LAL LAL WIND FARM - YENDON

Post-construction Noise Assessment

Prepared for:

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c/- Res Australia Pty Limited
Suite 6.01 Level 6
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Lal Lal Wind Farms Nom Co Pty Limited ACN 625 768 774 (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.11872-R15-v1.7	31 October 2023	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward
640.11872-R15-v1.6	22 August 2023	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward
640.11872-R15-v1.5	28 April 2023	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward
640.11872-R15-v1.4	13 April 2023	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward
640.11872-R15-v1.3	6 December 2022	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward
640.11872-R15-v1.2	27 October 2022	Gustaf Reutersward	Arvind Deivasigamani	Gustaf Reutersward

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) was engaged by Lal Lal Wind Farms Nom Co Pty Ltd to complete an assessment of the noise emissions of Lal Lal Wind Farm, which comprises of a total of 60 Vestas V136-3.8MW turbines with serrated trailing edge (38 in Yendon and 22 in Elaine).

The objective of the noise assessment was to measure and assess the noise levels from the wind farm in accordance with the Noise Compliance Test Plan (NCTP) prepared and endorsed Conditions 24 and 25 of the Planning Permit (ref: Planning Permit No. PL-SP/05/0461-2 amended 12 April 2022).

This report documents the methodology and results of the noise compliance assessment which has been performed based on noise monitoring conducted between June 2022 and August 2022.

The wind farm is electrically and mechanically complete and has been released by the market operator to generate at full power and has now reached practical completion.

The turbines of Yendon and Elaine wind farms make up separate stages of the Lal Lal Wind Farm and the turbines of each are separated by over 10 km and there are no compliance-critical receptors located in the intervening land which would be influenced by cumulative noise from both portions. Owing to a number of extended turbine outages during earlier Stage 1 noise testing, and to avoid further delay, it has been determined that a reasonable approach to the compliance assessment of Lal Lal Wind Farm would be to consider the Yendon and Elaine portions separately in this instance.

This report covers the Stage 1 assessment of the Yendon portion of the wind farm only, the equivalent report for Elaine is documented in SLR report 640.11872-R04-v2.0.

2 Conditions of Consent

Conditions 22 to 27 of the Lal Lal Wind Farm Consent set out the relevant noise-related requirements for the operation of the wind farm. The relevant sections of the Conditions of Consent are reproduced below.

NOISE LIMITS

22. Construction of the wind energy facility must comply with noise criteria specified in the EPA *Noise Control Guidelines, Construction and Demolition Site Noise,* Publication 1254, October 2008 at any dwelling existing on land in the vicinity of the proposed wind energy facility as at the date of the issue of this permit to the satisfaction of the Minister for Planning.

23. Except as provided below in this condition, the operation of the wind energy facility must comply with New Zealand Standard 6808:2010, Acoustics - Wind Fam1 Noise (the Standard) at any noise sensitive location existing as at 20 March 2017 to the satisfaction of the Minister for Planning.

    In determining compliance, the following requirements apply:

    a) The operator must ensure that at any wind speed, wind farm sound levels, determined in accordance with the Standard at noise sensitive locations (as defined in the Standard) do not exceed a noise limit of 40dB LA90, 10min or background (LA90, 10 min) plus 5dB, whichever is greater;

    b) Compliance must be assessed separately for all-time and nighttime. For the purpose of this requirement, nighttime is defined as 10.00pm to 7.00am; and

    c) Where special audible characteristics, including tonality, impulsive sound or excessive amplitude modulation occur, the measured noise level with the identified special audible characteristics will be modified by applying a penalty of up to + 6 dB L90 in accordance with section 5.4 of the Standard.

    The limits specified in this condition do not apply if an agreement has been entered into with any landowner waiving the limits. Evidence of the agreement must be provided to the satisfaction of the responsible authority upon request, and be in a form that applies to the land for the life of the wind energy facility.

NOISE COMPLIANCE ASSESSMENT

24. Before the development starts, a noise compliance testing plan must be prepared by a suitably qualified acoustics expert to the satisfaction of the Minister for Planning.

25. The noise compliance testing plan must be accompanied by a report from an auditor accredited under the *Environment Protection Act 1970* with the auditor's opinion on the methodology contained in the noise compliance testing plan.

When approved, the noise compliance testing plan will be endorsed by the Minister for Planning and will then form part of this permit.

The use must be carried out in accordance with the noise compliance testing plan to the satisfaction of the Minister for Planning.

For the purposes of determining compliance, the following requirements apply:

a) Acoustic compliance reports shall be prepared by a suitably qualified and experienced independent acoustic engineer to demonstrate compliance with the noise limits specified in the Standard.

b) Noise assessment positions must be located according to the Standard, and shown on a map.

c) A final compliance report must be submitted to the Minister for Planning after a 12-month period following full operation of the facility.

d) The final compliance report must be accompanied by a report from an auditor accredited under the *Environment Protection Act 1970* with the auditor ' s opinion on the methodology and results contained in the noise compliance testing plan.

e) Compliance reports must be publicly available and published on the wind farm operator's website.

f) Following facility commissioning, all complaints shall be managed following procedures set out in the noise complaints management plan.

NOISE COMPLIANCE ENFORCEMENT

26. For the purposes of complaints evaluation, the following requirements apply:

a) Post installation sound levels shall, where practical, be measured at the same locations where the background sound levels were determined (GPS coordinates and a map showing these locations are to be provided).

b) If a non-compliance with condition 23 is detected, or an acoustic investigation is required under the noise complaint investigation and response plan endorsed under condition 26, an independent assessment report must be prepared by a suitably qualified and experienced independent acoustic engineer to:

- identify the weather or operational conditions associated with the complaint / breach.
- analyse the uncertainty and confidence levels in the monitoring, and the steps taken to reduce uncertainty.
- target assessment to identify the cause and remediation actions.
- submit a remediation plan to the satisfaction of the Minister for Planning outlining the investigation process, complainant communications, actions and timelines to resolve the complaint/breach.
- if the complaint is not resolved through the processes outlined above, the Minister for Planning may request an independent peer review at the cost of the pem1it holder and on/off shut down testing to resolve uncertainty.

c) Following the initial post-construction reporting process, additional independent assessment may be requested by the Minister for Planning at any time, where complaints are received and are considered to reasonably warrant investigation.

d) If investigations indicate special audible characteristics are potentially occurring, procedures outlined in Appendix B of the Standard should be applied.

27. Before the first wind turbine is commissioned, the permit holder must prepare a Noise Complaint Investigation and Response Plan to the satisfaction of the Minister for Planning. The approved plan must be published on the wind farm operator's website.

The plan shall be designed in accordance with the Australian/New Zealand Standard AS/NZS I0002:2014 - *Guidelines/or complaint management in organisations* and include:

- a process of investigation to resolve a complaint.
- a requirement that all complaints will be recorded in an incidents register.
- how contact details will be communicated to the public.
- telephone number and email contact for complaints and queries.
- details of the appropriate council contact telephone number and email address (where available).
- a table outlining complaint information for each complaint received, including:
  - the complainant's name.
  - any applicable property reference number if connected to a background testing location.
  - the complainant's address.
  - a receipt number for each complaint which is to be communicated to the complainant.
  - the time, prevailing conditions and description of the complainant's concerns including the potential incidence of special audible characteristics.
  - the processes of investigation to resolve the complaint.

A report including a reference map of complaint locations, and outlining complaints, investigation and remediation actions is to be provided on an annual basis to the satisfaction of the Minister for Planning.

The register and complaints response process shall continue for the duration of the operation of the wind energy facility and must be made available to the Minister for Planning on request.

The wind energy facility operator must implement and comply with the Approved Noise Complaint, Investigation and Response Plan for the duration of the operation of the wind energy facility.

3 Noise Monitoring Locations

The noise monitoring covered in this report was completed at the reference receptor locations in **Table 1** and are shown in **Figure 1** below.

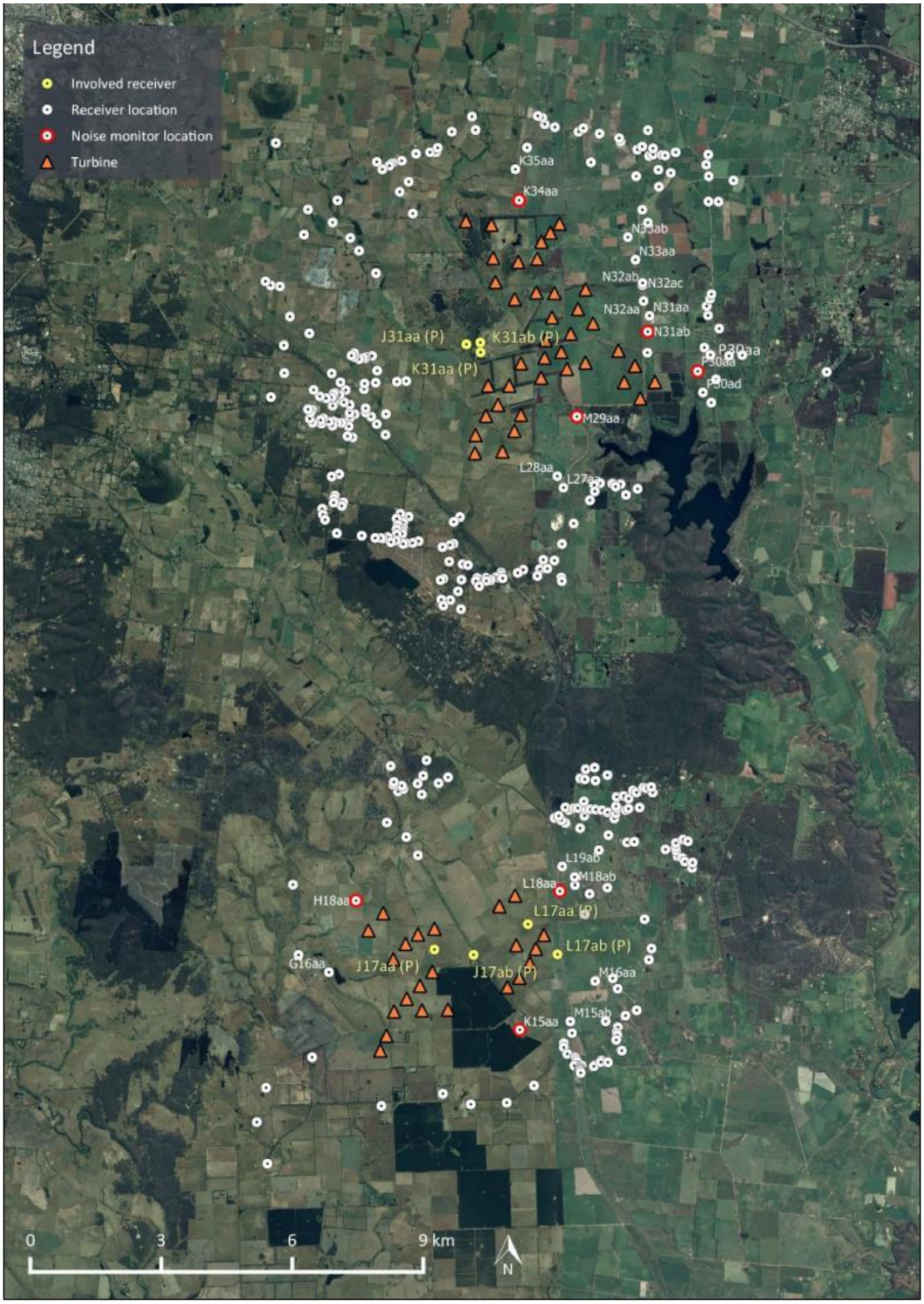
Table 1 Noise Monitoring Locations

Reference Receptor	Approx. UTM Coordinate (Zone 55 H)		Approx distance to nearest WTG
N31ab	5831551 m S	239917m E	0.9 km
M29aa	5829603m S	238292m E	1.2 km
K34aa	5834563m S	236968m E	0.9 km

4 Previous Measurements

Previous baseline noise surveys and analysis were conducted at seven receiver locations in 2016 and 2017 as detailed in the Marshall Day Report - *Lal Lal Wind Farm Background Noise Monitoring* (ref: 001 R01 20170649) (2018 LLWFBNM Report) dated 1 March 2018 and are shown in **Figure 1** below.

Figure 1 Baseline monitoring locations (ref: LLWFBNM Report)

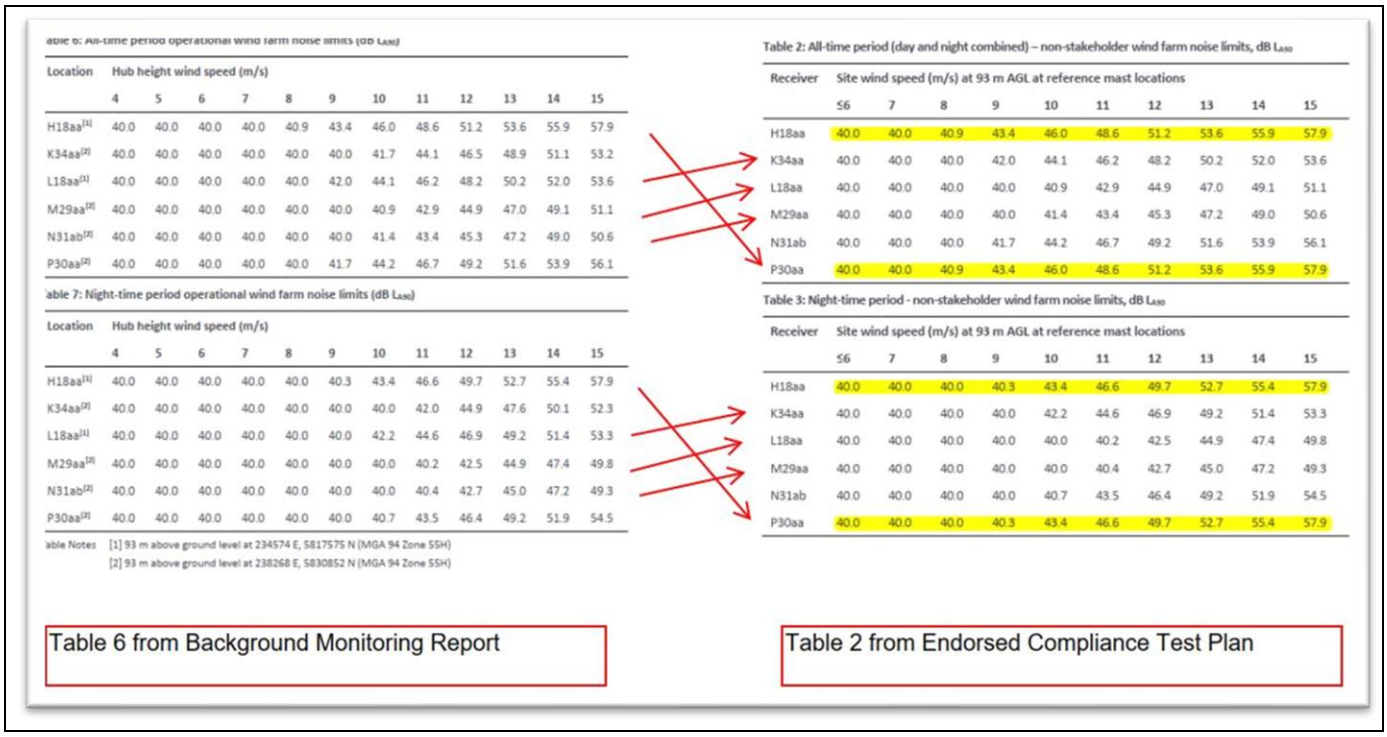


5 Noise Limit

SLR discovered that the noise limits stated in Table 2 of Endorsed Condition 24 and 25 of the MDA Report *Lal Lal Noise Compliance Test Plan* ref: 003 R03 20170649 (NCTP) and those shown in Table 6 of the MDA Report *Lal Lal Wind Farm Background Noise Monitoring* ref:001 R01 20170649 (Background Report) are inconsistent.

A closer review (as shown in the figure below) of the MDA reports reveal that it is likely that the numbers were incorrectly transferred from the Background Report to the NCTP. Furthermore, some numbers seem to be doubled up (see highlighted). This has been confirmed by Marshall Day Acoustics.

