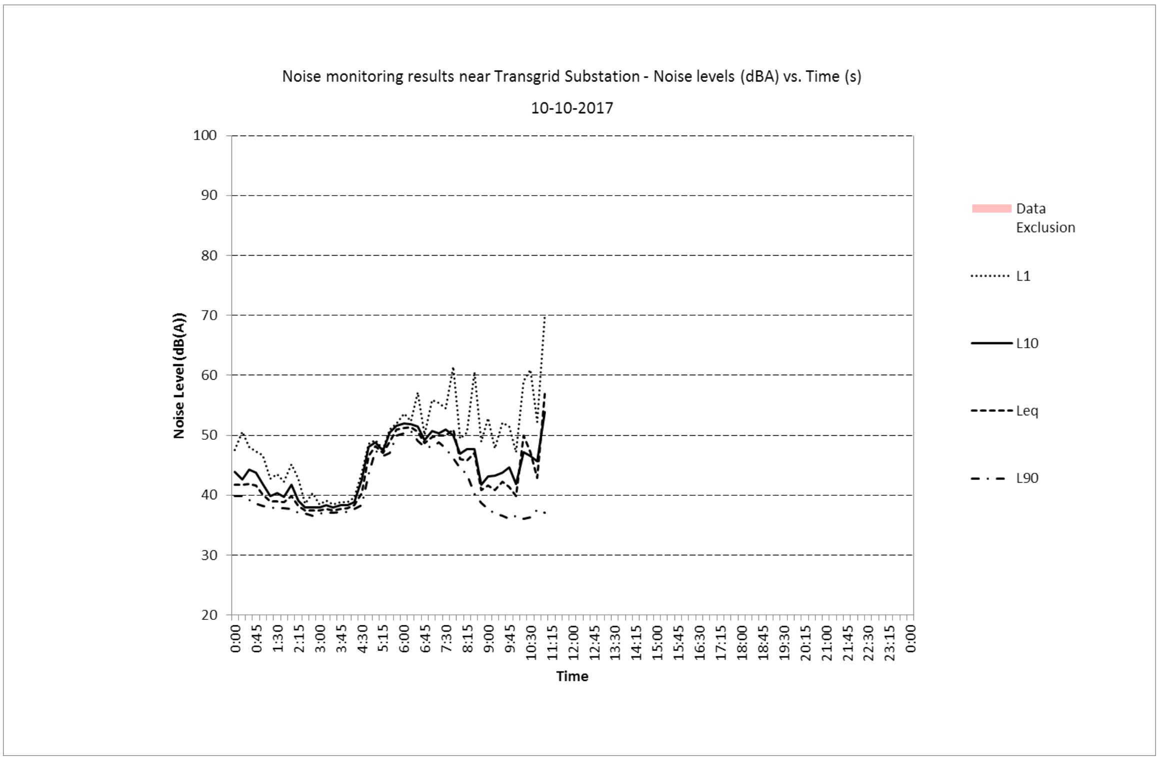
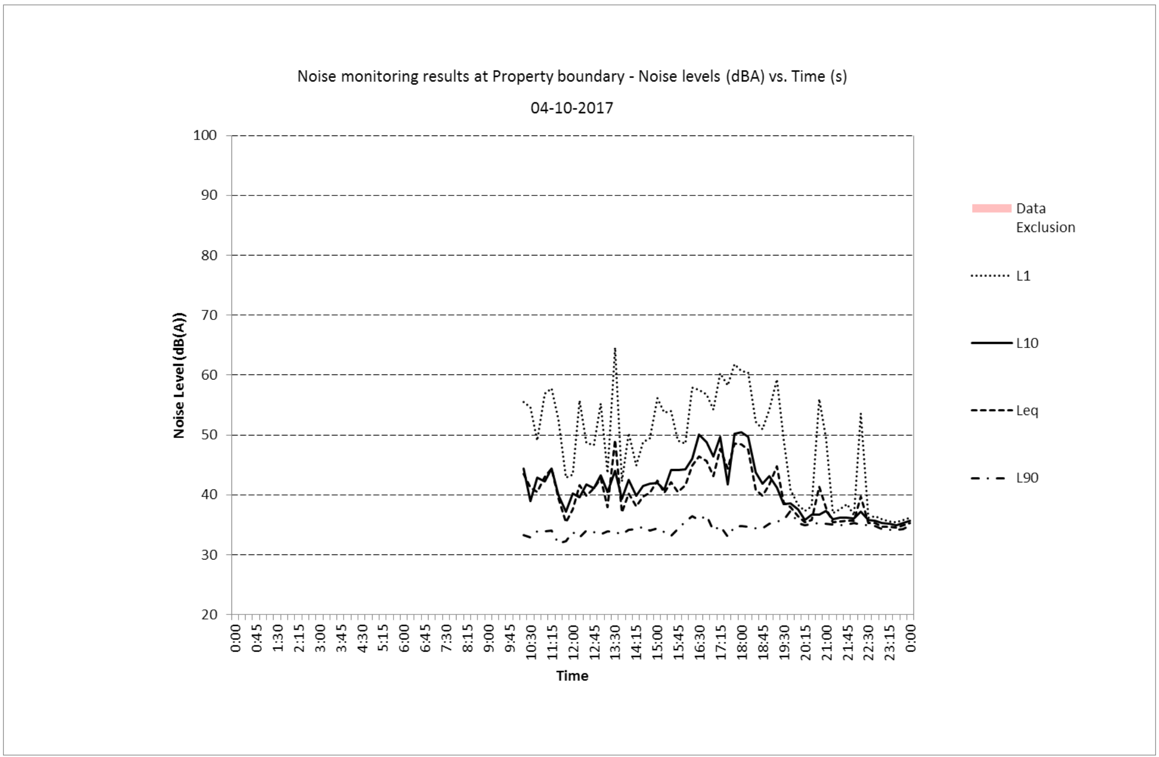