Figure 2 Noise Limit - Background Report vs NCTP



able 6: All-time period operational wind farm noise limits (dB L_{A90})

Location	Hub height wind speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa[1]	40.0	40.0	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
K34aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	41.7	44.1	46.5	48.9	51.1	53.2
L18aa[1]	40.0	40.0	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
M29aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
N31ab[2]	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
P30aa[2]	40.0	40.0	40.0	40.0	40.0	41.7	44.2	46.7	49.2	51.6	53.9	56.1

able 7: Night-time period operational wind farm noise limits (dB L_{A90})

Location	Hub height wind speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa[1]	40.0	40.0	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
K34aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	44.9	47.6	50.1	52.3
L18aa[1]	40.0	40.0	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
M29aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
N31ab[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
P30aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.7	43.5	46.4	49.2	51.9	54.5

able Notes [1] 93 m above ground level at 234574 E, 5817575 N (MGA 94 Zone 55H)
[2] 93 m above ground level at 238268 E, 5830852 N (MGA 94 Zone 55H)

Table 6 from Background Monitoring Report

Table 2: All-time period (day and night combined) – non-stakeholder wind farm noise limits, dB L_{A90}

Receiver	Site wind speed (m/s) at 93 m AGL at reference mast locations									
	≤6	7	8	9	10	11	12	13	14	15
H18aa	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
K34aa	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
L18aa	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
M29aa	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
N31ab	40.0	40.0	40.0	41.7	44.2	46.7	49.2	51.6	53.9	56.1
P30aa	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9

Table 3: Night-time period - non-stakeholder wind farm noise limits, dB L_{A90}

Receiver	Site wind speed (m/s) at 93 m AGL at reference mast locations									
	≤6	7	8	9	10	11	12	13	14	15
H18aa	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
K34aa	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
L18aa	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
M29aa	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
N31ab	40.0	40.0	40.0	40.0	40.7	43.5	46.4	49.2	51.9	54.5
P30aa	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9

Table 2 from Endorsed Compliance Test Plan

It is understood (as validated by Marshall Day Acoustics) that the limits contained in Table 6 the Background Report are technically correct with respect to NZS 6808:2010 *Acoustics - Wind farm noise*. The compliance assessment carried out in this subject report will be against the limits contained in Table 6 the Background Report.

It should be noted that:

- the NCTP limits are up to 2.4 dBA high for K34aa
- the NCTP limits are up to 0.5 dBA high for M29aa
- the NCTP limits are up to 5.5 dBA high for N31ab

The measured compliance margins have been assessed against:

- the correct NZS 6808 noise limits in **Table 5** through **Table 8**
- the erroneous NCTP limits in **Appendix G** for completeness.

6 Noise Measurement Methodology

Environmental noise loggers were installed at the assessment locations and configured in accordance with the *Lal Lal Wind Farm Noise Compliance Test Plan* (NCTP) dated 23 January 2018 (ref. 003 R03 20170649), which were endorsed to comply with the condition 24 and 25 of Lal Lal Windfarm Planning Permit.

The requirements specified in the NCTP and correspondent methodologies of this compliance monitoring survey are summarised in the **Table 2**.

Table 2 Summary of assessment methodology

Test Plan requirements	This assessment methodology
Operational noise measurement locations	
The measurements shall not occur within 3.5 m of a vertical reflecting surface	The compliance monitoring locations were consistent with the background monitoring positions.
The measurements shall occur within 20 m of the dwelling	
The measurements shall occur as close as practically possible to the location of the background noise monitoring	
Operational noise measurement procedures - Acoustic data	
The measurements shall comprise unattended monitoring for the measurement durations defined in Section 4.3 of the NCTP	The monitoring was completed over approximately 9 weeks between 26/5/2022 to 1/8/2022.
A-weighting - The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.	A-frequency weighting has been measured and used in the assessment
The LA90 noise level shall be determined in consecutive ten (10) minute intervals synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour	Noise loggers were configured as required.
All noise measurements shall be conducted using low noise floor (≤ 20 dB) instrumentation that is certified to Class 1 standards (highest standard of instrumentation for field measurements) in accordance with IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Specifications	Brüel & Kjær 2250 Sound Level Meter (SLM) was placed in the vicinity of the residence; refer to **Table 3** for equipment serial numbers. Calibration was completed with a Brüel & Kjær Type 4231 Sound Level Calibrator (S/N 30077429).
The independent (laboratory) calibration date of the sound level measurement instrumentation must be within 2 years of the measurement period, as specified in Section 5.5 of Australian Standard AS 1055-1:1997 Acoustics – Description and measurement of environmental noise – Part 1: General Procedures	All acoustic instrumentation had been calibrated by a NATA accredited laboratory and held current certificates of calibration at the time of the monitoring. Details of the acoustic instruments used at each reference location are presented in **Table 3.**

Test Plan requirements	This assessment methodology
Microphones shall be fitted with enhanced wind shield systems (enlarged primary wind shields or secondary wind shields) designed on the basis of the guidance contained in the UK Institute of Acoustics publication A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise dated May 2013 (the IOA GPG)	B&K 2250 Sentinel units were used with a microphone positioned at approximately 1.5 m above ground level and fitted with 150 mm-diameter G.R.A.S. outdoor microphone windscreen on the design recommendations detailed in the UK IOA good practice guide.
Subject to the consent of the residents, two (2) minute uncompressed audio recordings shall be obtained for every ten (10) minute interval of the survey. The sampling rate for audio recordings shall be sufficient to allow assessment of tonality, if required, across the frequency range 10-5000 Hz	Noise loggers configured as required.
Instantaneous one-third octave band sound pressure levels (fast response) shall be recorded in 100 ms intervals to enable an analysis of amplitude modulation if required.	Noise loggers configured as required.
Operational noise measurement procedures - Site wind speeds	
Site wind speeds shall be collected in ten (10) minute intervals throughout the noise measurement period. The timing of each ten (10) minute interval shall be synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour.	A meteorological mast at Yendon was installed at -37.633961^0,144.053090^0. The anemometer 1 of the meteorological mast collected wind speed and direction data at 93m AGL. For a period of the noise survey the anemometer on the meteorological mast at Yendon was unavailable due to a firmware upgrade and incompatibility to SCADA. For these periods the hub height wind data was derived from the nacelle anemometers from either Turbines YST32, 36, 38, 39, or 40. Wake free wind speed data was derived from the above reference locations by the projects wind engineers (Aurecon) using an appropriate analytical technique, as outlined in **Appendix E.**
This data shall be used to determine the wind speed at 93 m AGL (the reference wind speed height) corresponding to free-field conditions (i.e. free from turbine wake effects) at the reference mast locations listed in Table 4 of Section 3.0 (and any other reference mast locations used for additional background noise monitoring conducted prior to commencement of operation of the wind farm).	
Wind speeds at 93 m AGL which are determined from wind speed measurements at heights below 93 m shall be determined using the procedures outlined in the IOA GPG Supplementary Guidance Note 4: Wind Shear, or an alternative method deemed appropriate by the wind engineer responsible for the supply of the data	Not applicable
Operational noise measurement procedures – Other data	
Local wind speeds	A Vaisala weather station was also installed with each noise logger to log local wind speeds and rainfall for data exclusion
Rainfall	

Test Plan requirements	This assessment methodology
Site operational data	SCADA operational & power generation data collected during the monitoring period was provided by RES Australia
Attended observations of SACs	Attended subjective listening test observations are documented in **Appendix B**

7 Data validity screening

A valid data set was obtained by excluding data intervals in accordance with NCTP which includes the following criteria:

- Periods of local rain;
- Hub height wind speed exceeding 20 m/s;
- Hub height wind speed below cut-in wind speed (3 m/s).
- The measured sound frequencies (one-third octave bands) in each 10-minute interval are used to identify periods that are significantly affected by insect or frog noise. The 10-minute interval data is identified as being potentially influenced by extraneous noise when both of the following conditions are satisfied:
  - the highest A-weighted one-third octave band noise level is within 5 dB of the broadband A-weighted background noise level for that interval; and
  - the identified one-third octave band A-weighted noise level is greater than a level of 20 dB L_{A90}.

  During the survey June-July 2022 survey period the weather conditions were quite wet and consequently there was a significant proportion of the survey data which was affected by frog noise, especially during the night period.
- when one or more WTGs critical to wind farm noise level at each receptor was not operating.

7.1 Relevant Turbines

On this last point the full data set was filtered to ensure the compliance data set for each receptor only included periods when wind farm noise was effectively equivalent to a fully operational facility. This was achieved by:

- Using SCADA power generation data collected during the monitoring period to determine which WTGs were generating power and therefore operating during each interval.
- Checking a list of "relevant turbines" that is unique for each reference receptor location, to determine if any critical turbines were unavailable or operating atypically. If relevant turbines were not operating in a particular 10-minute interval, then that interval was flagged as invalid and not included in the compliance assessment. The "relevant turbines" list for each receptor was evaluated in two slightly different ways.

1. as defined in the NCTP Appendix G. The NCTP technique to screen for atypical wind farm operation ensures that if any or all of the non-relevant turbines were to not operate during a given measurement period, the predicted reduction in total noise level would be 0.1 dB or less and would therefore be inconsequential to the assessment outcome. This relevant turbine screening method shall be referred to as the NCTP method.
2. Using SoundPLAN noise model predicted results to determine if the difference between the predicted noise level with all wind turbines operating and the predicted noise level with only the actual operating turbines was typically less than 0.5 dBA. If any or all of the non-relevant turbines were to not operate during a given measurement period, the reduction in total noise level would be 0.5 dB or less and would therefore generally be inconsequential to the assessment outcome. This relevant turbine screening method shall be referred to as the 0.5 dB method.

The NCTP method is considered a very conservative approach, and due to regular turbine maintenance experienced during the monitoring period, a large amount of the collected data was deemed invalid.

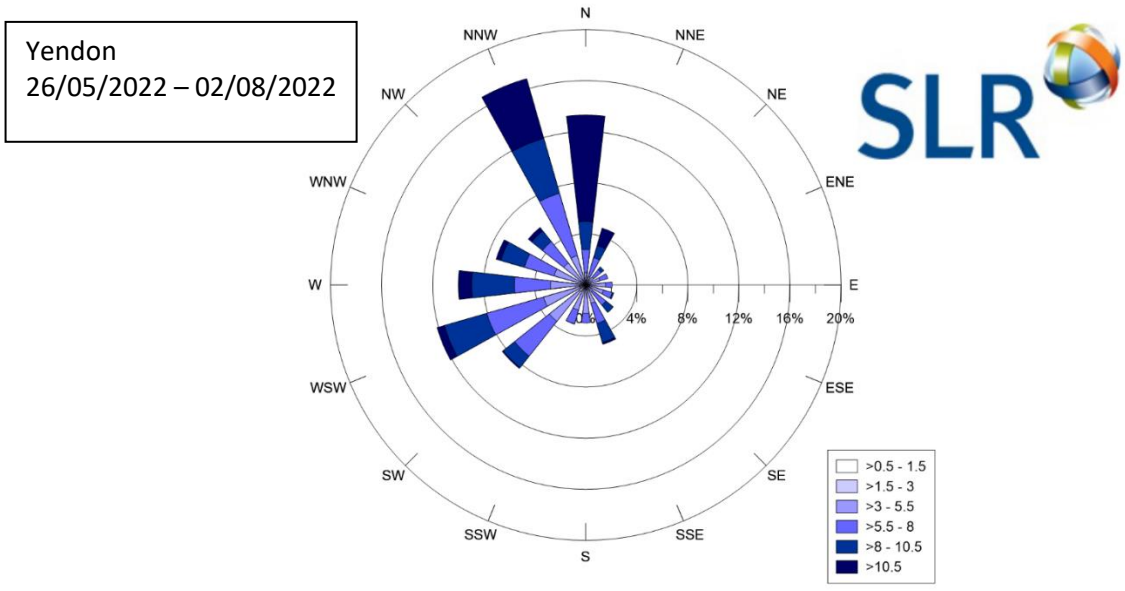
The re-interpretation of this requirement via the 0.5dB method is marginally less conservative, and yields more valid data. The 0.5 dB interpretation has been used on other wind farm projects and utilises the same logic as considered by NZS 6808 in explanatory note C7.6.3. for on-off testing.

Appendix F presents the "relevant turbines" for each reference receptor and both screening methods in a tabulated form. Results using both of the methods have been presented in **Section 10.1.1** and **Section 10.1.2** respectively.

Table 3 Measurement details for each location

Location	Period	Duration	Noise Logger Model / Serial #	Weather Station Model / Serial #	Total No. of monitoring intervals	Total No. of valid data points analysed	
						NCTP method	0.5 dB method
N31ab	26/5/2022 to 18/7/2022	~ 54 days	B&K 2250 #3006994	Vaisala WTX520 J1260018	7508 (All Time) 2850 (Night Only)	1108 (All Time) 526 (Night Only)	2683 (All Time) 1129 (Night Only)
M29aa	26/05/2022 to 1/8/2022	~67 days	B&K 2250 #3007014	#WS3	9514 (All Time) 3564 (Night Only)	1461 (All Time) 686 (Night Only)	2510 (All Time) 1031 (Night Only)
K34aa	26/05/2022 to 1/8/2022	~67 days	B&K 2250 #3008630	Vaisala WTX520 N2430027	9559 (All Time) 3619 (Night Only)	829 (All Time) 348 (Night Only)	2090 (All Time) 731 (Night Only)

Figure 3 Wind conditions during the survey period



8 Assessment of Special Audible Characteristics

8.1 Introduction

In general accordance with NCTP an assessment has been undertaken to establish whether the noise emissions from the wind farm exhibit any special audible characteristics (SACs).

8.2 Special Audible Characteristics

NZ 6808:2010 describes that wind turbines sound levels with special audible characteristics (SACs) shall be adjusted by arithmetically adding a penalty of up to +6 dB to the measured level to account for the adverse subjective response likely to be aroused by sounds containing such characteristics.

The document details that: "Sound that has special audible characteristics, such as tonality or impulsiveness, is likely to cause adverse community response at lower sound levels, than sound without such characteristics. Subjective assessment can be sufficient in some circumstances to assess special audible characteristics." Such that the initial test is subjective, to be followed up by an objective test if required.

The initial subjective evaluation therefore would focus on identifying any distinct noise character from the wind farm that contained:

1. Clearly audible tones
2. Impulses; and
3. Modulation of sound levels.

Tones occur where the sound under consideration has energy concentrated at a certain frequency (pitch), like a single note on a musical instrument.

Impulse sound, if present, would be heard as banging or thumping noises from the wind farm.

Modulation of sound level (amplitude modulation) is where the sound from the wind farm exhibits a regularly varying level greater than that characteristic of 'normal' wind turbine operation. 'Normal' wind turbine operation is generally acknowledged as including some minor amplitude modulation due to 'swishing' noise from the blades.

8.3 Subjective Attended Observations

In accordance with Appendix B1 of NZS 6808:2010, subjective attended observations of the wind farm noise were undertaken at each reference location, as well as a number of intermediary locations, in order to determine if the noise from the wind farm exhibits any special audible characteristics that may require a penalty adjustment to be applied or warrant rectification works.

Each subjective assessment of the wind farm noise was conducted by a professional acoustic engineer (grade Member of the Australian Acoustical Society), as per the process below:

1. An acoustic engineer listened to the sound at the reference location for a minimum period of 10 minutes;
2. As far as practical, the listening position was the same as the noise logger position used for measurement of the 'A'-weighted sound pressure levels;

3. The sounds at the reference location were noted, including any sound from the wind farm and any SACs due to the wind farm;
4. The local weather and wind conditions at the reference locations during the assessment period were noted subjectively and using a handheld anemometer / thermometer;
5. Attended observation surveys were completed during deployment and retrieval of the monitoring equipment as well as during an interim visit and included day-time, night-time and early morning periods and a variety of wind farm operational states under differing meteorological conditions (e.g. wind speed, wind direction and wind shear).

A summary of the attended subjective listening survey notes is included in **Appendix D.**

8.3.1 Subjective assessment findings

The listening survey notes in **Appendix D** wind farm noise detail that at some times and survey locations, there was an audible and discernible "hum" character. Additional listening tests at intermediary and positions close to turbines confirmed that the source of the hum was from turbines. The use of a spectrogram application on a handheld device confirmed the frequency of the hum was typically between 280 Hz to 400 Hz and was dependent upon turbine rotation speed / wind speed.

No other significant SACs were observed in the listening surveys.

On the basis of the observed audible "hum" character and in accordance with the NCTP and NZS 6808:2010 an objective assessment for tonality is required.

8.3.2 Objective assessment of tonality

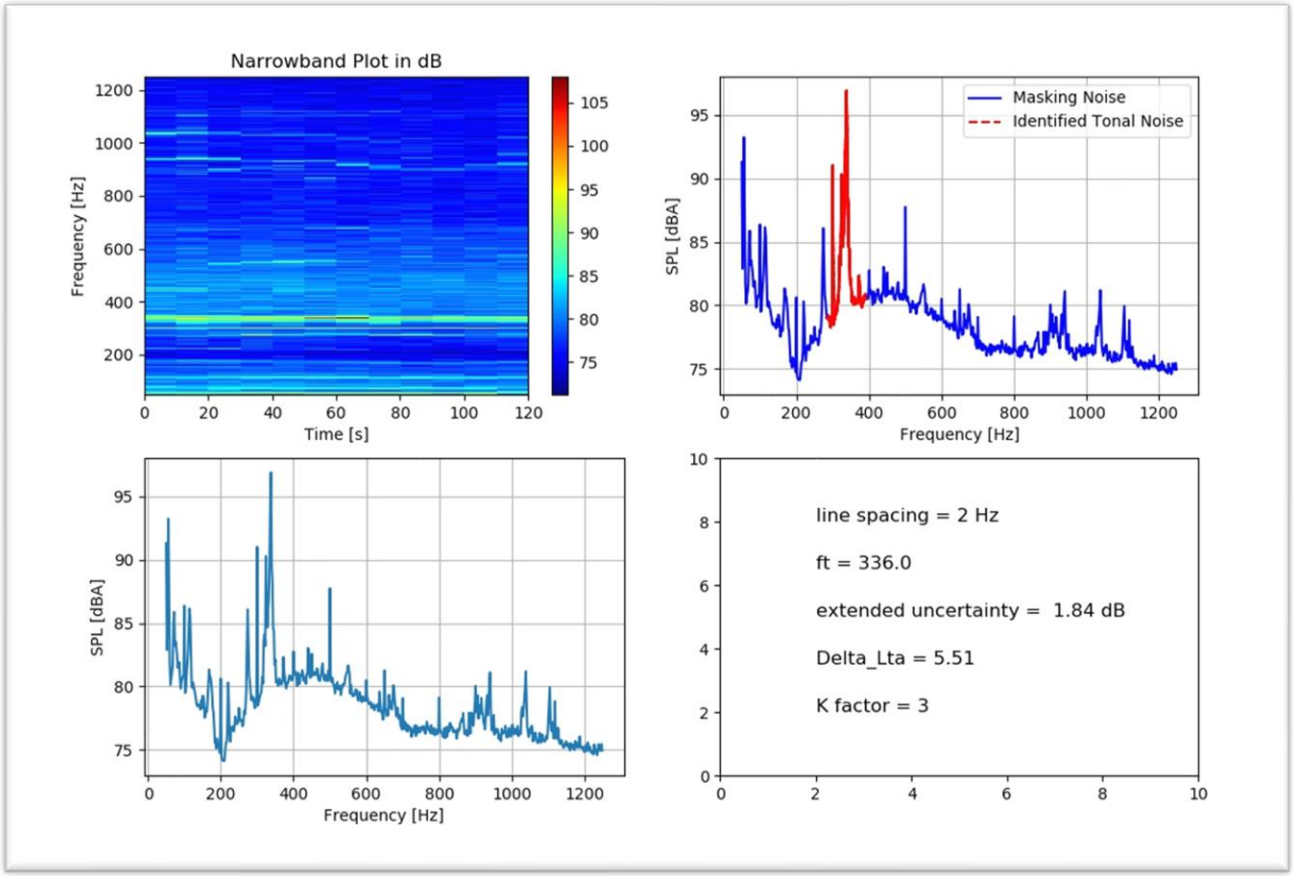
For all intervals that were identified in the Valid Data Screening process (see **Section 7**) the recorded audio (48kHz, 16-bit, 2 min duration per 10 min measurement, WAV format) was analysed using a narrow band tonality procedure as required by the NCTP, namely:

- International Standard ISO 1996-2:2017 *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels* 2017 (ISO 1996-2:2017) where,
- the narrow band method defined in ISO 1996-2:2017 Annex J *Objective method for assessing the audibility of tones in noise — Engineering method* (Annex J) is to be used, which directly references:
- that tonal audibility levels are to be determined in accordance with ISO/PAS 20065:2016 *Acoustics - Objective method for assessing the audibility of tones in noise – Engineering Method* (ISO/PAS 20065:2016).

Intervals that had been screened and identified as non-valid (e.g. affected by rain or excessive insect noise or whilst relevant WTGs weren't operating), were not assessed for tonality as such intervals would not be included in the compliance assessment in any case.

Automated signal processing scripts were used to generate twelve 10 second narrow band spectra for each valid data interval. Each spectrum had a frequency investigation range between 50 Hz and 1250 Hz with a 2 Hz line spacing. Using the method described in ISO/PAS 20065:2016 and ISO 1996-2:2017, the script determined all relevant metrics including dominant tone frequency, tonal mean audibility, extended uncertainty and any K factor penalty. Furthermore, a summary graphic of the narrow band spectrum and any identified tones as well as a coloured spectrogram were stored for each analysed record to assist in identification and confirmation that the tone was wind farm related and not a false positive from another extraneous source.

Figure 4 Example of tonality summary graphic



All intervals in which a tone of sufficient audibility was identified had the requisite K factor penalty arithmetically added to the measured L_{A90} for that interval.

The statistical distribution of valid intervals in which tonality was identified and a penalty applied is summarised in **Table 4** and example summary graphics for which an interval identified with a significant tone present for each receptor is included in **Appendix B.**

Table 4 Tonality penalty statistical distribution of valid intervals

Receptor	Assessment Period	K factor penalty						
		+ 0 dB	+ 1 dB	+2 dB	+3 dB	+4 dB	+5 dB	+6 dB
NCTP method								
N31ab	All-time	88.7%	5.1%	2.8%	1.8%	1.5%	0.1%	0.0%
	Night Only	85.4%	6.8%	4.1%	2.1%	1.4%	0.2%	0.0%
M29aa	All-time	96.1%	1.8%	1.5%	0.6%	0.0%	0.0%	0.0%
	Night Only	95.4%	1.8%	1.5%	0.7%	0.4%	0.1%	0.0%
K34aa	All-time	97.6%	0.9%	0.8%	0.4%	0.3%	0.0%	0.0%
	Night Only	97.4%	1.3%	0.8%	0.3%	0.3%	0.0%	0.0%
0.5 dB method								
N31ab	All-time	88.2%	3.5%	3.0%	2.6%	2.5%	0.1%	0.0%
	Night Only	82.2%	5.0%	4.5%	4.2%	4.0%	0.2%	0.1%
M29aa	All-time	93.8%	2.3%	1.7%	1.6%	0.7%	0.0%	0.0%
	Night Only	91.3%	2.5%	2.0%	2.7%	1.5%	0.1%	0.0%
K34aa	All-time	97.0%	1.1%	1.1%	0.4%	0.3%	0.1%	0.0%
	Night Only	94.5%	1.7%	2.4%	0.9%	0.4%	0.1%	0.0%

9 Compliance Assessment

With respect to suitable data range the NZS 6808:2010 methodology suggests a minimum of 10 days of continuous monitoring to be completed which would result in typically a set of at least 1,440 valid data points during the period for analysis, as detailed in the informative comment extracted from the standard.

> ***C7.2.1*** *It is expected that a minimum of 10 days of continuous monitoring will be required to give a suitable range of data. Typically, this will give in excess of 1440 data points, which should be plotted against the appropriate corresponding wind data. It may be necessary to take further measurements if the results show:*
>
> *(a) The distribution of data points is not uniform between minimum and maximum for each 1 m/s wind speed interval (for example there are gaps in the distributions or there is a more densely populated area of data points);*
>
> *(b) A lack, or sparseness, for one or more wind condition which, upon examination of the sound level/wind speed relationship, may represent an important subset of data. For example, a wind condition which demonstrates a tendency towards low sound levels at high wind speeds should be adequately represented in the data set if it is significant in the annual wind 'rose'. This may require measurements to be made for extended periods of time to ensure that data includes the representative range of wind conditions; or*
>
> *(c) Significant variation due to seasonal factors (such as insects and livestock), changes in stream levels, or contaminating sounds.*

As a consequence of the valid data screening process (to remove adverse local weather, relevant turbine outages and frog activity, refer **Section 7**) a considerable amount of data was discarded from the analysis data set at each reference location. For the NCTP screening method the number of valid data points was 1107 (N31ab), 1461 (M29aa) and 829 (K34aa) for the all-time period, despite the noise monitoring campaign extending for over 60 days. Fortunately, the extended monitoring period combined with the valid data screening has resulted in a good distribution of data across wind conditions and consideration of seasonal influence that addresses (a), (b), (c), and as such the NCTP screened data sets should be considered statistically robust.

In accordance with the planning permit, the data sets are considered for both:

- all periods: 0000 to 2400 hours, and
- night periods: 2200 to 0700 hours.

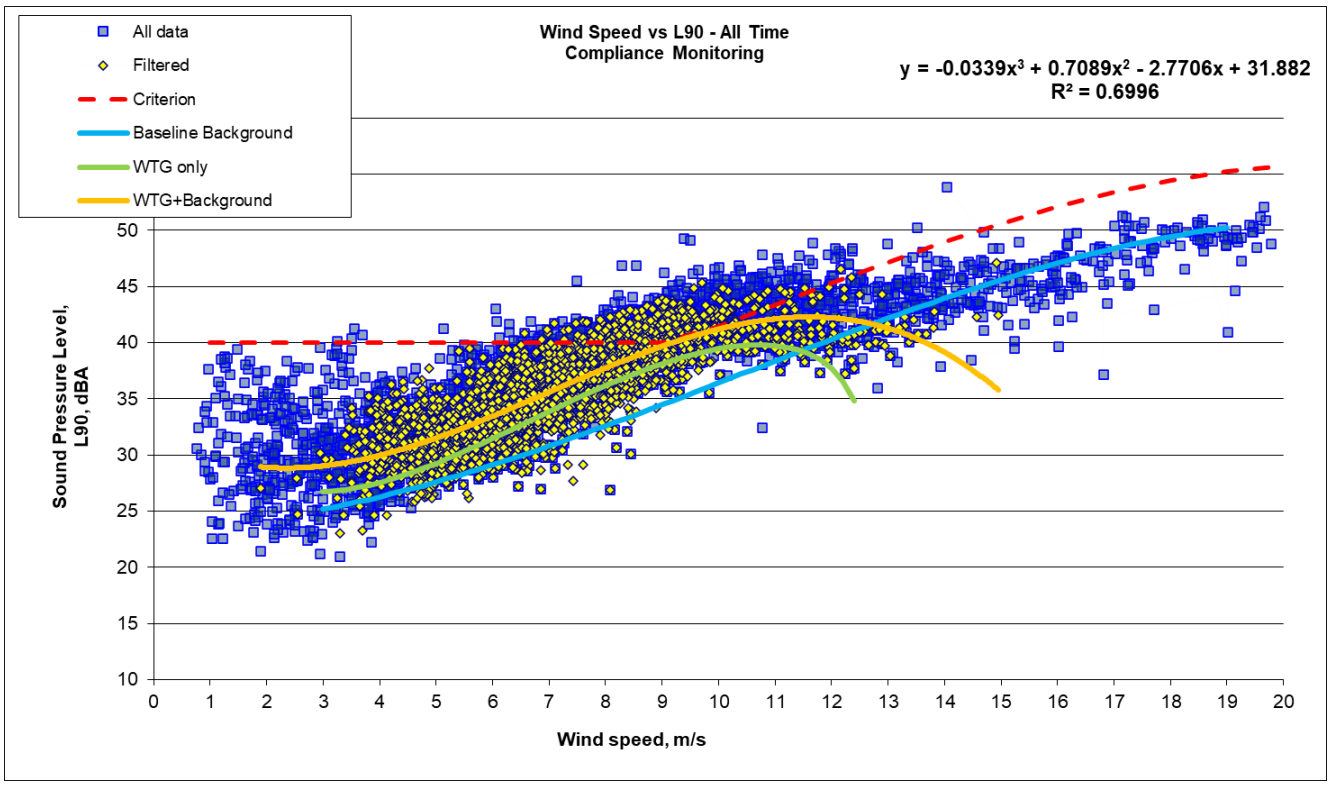
The assessment process can be summarised as follows (refer **Figure 5**):

1. The original *All data* set (blue dots) and the *Filtered* valid data set with any SAC adjustments applied (yellow dots) are plotted against the derived wake free hub height wind speed to obtain a L_{A90} sound pressure level versus wind speed characteristic for each location. A trend line of best fit for the filtered data set is then determined using a cubic polynomial, which represents the wind farm + background noise (refer *WTG+Background* yellow line)
2. The trend line, from (1) above, is then corrected to remove the influence of ambient background noise by logarithmically subtracting the previously collected background noise regression trend line (refer *Baseline*

Background blue line). The resulting background corrected trend line represents the wind farm only noise (refer *WTG only* green line). At higher wind speeds where background noise dominates over wind farm noise, and a result of logarithmic subtraction, the green line would tend to asymptote to 0 dBA. Consequently, *WTG only* noise has only been calculated for wind speeds where the *WTG+Background* noise is more than 1 dB higher than the *Baseline Background* noise regression trend line.

3. The wind farm only noise (refer *WTG only* green line) is then compared with the noise limit (refer *Criterion* dashed red line) to determine compliance at each receptor. The resulting difference between them is referred to as the compliance margin.

Figure 5 Example compliance assessment graph



10 Results

10.1 NZS 6808 noise limit assessment

The data was collected as outlined in **Section 6,** screened for validity as outlined in **Section 7** and evaluated for SACs as outlined in **Section 8.** The compliance assessment was completed as outlined in **Section 9.**

The results of the analysis for screening as per the NCTP method are presented in **Section 10.1.1.**

The results of the analysis for screening as per the 0.5 dB method are presented in **Section 10.1.2.**

10.1.1 NCTP screening method

A summary table showing the compliance margin is shown in **Table 5** and **Table 6**. Refer to **Appendix B** for detailed summaries for each site.

Table 5 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	12.2	11.5	9.7	7.2	4.6	2.4	2.2	3.9	8.8	-	-	-
M29aa	20.0	15.1	11.4	8.2	5.4	3.1	2.3	3.3	6.0	15.8	-	-
K34aa	12.6	10.8	8.3	5.7	3.2	1.2	1.7	4.6	15.9	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 6 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	13.1	11.4	9.4	7.1	4.9	2.8	1.0	0.1	1.8	5.0	14.9	-
M29aa	20.7	14.4	10.8	7.9	5.3	3.2	1.6	1.0	4.0	13.3	-	-
K34aa	13.5	11.2	8.5	5.7	3.2	1.2	0.1	2.6	12.8	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

10.1.2 0.5 dB screening method

A summary table showing the compliance margin is shown in **Table 7** and **Table 8**. Refer to **Appendix C** for detailed summaries for each site.

Table 7 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	12.4	10.7	8.5	6.1	3.8	1.9	2.0	3.6	7.6	-	-	-
M29aa	19.0	13.7	10.3	7.6	5.2	3.1	2.3	3.1	4.5	7.0	13.3	-

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
K34aa	11.8	10.0	7.9	5.5	3.2	1.2	1.4	3.3	7.5	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 8 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	11.4	10.7	8.9	6.5	4.0	1.7	-0.1	-0.5	3.0	16.2	-	-
M29aa	18.2	13.2	10.1	7.5	5.2	3.1	1.4	0.1	1.6	4.1	8.8	-
K34aa	11.9	10.6	8.6	6.1	3.6	1.3	-0.3	1.4	6.9	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement

11 Conclusion

The noise emissions from the Yendon section of Lal Lal Wind Farm have been assessed as the Stage 1 Noise Testing in accordance with the NCTP which were endorsed to comply with the condition 24 and 25 of Lal Lal Wind Farm Planning Permit.