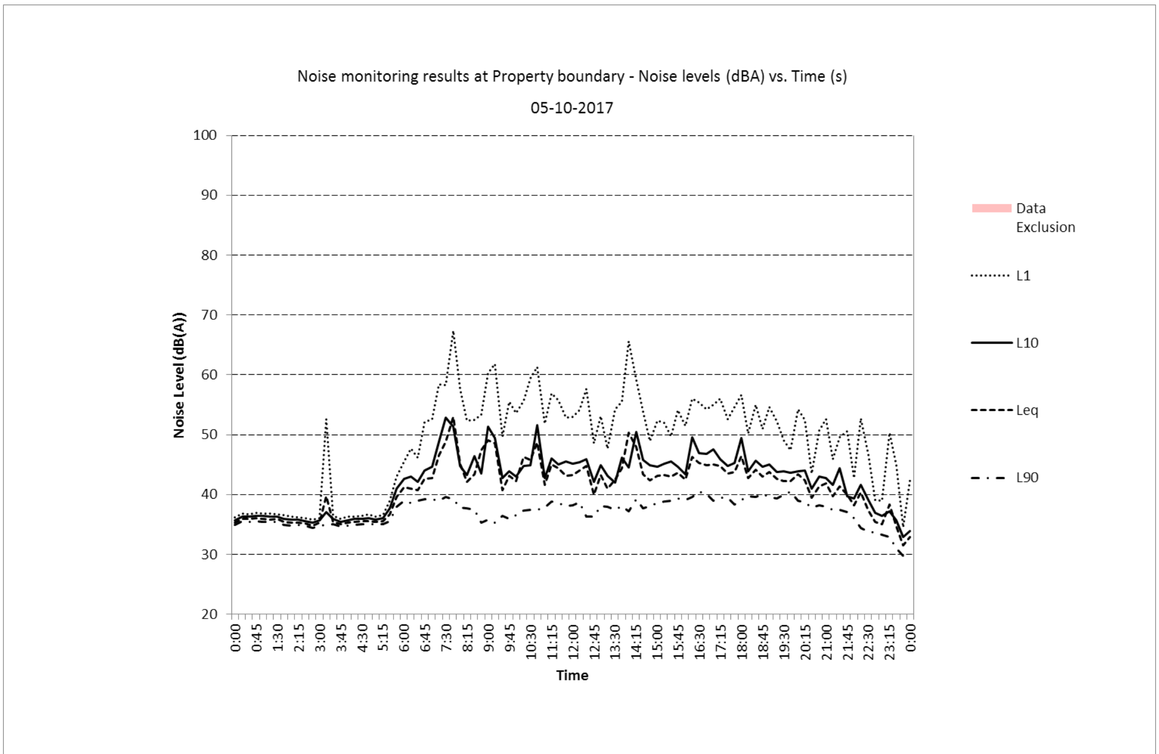
L10
Leq
L90

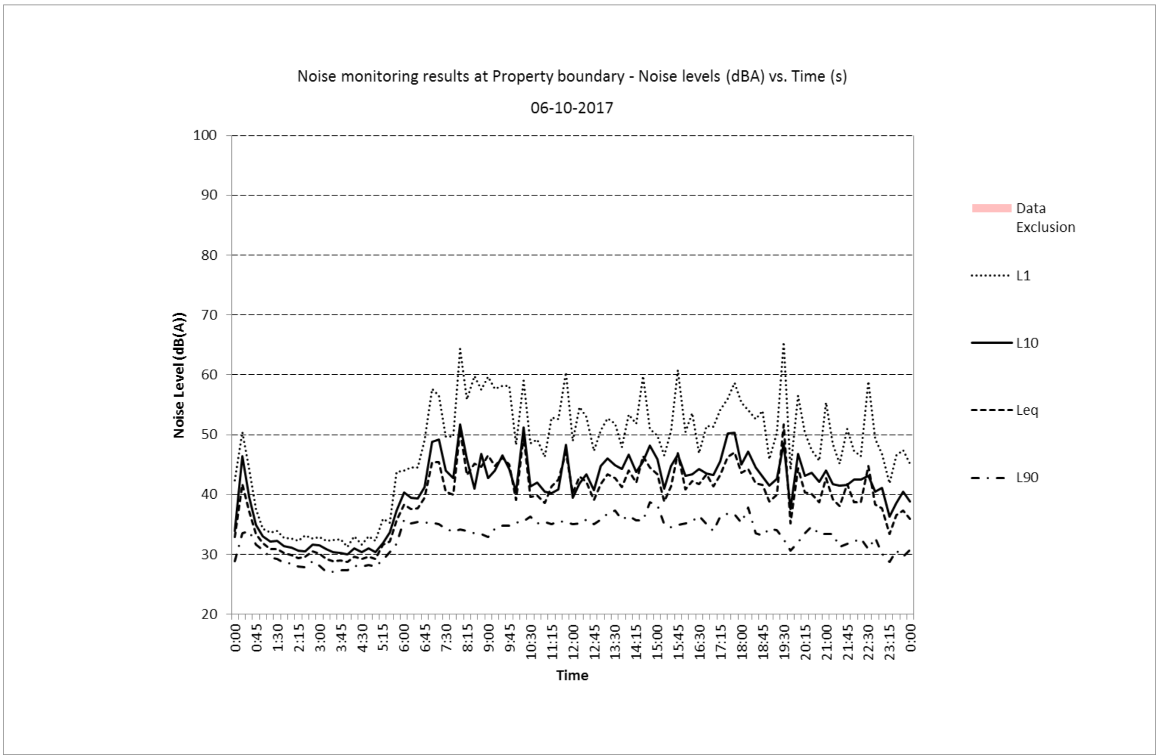

Noise monitoring results near Transgrid Substation - Noise levels (dBA) vs. Time (s)
09-10-2017
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90