Unattended noise compliance monitoring was undertaken for a period of approximately 60 days between 26 June 2022 to 1 August 2022 at the three reference receivers N31ab, M29aa and K34aa.

The collected data was screened to obtain a valid data set by excluding data intervals in accordance with the NCTP to remove periods of local rain, periods of wind outside the operating wind speed range, periods adversely affected by extraneous insect or frog noise, or when one or more WTGs critical to wind farm noise level at each receptor was not operating. On this last point the data set was screened in two slightly different ways, the NCTP method, and the slightly less conservative 0.5 dB method which provides a higher number of valid data points.

The survey period included extended periods of wet weather, which have been characteristic across much of Australia in 2022. One consequence of this has been that frog populations were very high and widespread and hence frog call noise was observed to be significant at most locations in the project area. One-third octave band data validity screening (refer to **Section 7)** resulted in large amounts of extraneous noise affected data being discarded from the analysis data set, however, it is evident that some data points within the valid dataset remain affected by the influence of frog noise. This is evidenced by:

1. the fact that at all reference locations the regression curves for the NCTP screening method (0.1dB) are lower than the less stringent 0.5dB screening method in almost all instances, which is counter-intuitive should noise levels have been influenced or dominated by WTG noise alone.
2. A detailed investigation of selected periods was completed (refer to **Appendix F**) in which the influence of frog & insect noise was evaluated across 3 selected periods where the extraneous noise screening method was shown to successfully trigger and reject data, as well as fail to trigger and have periods of insect / frog noise residually influence the valid data set.

A consequence of this is that the elevated frog activity (compared to the period when baseline conditions were established) still has some influence on the compliance data set, which serves to erroneously elevate the derived WTG noise level.

Subjective assessment listening surveys were completed, and it was observed that at some periods certain survey locations, there was an audible and discernible “hum” character in the noise emissions from turbines. No other special audible characteristics were observed in the listening surveys.

On the basis of the observed audible “hum” character and in accordance with the NCTP an objective assessment for tonality was completed on the recorded audio samples for all valid intervals, in accordance with ISO/PAS 20065:2016. All intervals in which a tone of sufficient audibility was identified had the requisite K factor penalty arithmetically added to the measured L_{A90} for that interval.

As a consequence of the valid data screening process (to remove adverse local weather, relevant turbine outages and frog activity, (refer **Section 7**) a large amount of data was discarded from the analysis data set at each reference location.

11.1 Conclusion - 0.5 dB screening method

To maintain consistency and transparency with earlier compliance assessments (e.g. Elaine Wind Farm Stage 1) this report has chosen to also evaluate the marginally less conservative 0.5dB screening method for "relevant turbines", noting that this is not required under the NCTP.

The 0.5 dB method screened data set yielded a greater amount of valid data 2683 (N31ab), 2510 (M29aa) and 2090 (K34aa) for the all-time period, compared to the NCTP method.

The assessment indicates that all receptors comply with their relevant NZS 6808 noise for the all-time period, with a minimum margin of compliance at N31ab, M29aa and K34aa of approximately 2 dBA, 2 dBA and 1 dBA respectively. Similarly, the assessment indicates that all receptors comply with the all-time period noise limits incorrectly specified in the NCTP.

The result for the night-time only data indicates a minor exceedance of the NZS 6808 noise limit at receptor N31ab and K34aa of <0.5 dBA and <0.3 dBA respectively. It should be noted that the above indicated marginal exceedances may be the result of residual extraneous noise which has contributed to the overall measured noise level. However, the assessment indicates all receptors comply with the all-time period noise limits incorrectly specified in the NCTP.

Whilst the above results with 0.5dB screening method are not currently able to demonstrate compliance with the night-time NZS 6808 noise limit at N31ab and K34aa this should not be considered as evidence of non-compliance.

The monitoring described in this report form part of the Stage 1 of noise compliance measurements. As of March 2023, further noise testing is currently being undertaken where drier ground conditions with fewer frogs are anticipated to reduce excess residual extraneous noise influence as well as a number of additional supplementary methods (in accordance with the approach defined in the NCTP) will be investigated which may enable the compliance of the wind farm with the NCTP/NZ6808 to be more conclusively demonstrated.

11.2 Conclusion – NCTP screening method

The NCTP screening method for "relevant turbines" adopts a very conservative approach with a predictive tolerance of only 0.1 dB reduction from full operation.

NZS6808:2010 indicates (informative comment C7.2.1) that a minimum of 10 days of monitoring data is expected to give a suitable range of data, and further measurements may be required if:

- The distribution of data is not uniform between minimum and maximum.
- There is a lack or sparseness of data.
- There are significant variation due to seasonal factors or contaminating sounds.

For the NCTP screening method the number of valid data points was 1107 (N31ab), 1461 (M29aa) and 829 (K34aa) for the all-time period.

The extended monitoring period (~54-67 days), together with the valid data screening methods, has resulted in a good distribution of data across wind conditions and the removal of contaminating sounds and consideration of seasonal influence as far as possible, and as such the NCTP screened data sets are considered sufficiently statistically robust for NZS6808 assessment. Therefore, it can be concluded that the NCTP screening method was successful in providing a robust data set for analysis.

Notwithstanding the residual influence of frog noise artificially elevating the result, the monitoring and analysis (NCTP screening method) indicates that all reference receptors comply with their relevant NZS 6808 noise criteria and the noise limits incorrectly specified in the NCTP for both the all-time and night-only periods.

On this basis it can be concluded that Yendon Wind Farm complies with its operational noise limits in accordance with the monitoring and analysis methodology specified in NCTP.

APPENDIX A

Glossary

Term	Description
'A' weighted	A frequency adjustment which represents how humans hear sounds.
ABL	Assessment Background Level. The single-figure background level representing each assessment period (day, evening and night). Defined in the *Noise Policy for Industry*.
Ambient noise level	The all-encompassing sound associated with an environment or area.
Background creep	The incremental increase in background noise levels over time as new developments are built in an area.
dB	Decibel
dBA	'A' weighted decibel
DW	The weighted level difference between two rooms, that is, the on-site sound insulation between two spaces.
Facade affected	A monitoring location which is influenced by facade reflections. Measurements at facades are typically taken at a distance of 1 m away and the measured noise level generally regarded as being +2.5 dB higher than 'free field'.
Free field	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
Hz	Hertz
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L_{90} , L_{10}, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
L_{AE} (or SEL)	Sound Exposure Level. This is the constant sound level that has the same amount of energy in one second as the original noise event.
LA_{eq}	The 'A' weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
L_{Amax}	The A' weighted maximum sound pressure level of an event.
Term	Description
Low frequency	Noise containing energy in the low frequency range.
L_P or SPL	Sound Pressure Level
Lw or SWL	Sound Power Level
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
Noise reduction	The difference in sound pressure level between any two areas.
NR noise rating	Single number evaluation of the background noise level in a space. The NR level is typically around 5 to 6 dB below the 'A' weighted noise level.
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Offensive noise	Noise that is considered harmful or which interferes unreasonably with affected receivers.
PNTL	Project Noise Trigger Levels. Target noise levels for a particular noise generating development.
RBL	Rating Background Level. The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. Defined in the *Noise Policy for Industry*.
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Time weighting	Sound level meters can be set to 'fast' or 'slow' response. 'Fast' corresponds to a 125 ms time constant and 'slow' corresponds to a 1 second time constant.
Tonality	Noise containing a prominent frequency.
Transmission loss (or sound transmission loss or sound reduction index)	A test which rates the sound transmission properties of a wall, floor or roof construction.

APPENDIX B

Compliance Assessment
against 6808 Limits derived from pre-construction baseline

NCTP method screening

Location K34aa

Location K34aa is located to the north of the Yendon portion of the Lal Lal Wind Farm, approximately 860m from the nearest WTG. The monitoring location is shown in **Figure 6.**

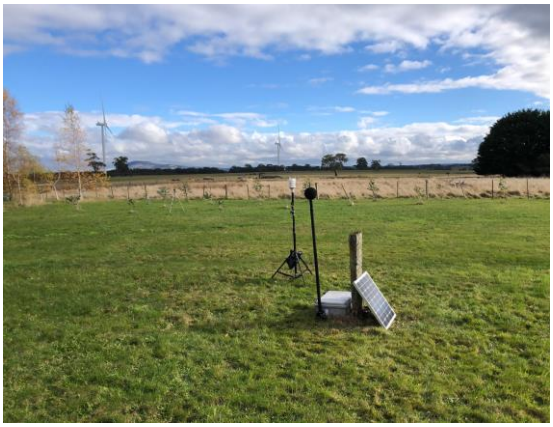
Figure 6 K34aa measurement location

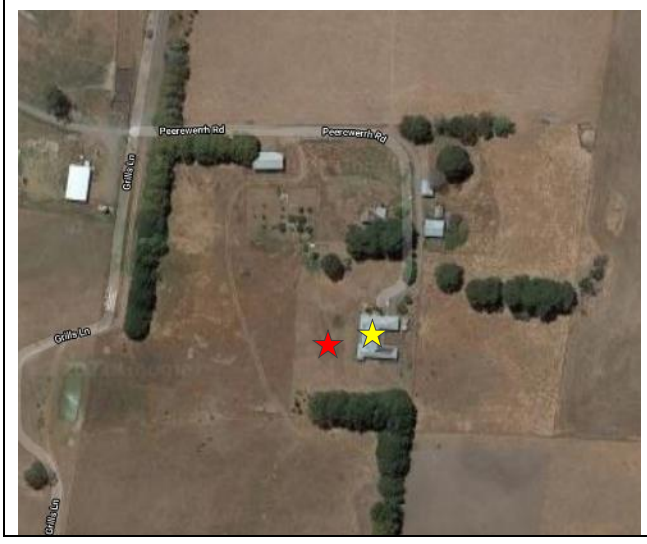
Looking North

Looking East

Looking South

Looking West





Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 7** and **Figure 8**. **Table 11** and **Table 12** presents the summary tables of results for all time and night only periods respectively.

Figure 7 K34aa compliance results - all time

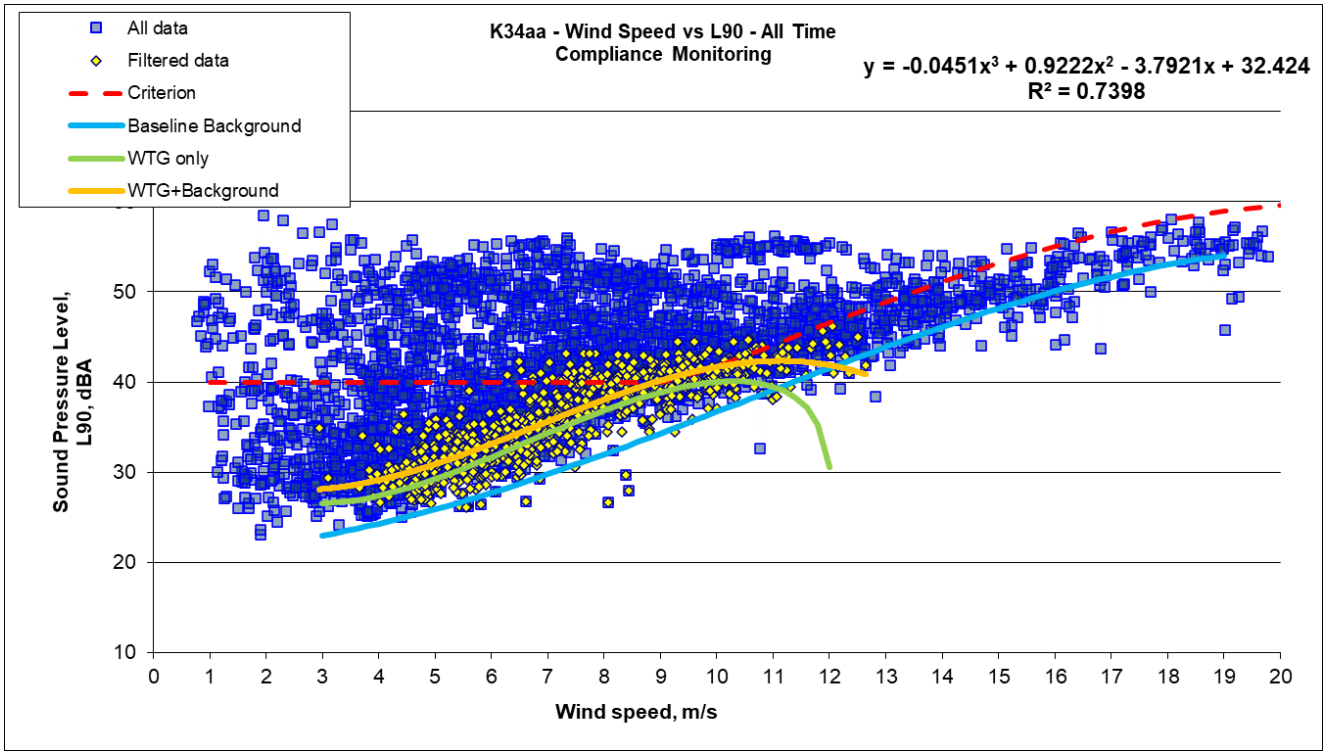


Figure 8 K34aa compliance results – night only

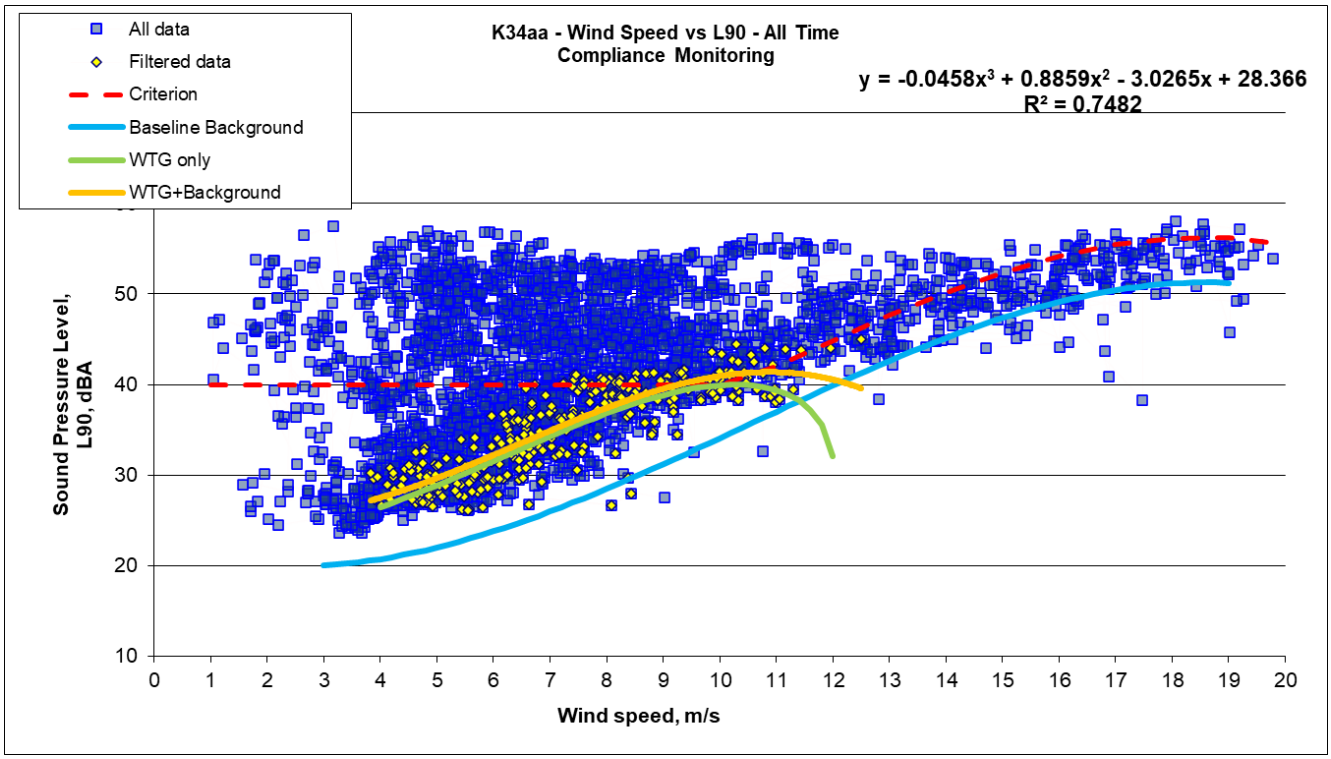


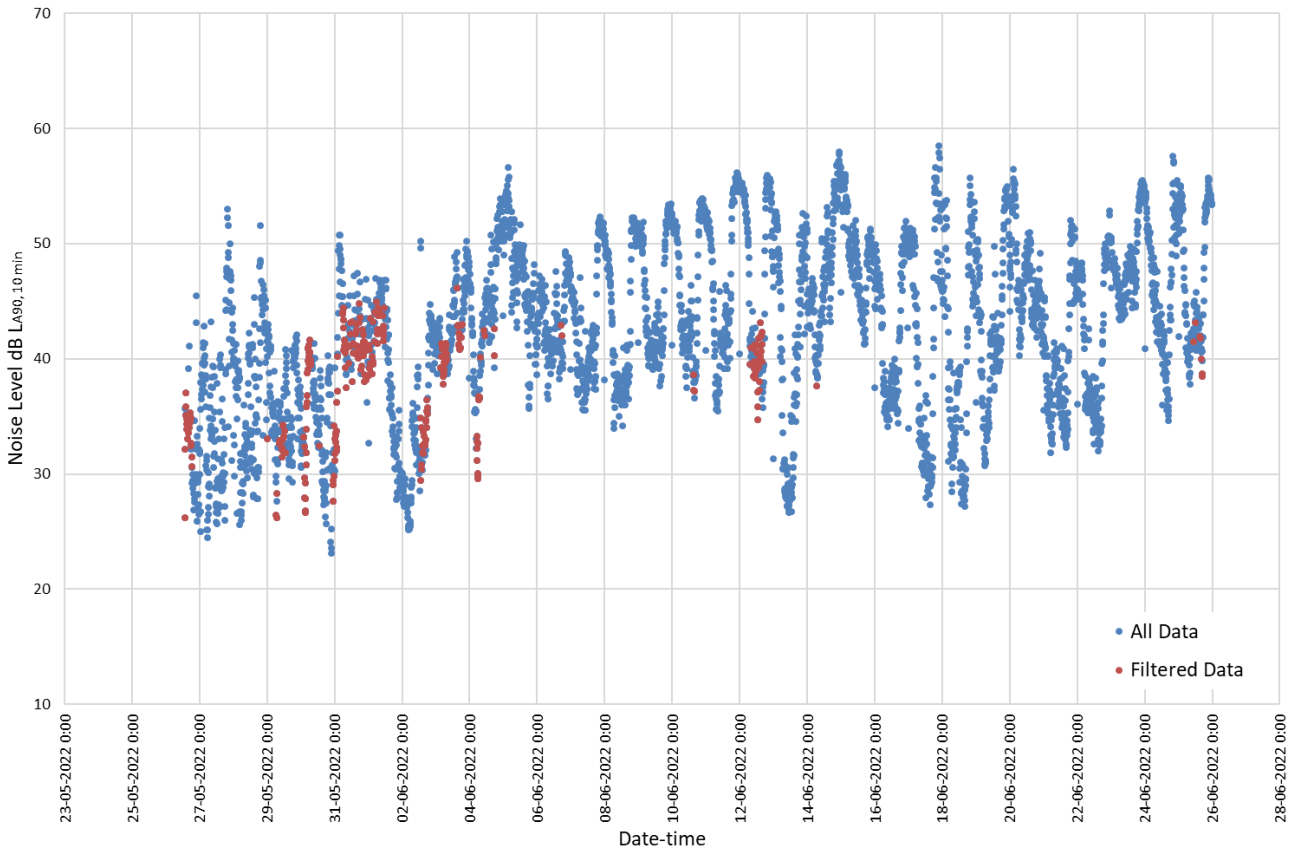
Table 9 K34aa compliance results – all time

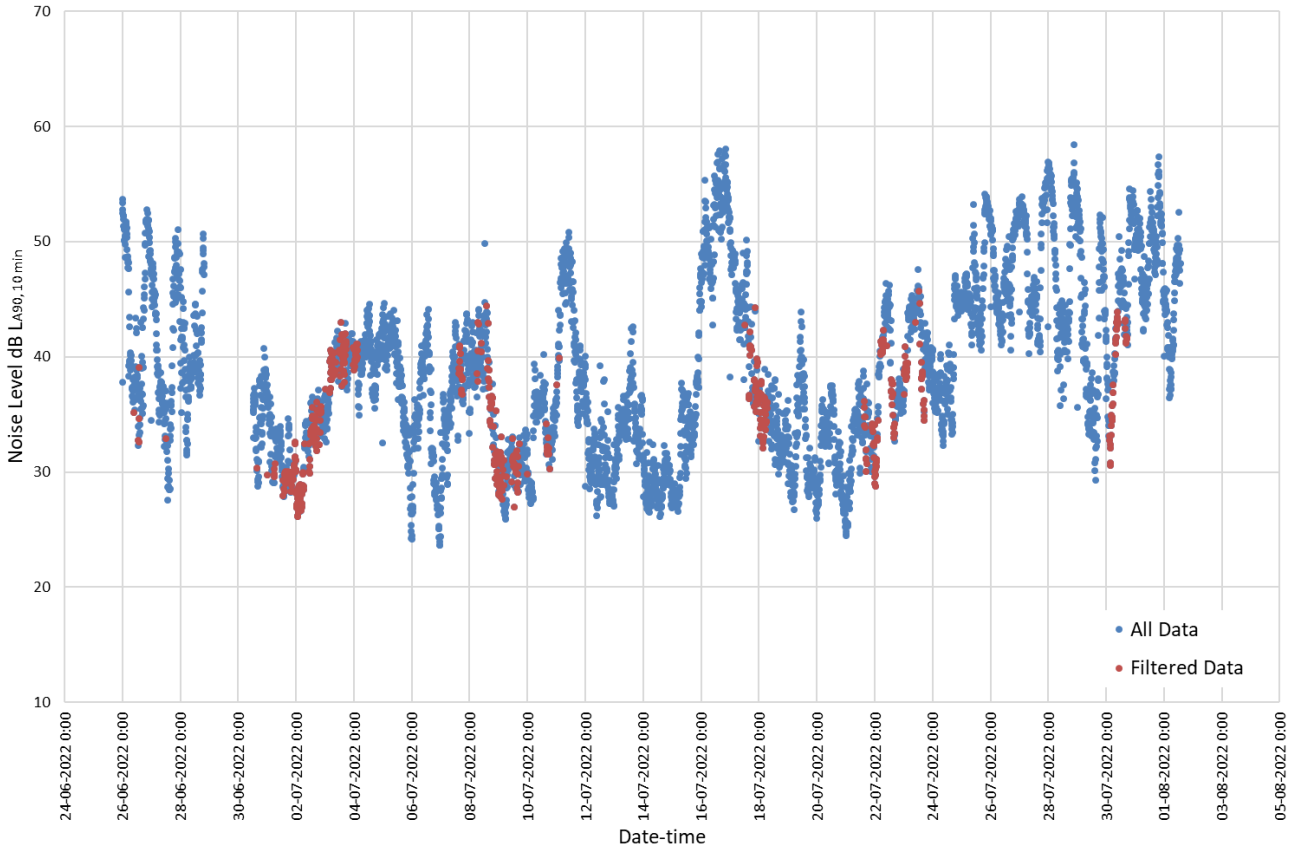
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.3	25.9	27.7	29.8	32.0	34.3	36.7	39.1	41.5	43.9	46.1	48.2
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	41.7	44.1	46.5	48.9	51.1	53.2
Background + WTG, dBA	29.1	30.9	33.1	35.6	38.0	40.1	41.7	42.3	41.9	40.0	36.5	31.0
Corrected WTG noise, dBA	27.4	29.2	31.7	34.3	36.8	38.8	40.0	39.5	30.6	-	-	-
Compliance Margin, dBA	12.6	10.8	8.3	5.7	3.2	1.2	1.7	4.6	15.9	-	-	-

Table 10 K34aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	20.7	22.0	23.8	26.0	28.5	31.2	34.1	37.0	39.9	42.6	45.1	47.3
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	44.9	47.6	50.1	52.3
Background + WTG, dBA	27.5	29.7	32.2	34.9	37.4	39.5	40.9	41.4	40.5	38.2	34.1	27.9
Corrected WTG noise, dBA	26.5	28.8	31.5	34.3	36.8	38.8	39.9	39.4	32.1	-	-	-
Compliance Margin, dBA	13.5	11.2	8.5	5.7	3.2	1.2	0.1	2.6	12.8	-	-	-

Figure 9 Time history of measured LA90,10-minutes at K34aa




70
60
50
40
30
20
10
Noise Level dB LA90, 10 min
24-06-2022 0:00
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
22-07-2022 0:00
24-07-2022 0:00
26-07-2022 0:00
28-07-2022 0:00
30-07-2022 0:00
01-08-2022 0:00
03-08-2022 0:00
05-08-2022 0:00
Date-time
All Data
Filtered Data

Location M29aa

Location M29aa is located to the south of the Yendon portion of the Lal Lal Wind Farm, approximately 1200m from the nearest WTG. The monitoring location is shown in **Figure 10**.

Figure 10 M29aa measurement location

Looking Northwest

Looking Northeast

Looking Southwest

Looking Southeast

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 11** and **Figure 12**. **Table 11** and **Table 12** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 11 M29aa compliance results - all time