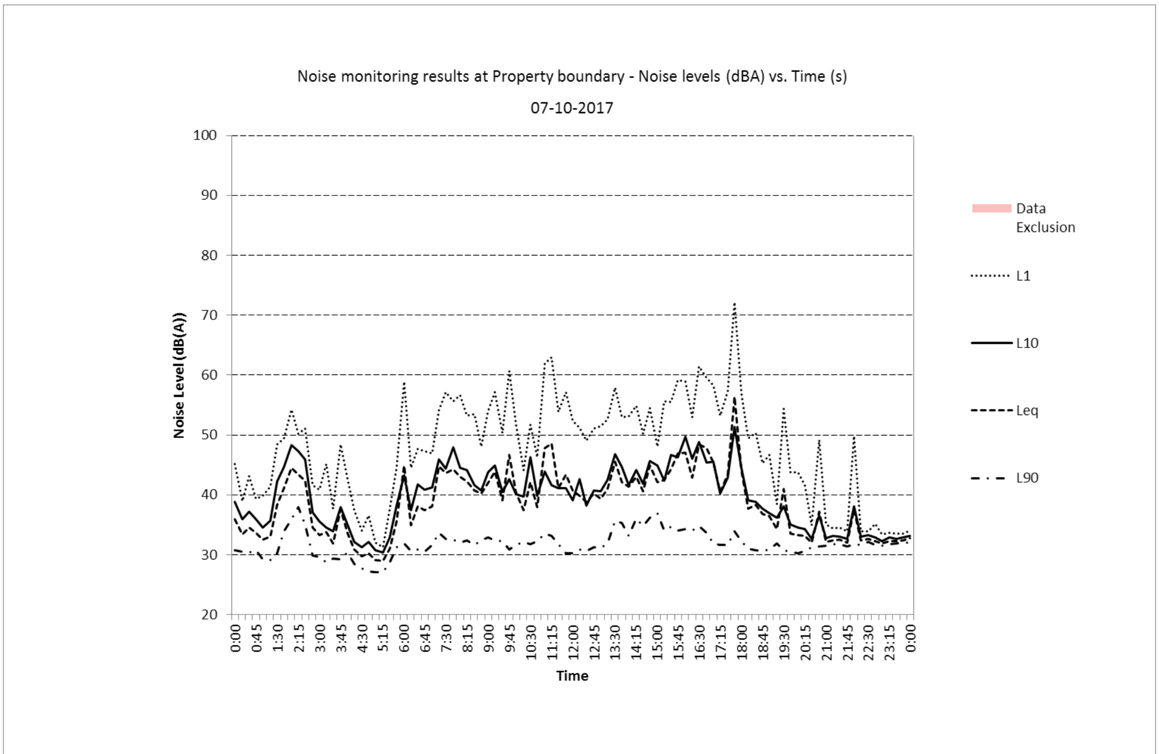

Noise monitoring results near Transgrid Substation - Noise levels (dBA) vs. Time (s)
10-10-2017
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90

Noise monitoring results at Property/Lot boundary – Location 2






Noise monitoring results at Property boundary - Noise levels (dBA) vs. Time (s)
06-10-2017
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90


Noise monitoring results at Property boundary - Noise levels (dBA) vs. Time (s)
07-10-2017
Noise Level (dB(A))
Time
Data Exclusion
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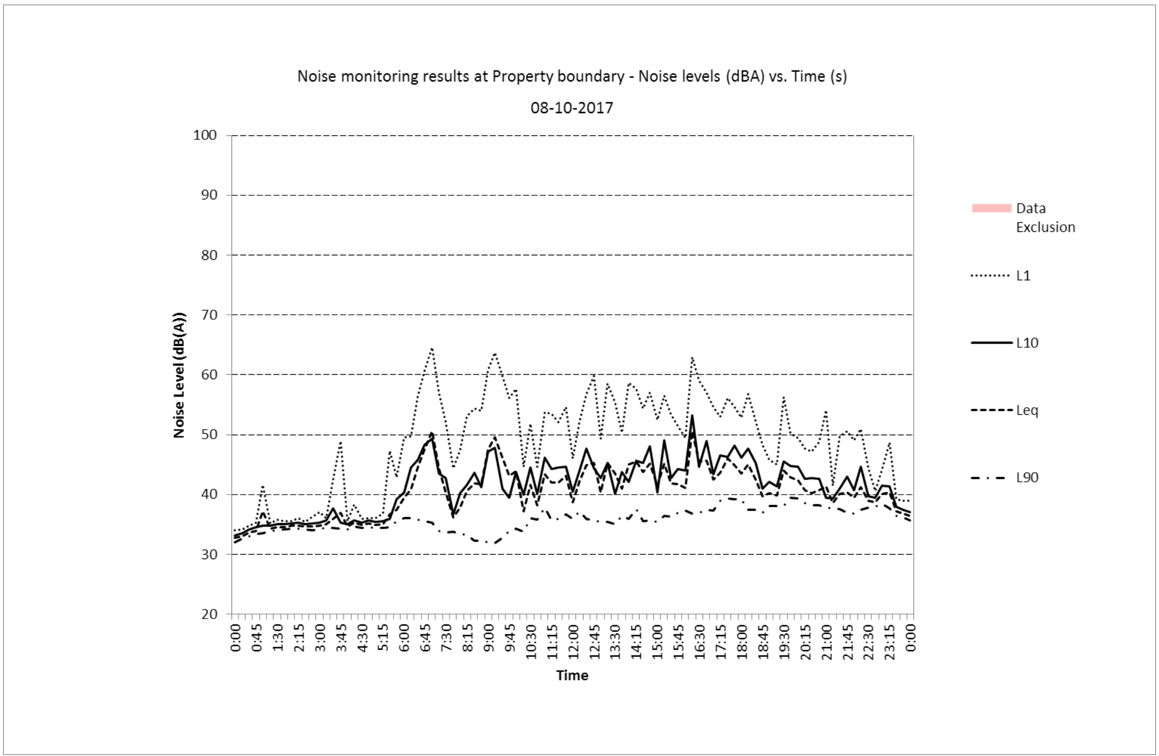
L10
Leq
L90