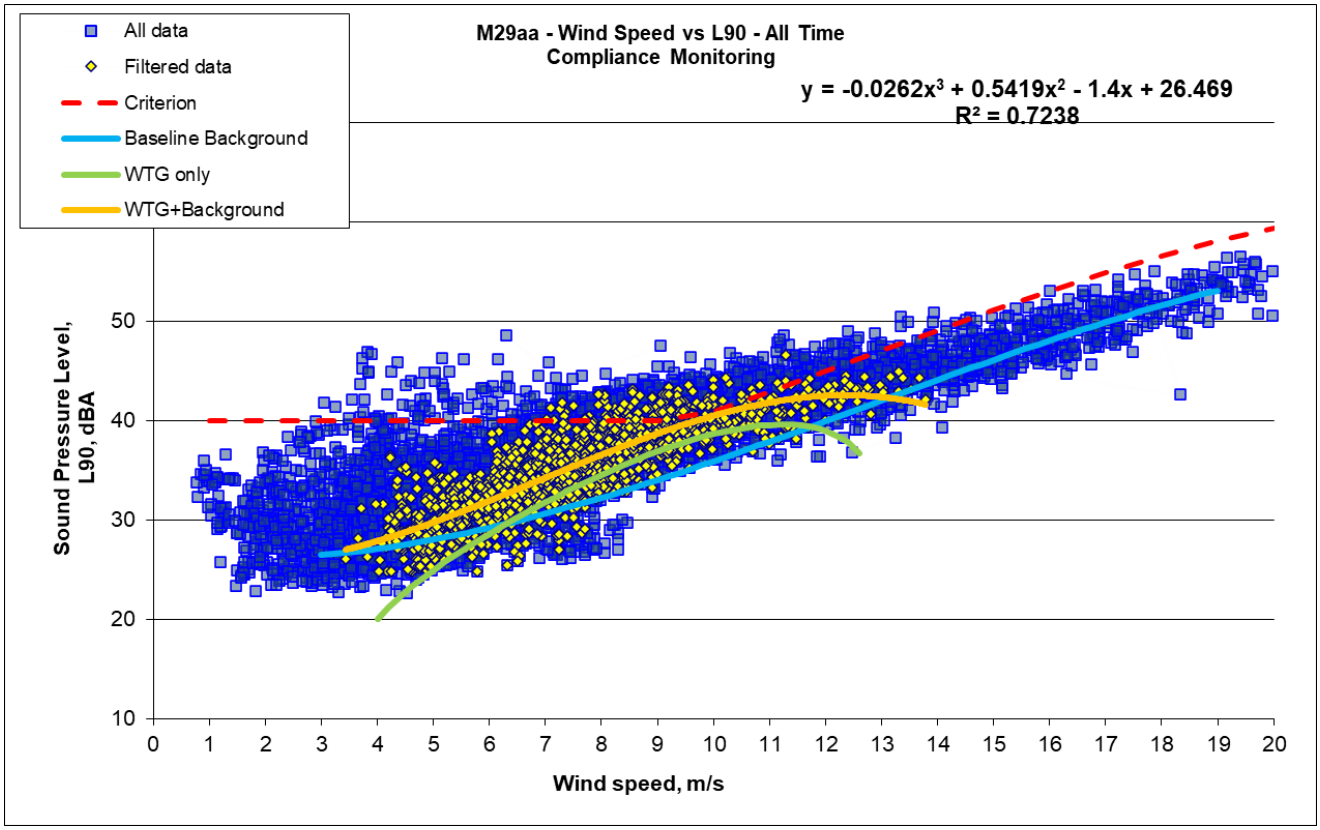


Figure 12 M29aa compliance results – night only

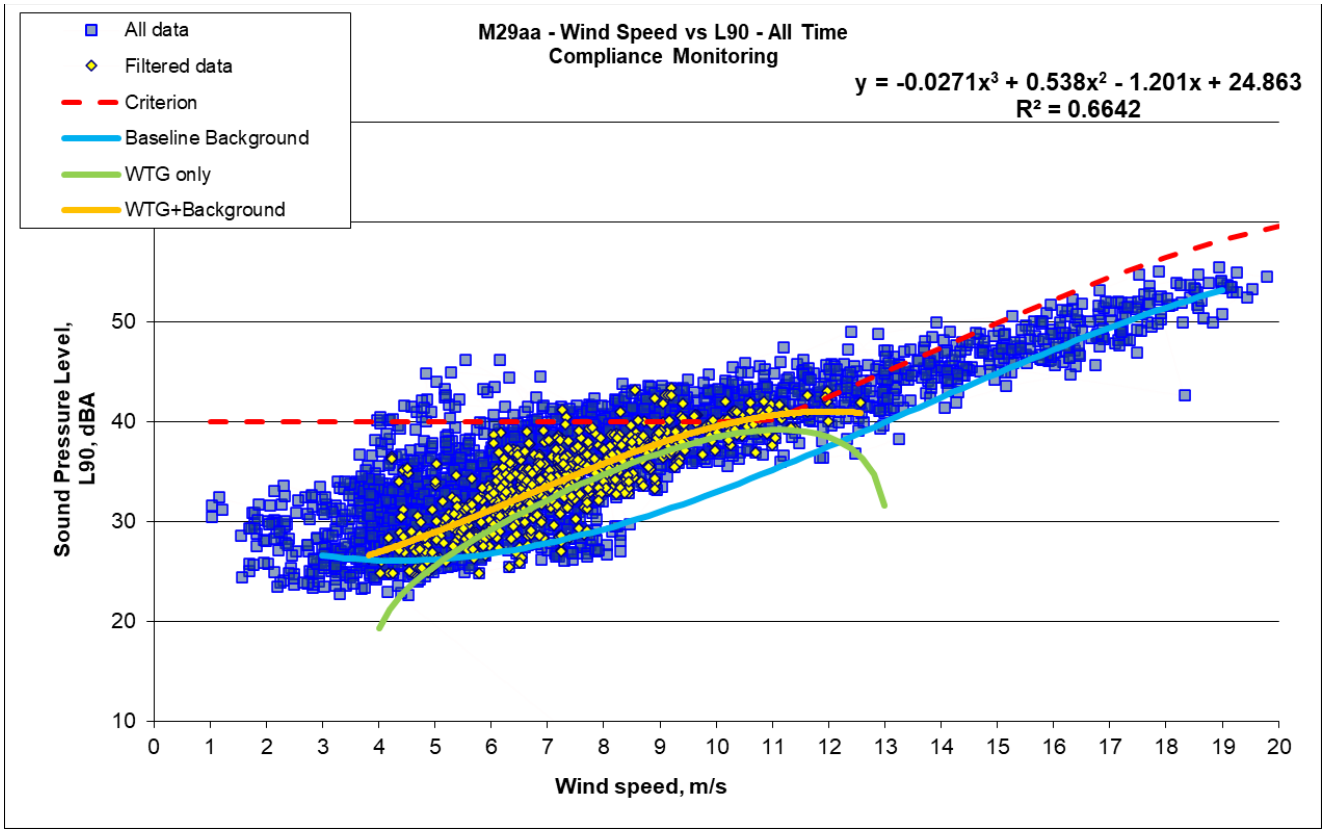


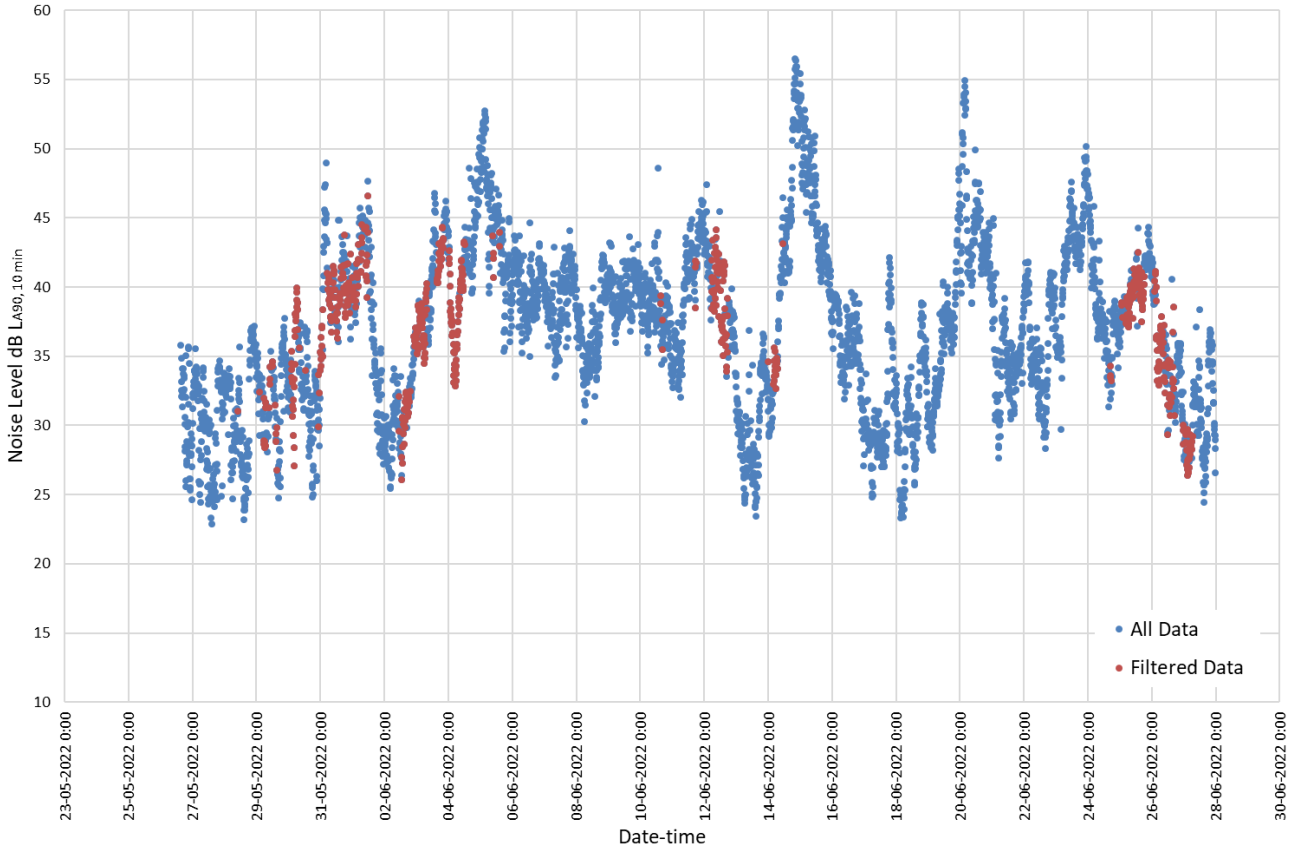
Table 11 M29aa compliance results – all time

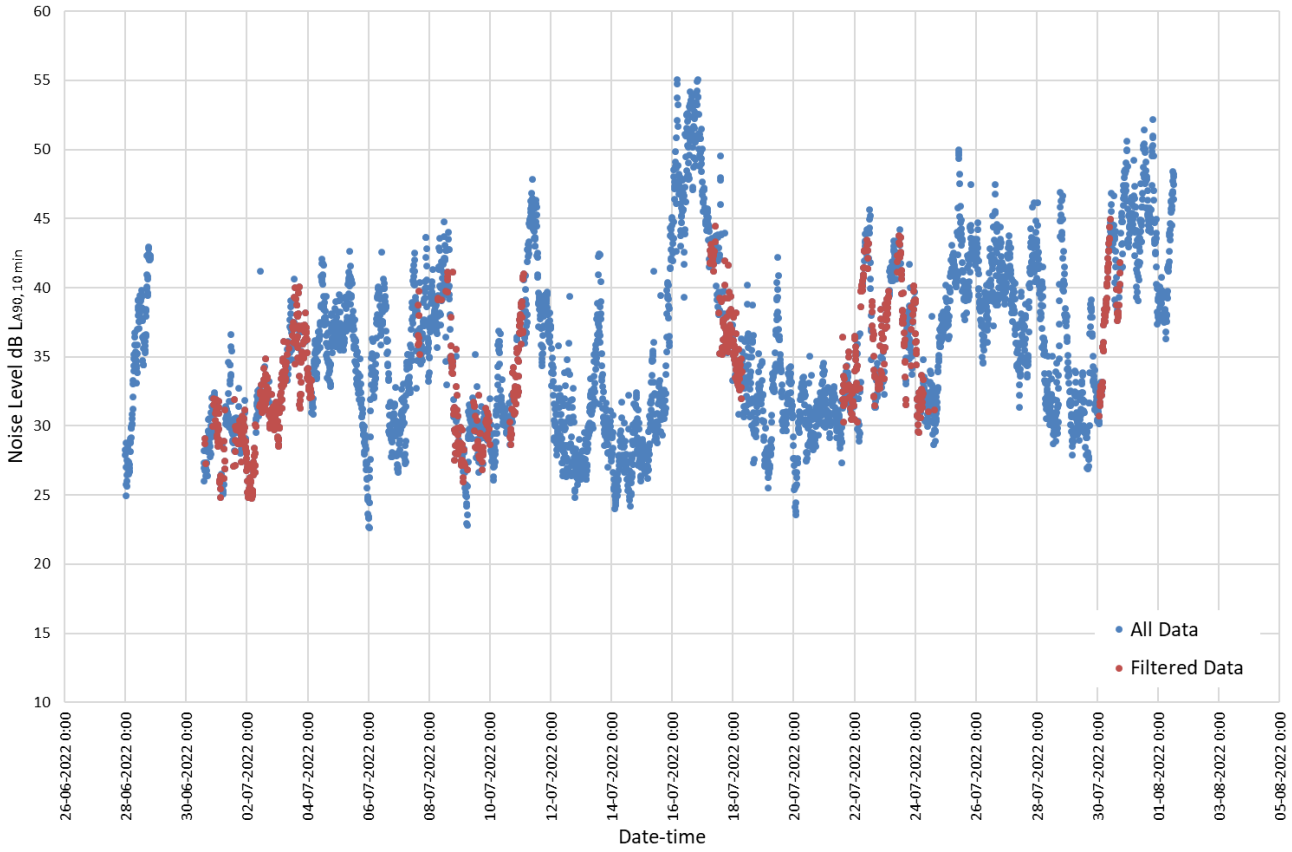
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	27.1	28.0	29.2	30.6	32.2	34.0	35.9	37.9	39.9	42.0	44.1	46.1
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
Background + WTG, dBA	27.9	29.7	31.9	34.2	36.6	38.7	40.5	41.8	42.5	42.4	41.3	39.1
Corrected WTG noise, dBA	20.0	24.9	28.6	31.8	34.6	36.9	38.6	39.6	39.0			
Compliance Margin, dBA	20.0	15.1	11.4	8.2	5.4	3.1	2.3	3.3	6.0			

Table 12 M29aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	26.1	26.2	26.8	27.8	29.2	31.0	33.0	35.2	37.5	39.9	42.4	44.8
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
Background + WTG, dBA	26.9	28.9	31.2	33.5	35.8	37.8	39.5	40.6	41.0	40.5	39.0	36.3
Corrected WTG noise, dBA	19.3	25.6	29.2	32.1	34.7	36.8	38.4	39.2	38.5			
Compliance Margin, dBA	20.7	14.4	10.8	7.9	5.3	3.2	1.6	1.0	4.0			

Figure 13 Time history of measured LA90,10-minutes at M29aa




Noise Level dB LA90, 10 min
60
55
50
45
40
35
30
25
20
15
10
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
22-07-2022 0:00
24-07-2022 0:00
26-07-2022 0:00
28-07-2022 0:00
30-07-2022 0:00
01-08-2022 0:00
03-08-2022 0:00
05-08-2022 0:00
Date-time
All Data
Filtered Data

Location N31ab

Location N31ab is located to the east of the Yendon portion of the Lal Lal Wind Farm, approximately 900m from the nearest WTG. The monitoring location is shown in **Figure 14**.

Figure 14 N31ab measurement location

Looking North

Looking East

Looking South

Looking West

Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 15** and **Figure 16. Table 13** and **Table 14** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 15 N31ab compliance results - all time

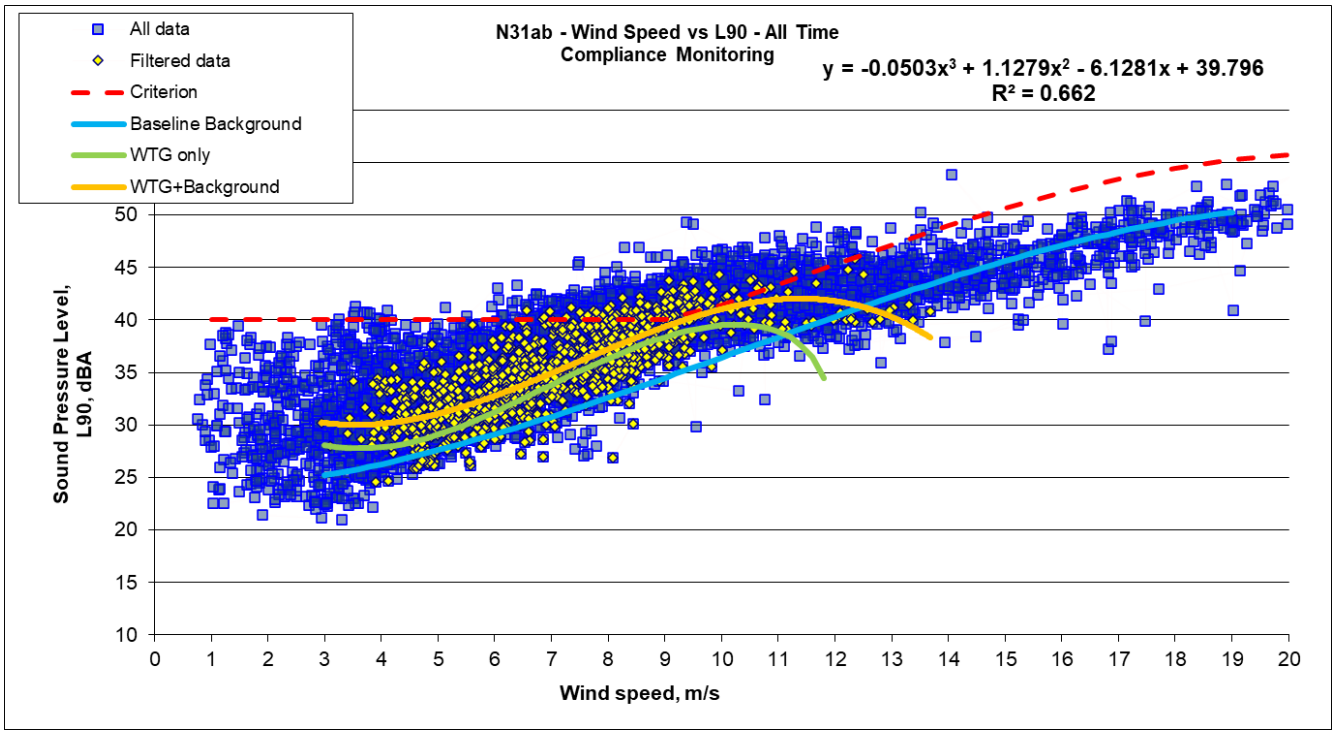


Figure 16 N31ab compliance results – night only

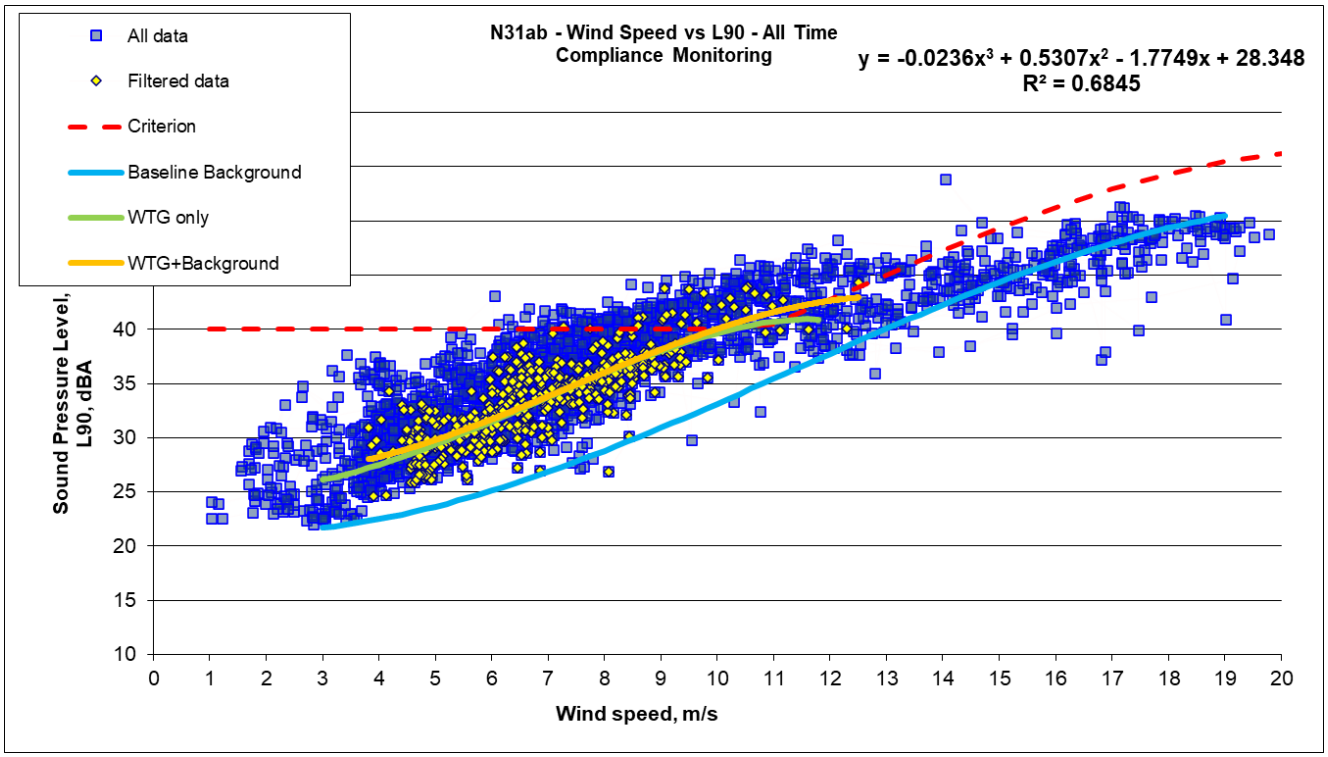


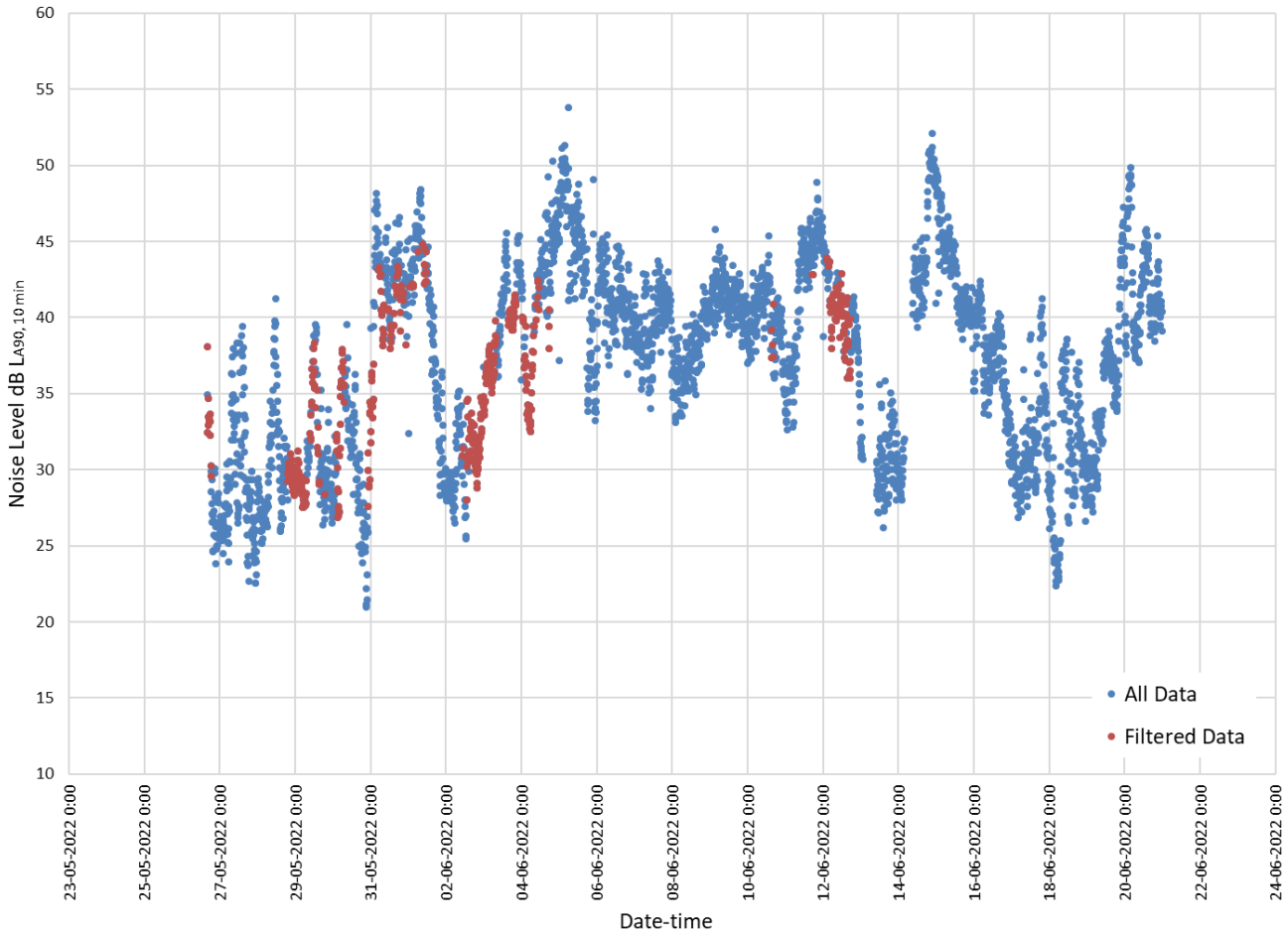
Table 13 N31ab compliance results – all time

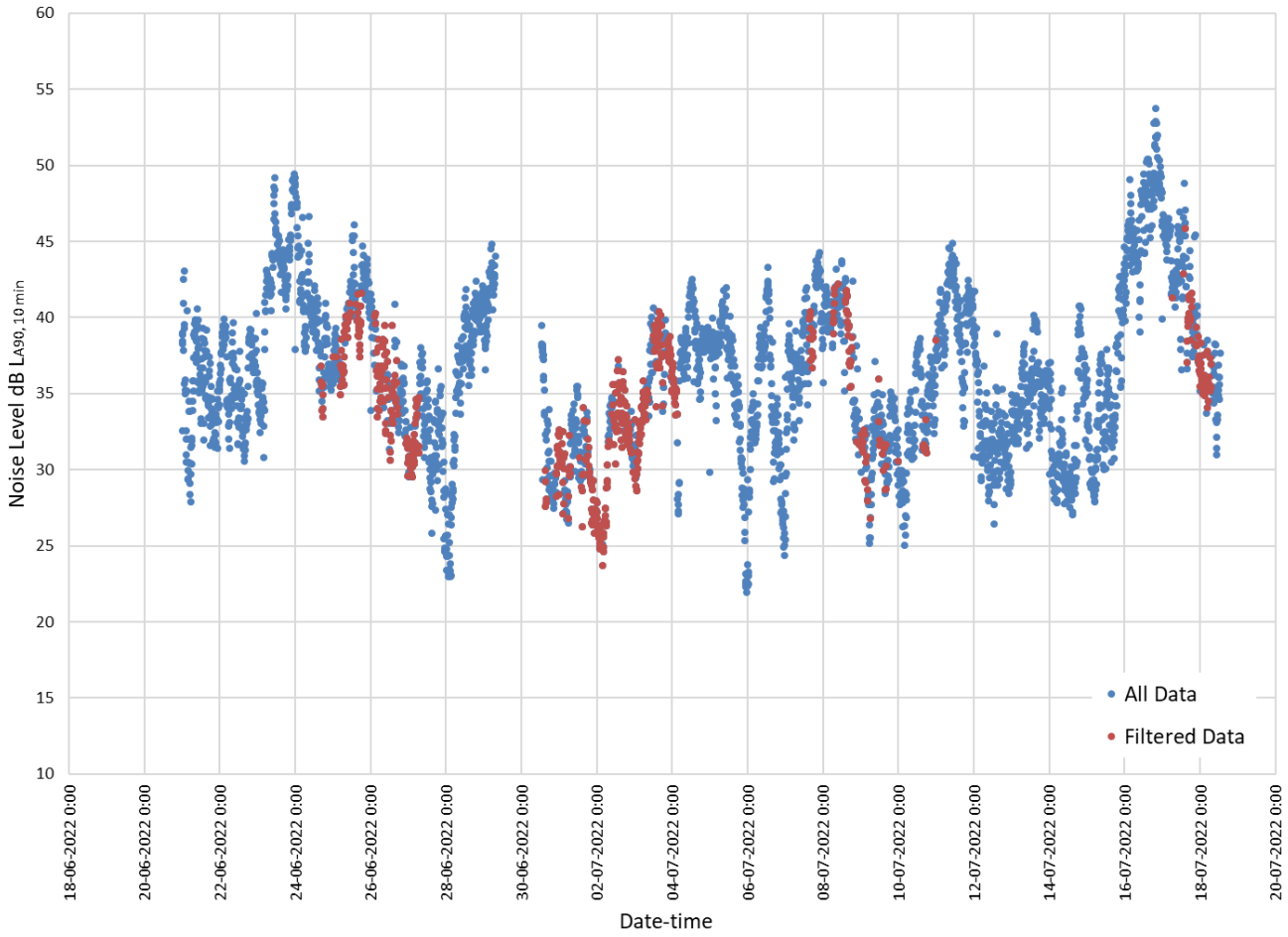
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	26.3	27.6	29.1	30.8	32.6	34.5	36.4	38.4	40.3	42.2	44.0	45.6
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
Background + WTG, dBA	30.1	31.1	32.8	34.9	37.2	39.4	41.0	41.9	41.8	40.3	37.1	32.0
Corrected WTG noise, dBA	27.8	28.5	30.3	32.8	35.4	37.6	39.2	39.4	36.5			
Compliance Margin, dBA	12.2	11.5	9.7	7.2	4.6	2.4	2.2	3.9	8.8			

Table 14 N31ab compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	22.5	23.6	25.1	26.8	28.8	30.9	33.1	35.4	37.7	40.0	42.2	44.3
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
Background + WTG, dBA	28.2	29.8	31.7	33.8	36.0	38.1	40.0	41.6	42.6	43.0	42.7	41.4
Corrected WTG noise, dBA	26.9	28.6	30.6	32.9	35.1	37.2	39.0	40.4	40.9			
Compliance Margin, dBA	13.1	11.4	9.4	7.1	4.9	2.8	1.0	0.1	1.8			

Figure 17 Time history of measured LA90,10-minutes at N31ab




Noise Level dB LA90,10 min
60
55
50
45
40
35
30
25
20
15
10
18-06-2022 0:00
20-06-2022 0:00
22-06-2022 0:00
24-06-2022 0:00
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
Date-time
All Data
Filtered Data

APPENDIX C

Compliance Assessment
against 6808 Limits derived from pre-construction baseline

0.5 dB method screening

Location K34aa

Location K34aa is located to the north of the Yendon portion of the Lal Lal Wind Farm, approximately 860m from the nearest WTG. The monitoring location is shown in **Figure 18**.

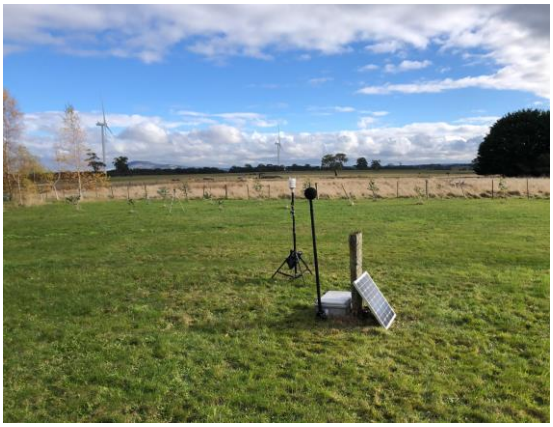
Figure 18 K34aa measurement location

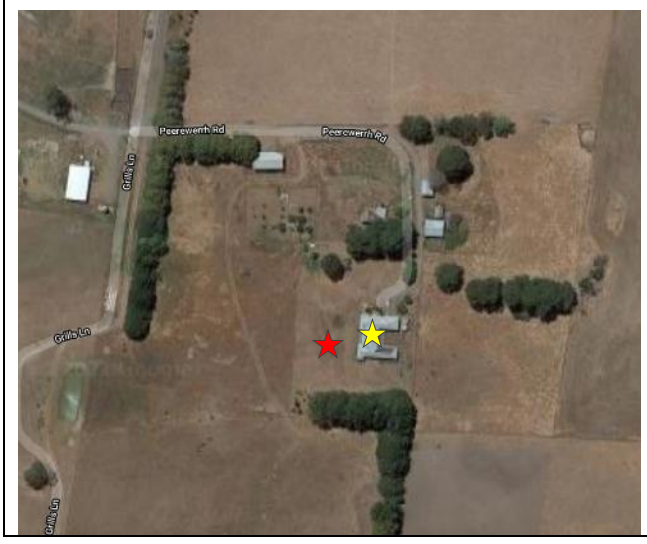
Looking North

Looking East

Looking South

Looking West





Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 7** and **Figure 8**. **Table 11** and **Table 12** presents the summary tables of results for all time and night only periods respectively.