Noise monitoring results at Property boundary - Noise levels (dBA) vs. Time (s)
08-10-2017
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
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18:00
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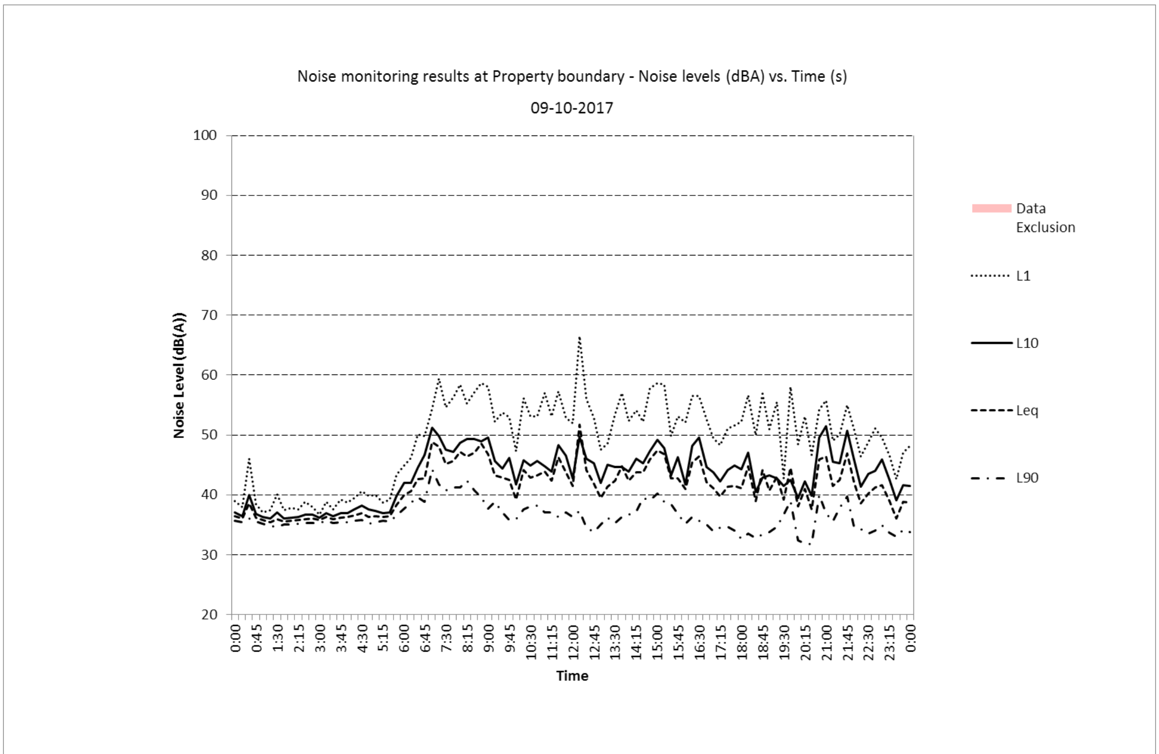
Data Exclusion
L1
L10
Leq
L90



Noise monitoring results at Property boundary - Noise levels (dBA) vs. Time (s)
09-10-2017
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
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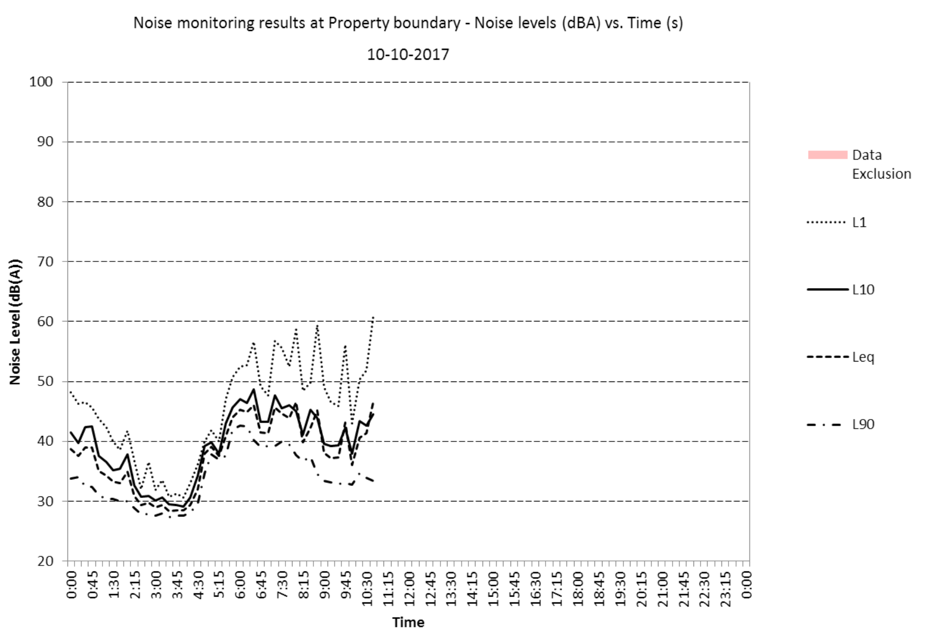
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90


Noise monitoring results at Property boundary - Noise levels (dBA) vs. Time (s)
10-10-2017
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90

Appendix C Glossary

GLOSSARY In this acoustic report unless the context of the subject matter otherwise indicates or requires, a term has the following meaning:	
TERM	DEFINITION
ABL	The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time (for each day). It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.
Adverse Weather	Weather effects that increases noise (i.e. wind and temperature inversion) that occurs at a site for a significant period of time (i.e. wind occurring more than 30% of the time in any assessment period in any season and / or temperature inversion occurring more than 30% of the nights in winter).
Ambient Noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources both near and far.
Assessment Period	The period in a day over which assessments are made: day (0700 to 1800h), evening (1800 to 2200h) or night (2200 to 0700h) or actual operating period if only a part of a period(s).
A – Weighting Filter	A-weighting is the most commonly used of a family of curves defined in the International standard IEC 61672:2003 and various national standards relating to the measurement of sound

	pressure level. A-weighting is applied to instrument-measured sound levels in effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is excluded. Usually described using the L90 measurement parameter.
C – Weighting Filter	The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dB(A)). The C-weighted sound level (i.e., measured with the C-weighting) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low-frequency content of complex sound environments and entertainment noise.
Decibel	The ratio of sound pressures which we can hear is a ratio of 106 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (Lp) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.
dB(A)	The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a sound level meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. It is worth noting that an increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise, and a change of 2 to 3 dB is subjectively barely perceptible.
Equivalent Continuous Sound Level (Leq)	Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period, similar to the average. Hence fluctuating levels can be described in terms of a single figure level.
Extraneous Noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated during holiday periods and during special events such as concert or sporting events.
Fast Time Weighting	125 ms integration time while the signal level is increasing and decreasing.
Frequency	The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20 kHz. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.
Impact Sound	The sound produced by the collision of two solid objects. Typical sources are footsteps, dropped objects, etc., on an interior surface (wall, floor, or ceiling) of a building.
L_{Aeq}	See equivalent continuous sound level definition above. This is the A-weighted energy average of the varying noise over the sample period and is equivalent to the level of a constant noise