Figure 19 K34aa compliance results - all time

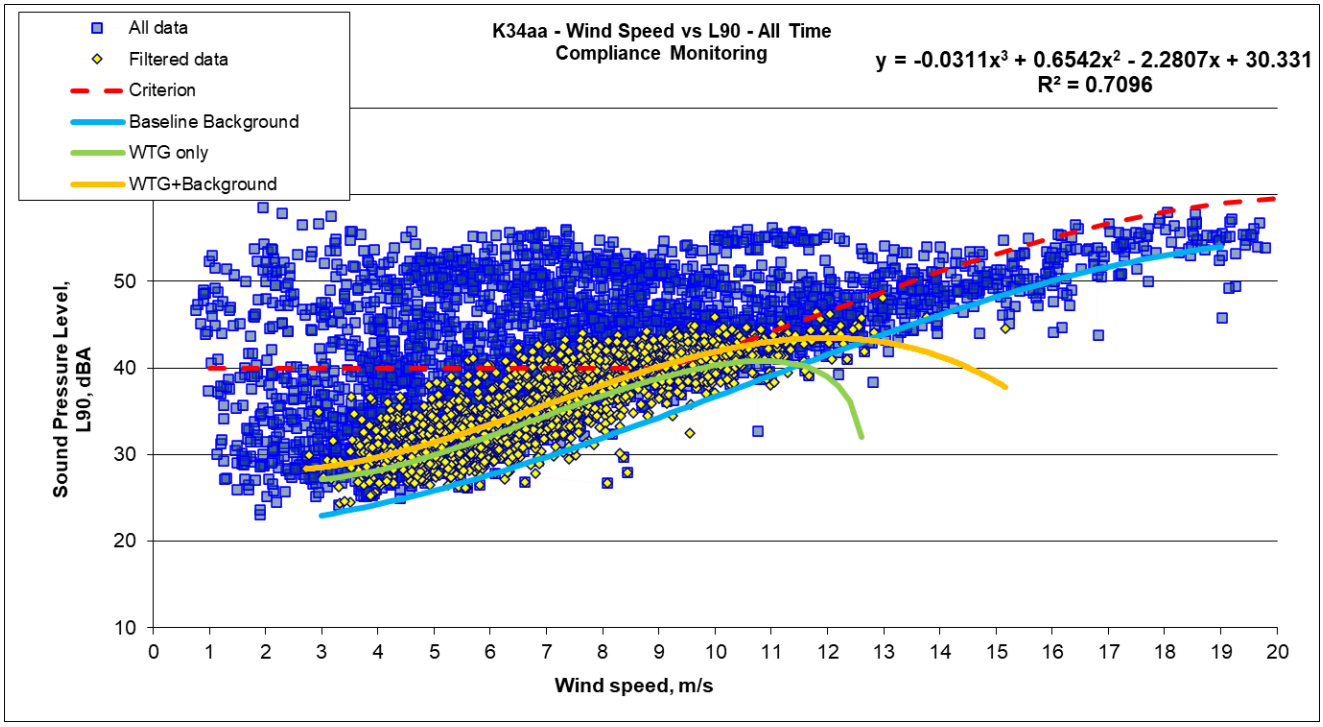


Figure 20 K34aa compliance results – night only

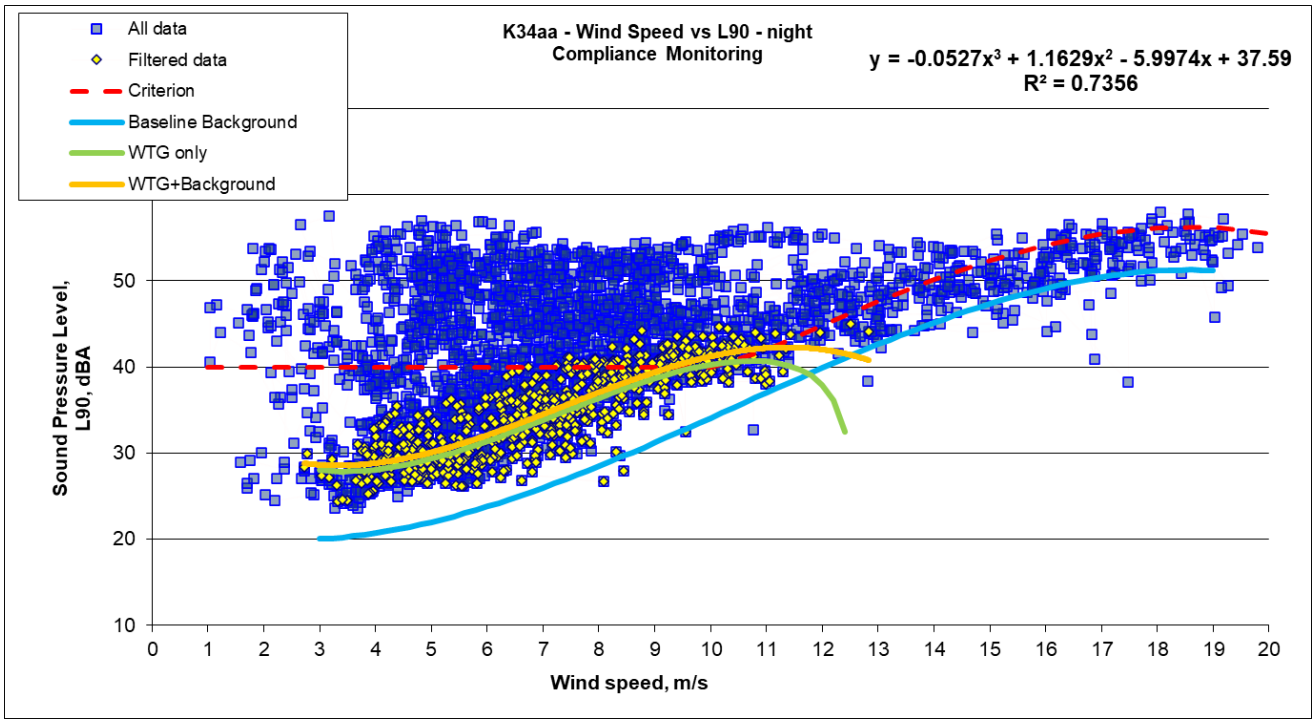


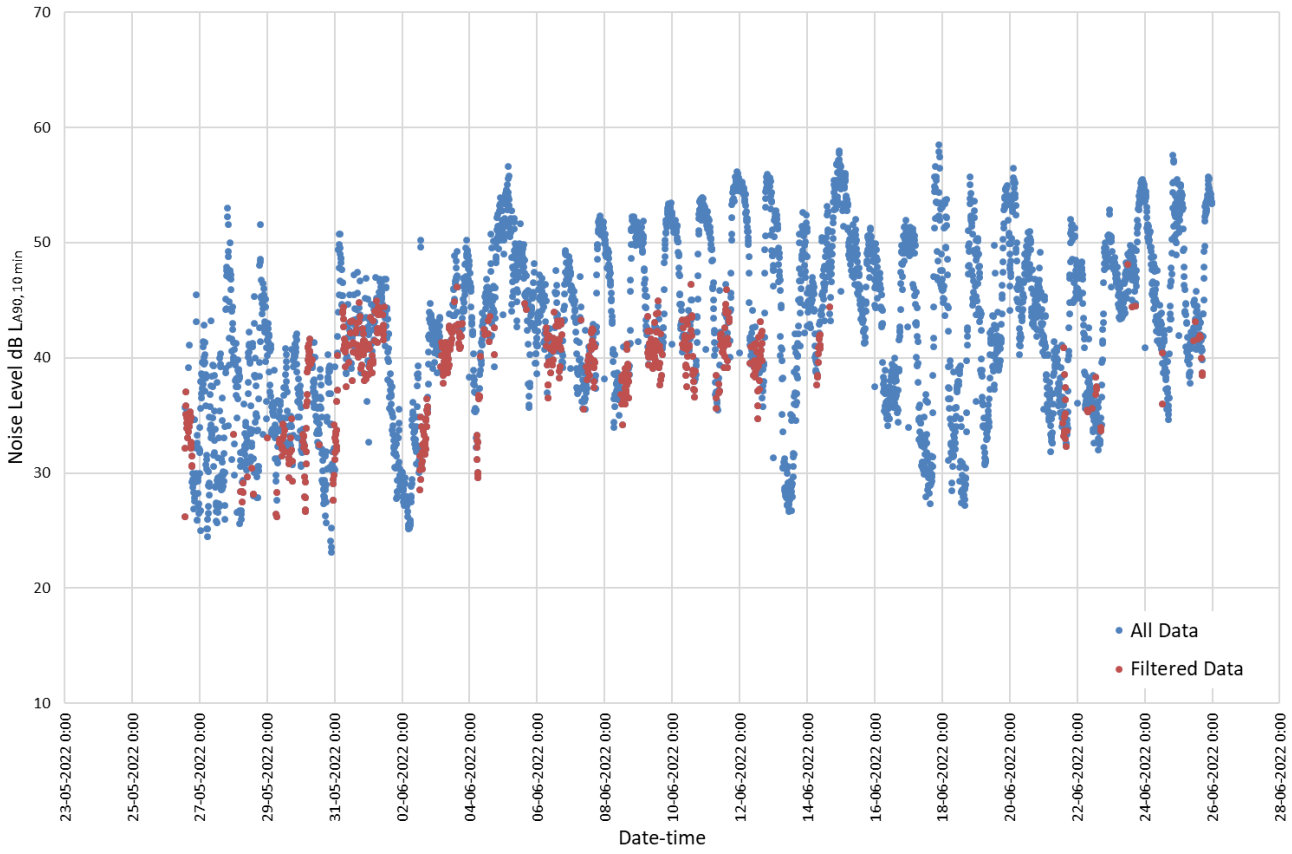
Table 15 K34aa compliance results – all time

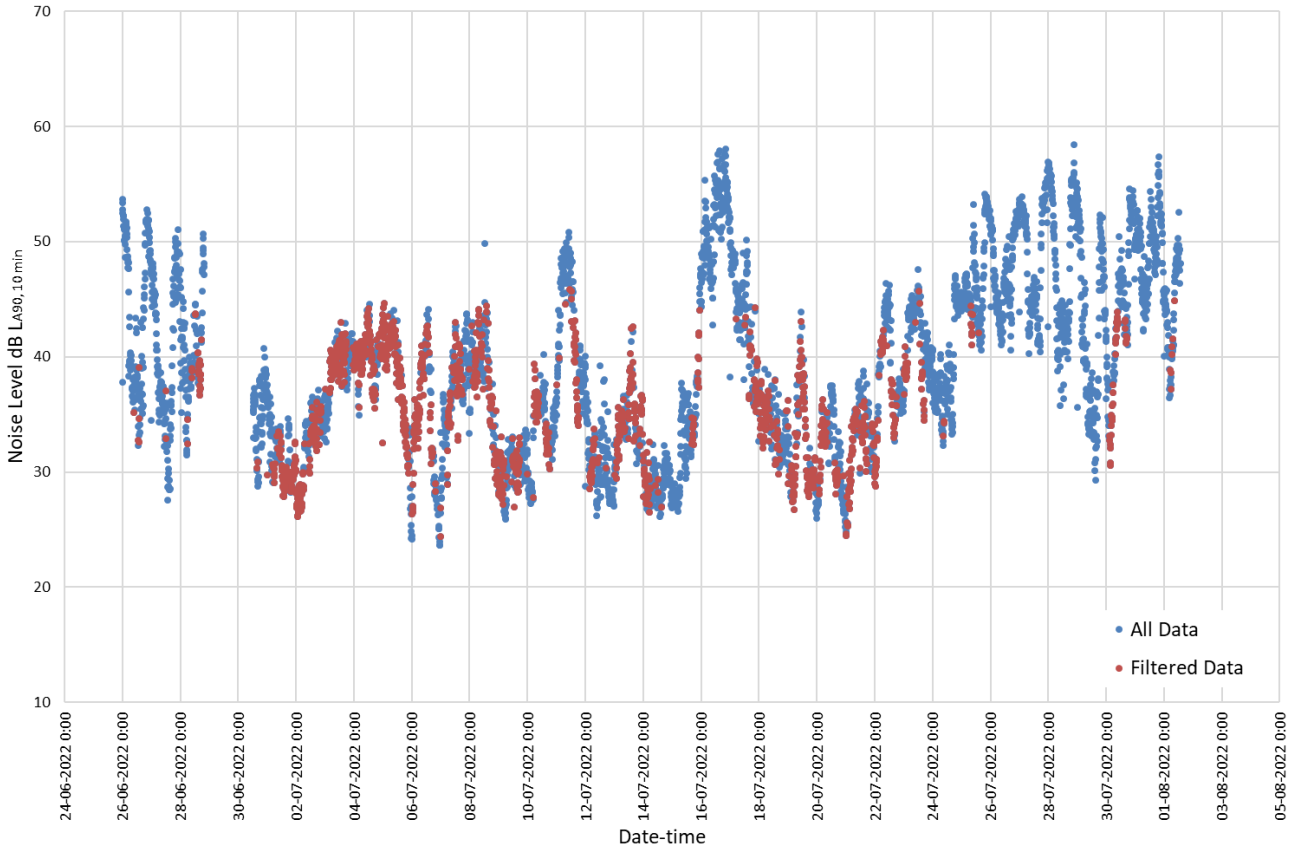
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.3	25.9	27.7	29.8	32.0	34.3	36.7	39.1	41.5	43.9	46.1	48.2
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	41.7	44.1	46.5	48.9	51.1	53.2
Background + WTG, dBA	29.7	31.4	33.5	35.8	38.0	40.1	41.9	43.0	43.5	43.0	41.3	38.4
Corrected WTG noise, dBA	28.2	30.0	32.1	34.5	36.8	38.8	40.3	40.8	39.0			
Compliance Margin, dBA	11.8	10.0	7.9	5.5	3.2	1.2	1.4	3.3	7.5			

Table 16 K34aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	20.7	22.0	23.8	26.0	28.5	31.2	34.1	37.0	39.9	42.6	45.1	47.3
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	44.9	47.6	50.1	52.3
Background + WTG, dBA	28.8	30.1	32.1	34.5	37.1	39.4	41.2	42.2	42.0	40.4	37.0	31.4
Corrected WTG noise, dBA	28.1	29.4	31.4	33.9	36.4	38.7	40.3	40.6	37.9			
Compliance Margin, dBA	11.9	10.6	8.6	6.1	3.6	1.3	-0.3	1.4	6.9			

Figure 21 Time history of measured LA90,10-minutes at K34aa




70
60
50
40
30
20
10
Noise Level dB LA90, 10 min
24-06-2022 0:00
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
22-07-2022 0:00
24-07-2022 0:00
26-07-2022 0:00
28-07-2022 0:00
30-07-2022 0:00
01-08-2022 0:00
03-08-2022 0:00
05-08-2022 0:00
Date-time
All Data
Filtered Data

Location M29aa

Location M29aa is located to the south of the Yendon portion of the Lal Lal Wind Farm, approximately 1200m from the nearest WTG. The monitoring location is shown **Figure 22**

Figure 22 M29aa measurement location

Looking Northwest

Looking Northeast

Looking Southwest

Looking Southeast

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 11** and **Figure 12**. **Table 11** and **Table 12** presents the summary tables of results for all time and night only periods respectively.

Figure 23 M29aa compliance results - all time

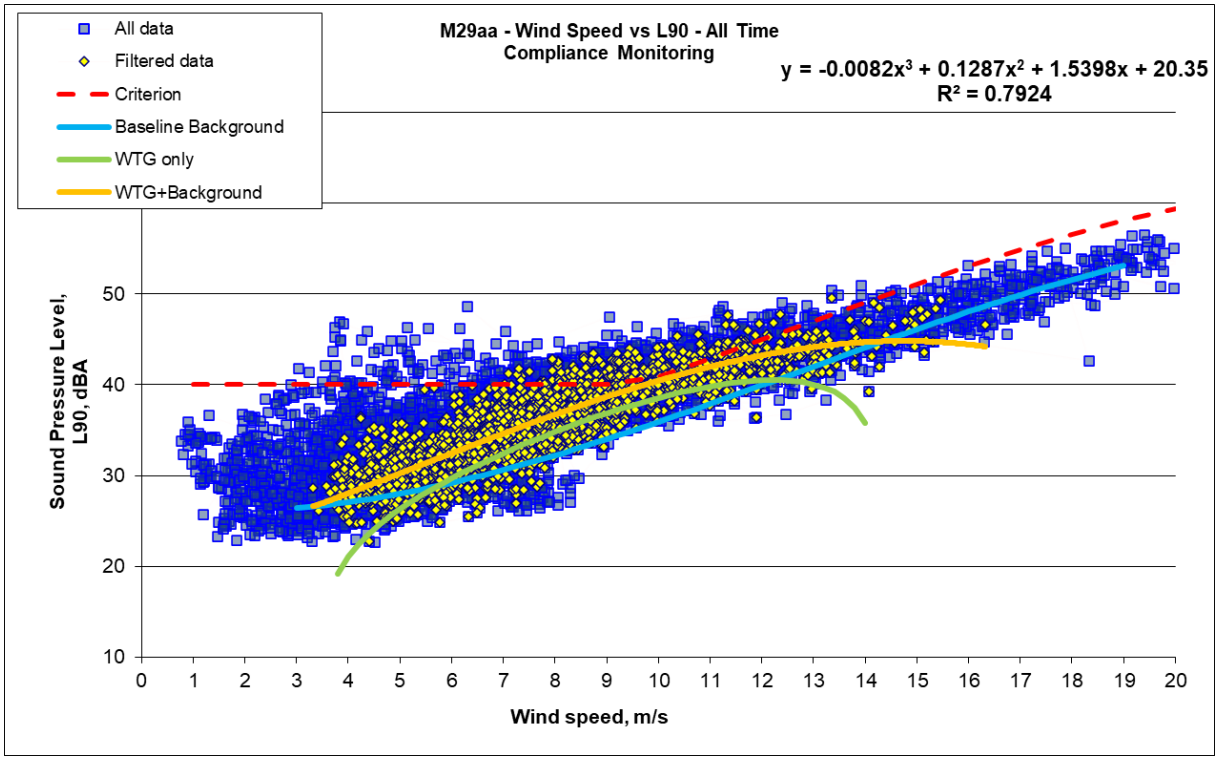


Figure 24 M29aa compliance results – night only

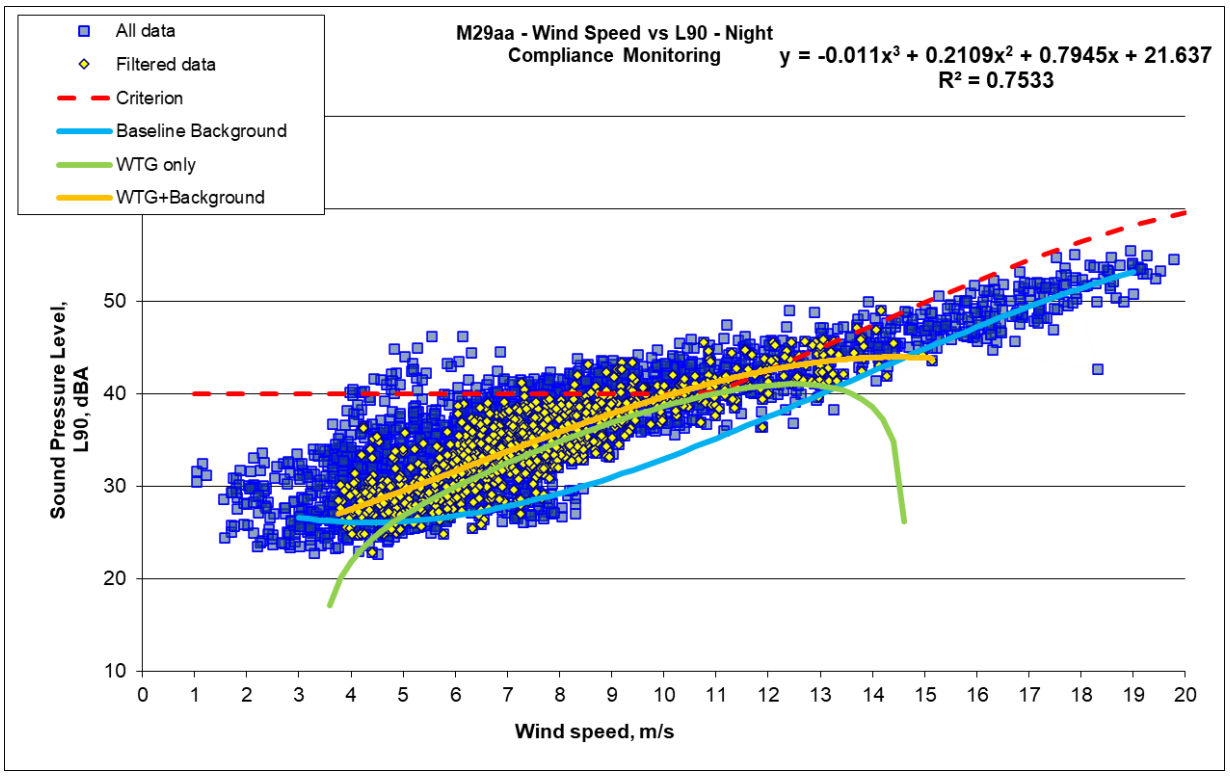