	which contains the same energy as the varying noise environmental. This measure is also a common measure of environmental noise and road traffic noise.
$L_{Aieq,T}$	Equivalent continuous A-weighted sound pressure level over the measurement period T with impulse time weighting.
$L_{Ceq,T}$	The equivalent continuous C-weighted sound pressure level (integrated level) that, over the measurement period T, has the same mean square sound pressure (referenced to 20 µPa) as the fluctuating sound(s) under consideration.
$L_{C, Peak}$	The C weighted Peak sound pressure level during a designated time interval or a noise event.
Low Frequency	Noise containing major components in the low-frequency range (20Hz to 250Hz) of the frequency spectrum.
Maximum Noise Levels L^{max}	The maximum noise level identified during a measurement period. Experimental data has shown that the human ear does not generally register the full loudness of transient sound events of less than 125 ms (millisecond). Fast time weighting has an exponential time constant of 125 ms, which reflects the ear's response. The maximum A weighted level measured with fast time weighting is denoted as L_{AMax}, f. Slow time weighting (S) with an exponential time constant of 1second is used to allow more accurate estimation of the average sound level on a visual display. Impulse (I) time weighting has a fast rise (35 ms) and a slow decay and is intended to mimic the ear's response to impulsive sounds.
Maximum Noise Levels L_{max}	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
Minimum Noise Levels L_{min}	The minimum noise level over a sample period is the minimum level, measured on fast response, during the sample period.
Noise Sensitive Receiver (NSR)	A noise sensitive receiver is any person or building or outside space in which they reside or occupy that has the potential to be adversely impacted by noise from an outside source, or noise not generated by the noise sensitive receiver.
Octave Bands	Octave bands are frequency ranges in which the upper limit of each band is twice the lower limit. Octave bands are identified by their geometric mean frequency, or centre frequency.
One-Third Octave Bands	One-Third Octave Bands are frequency ranges where each octave is divided into one-third octaves with the upper frequency limit being 1.26 times the lower frequency. They are identified by the geometric mean frequency of each band, or centre frequency.
Project-Specific Noise Levels	They are target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive or amenity criteria derived from the NSW Industrial Noise Policy.
RBL	The Rating Background Level for each period is the median value of the ABL values for the period over all the days measured. There is a therefore an RBL value for each period – daytime, evening and night-time.

Shoulder Periods	Where early morning (5 am to 7 am) operations are proposed, it may be unduly stringent to expect such operations to be assessed against the night-time criteria (especially if existing background noise levels are steadily rising in these early morning hours). In these situations, appropriate noise level targets may be negotiated with the regulatory/consent authority on a case-by-case basis.
Slow Time Weighting	1 second integration time while the signal level is increasing and decreasing.
Sound Power	The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.
Sound Reduction Index (R)	The sound reduction index (or transmission loss) of a building element is a measure of the loss of sound through the material, i.e. its attenuation properties. It is a property of the component, unlike the sound level difference which is affected by the common area between the rooms and the acoustic of the receiving room. The weighted sound reduction index, R_w, is a single figure description of sound reduction index which is defined in BS EN ISO 717-1: 1997. The R_w is calculated from measurements in an acoustic laboratory. Sound insulation ratings derived from site (which are invariably lower than the laboratory figures) are referred to as the R'_w ratings.
Statistical Noise Levels	For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L_{90}, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A-weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, e.g. $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.
L_{A1}	The L_{A1} level is the A-weighted noise level which is exceeded for 15 of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.
L_{A10}	The L_{A10} level is the A-weighted noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.
L_{A50}	The L_{A50} level is the A-weighted noise level which is exceeded for 50% of the sample period.
L_{A90}	The LA90 level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is a commonly referred to as the background noise level.
Temperature Inversion	An atmospheric condition in which temperature increases with height above the ground.
Tonality	Noise containing a prominent frequency and characterised by a definite pitch.
Typical Levels	Some noise levels of some common noise sources are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing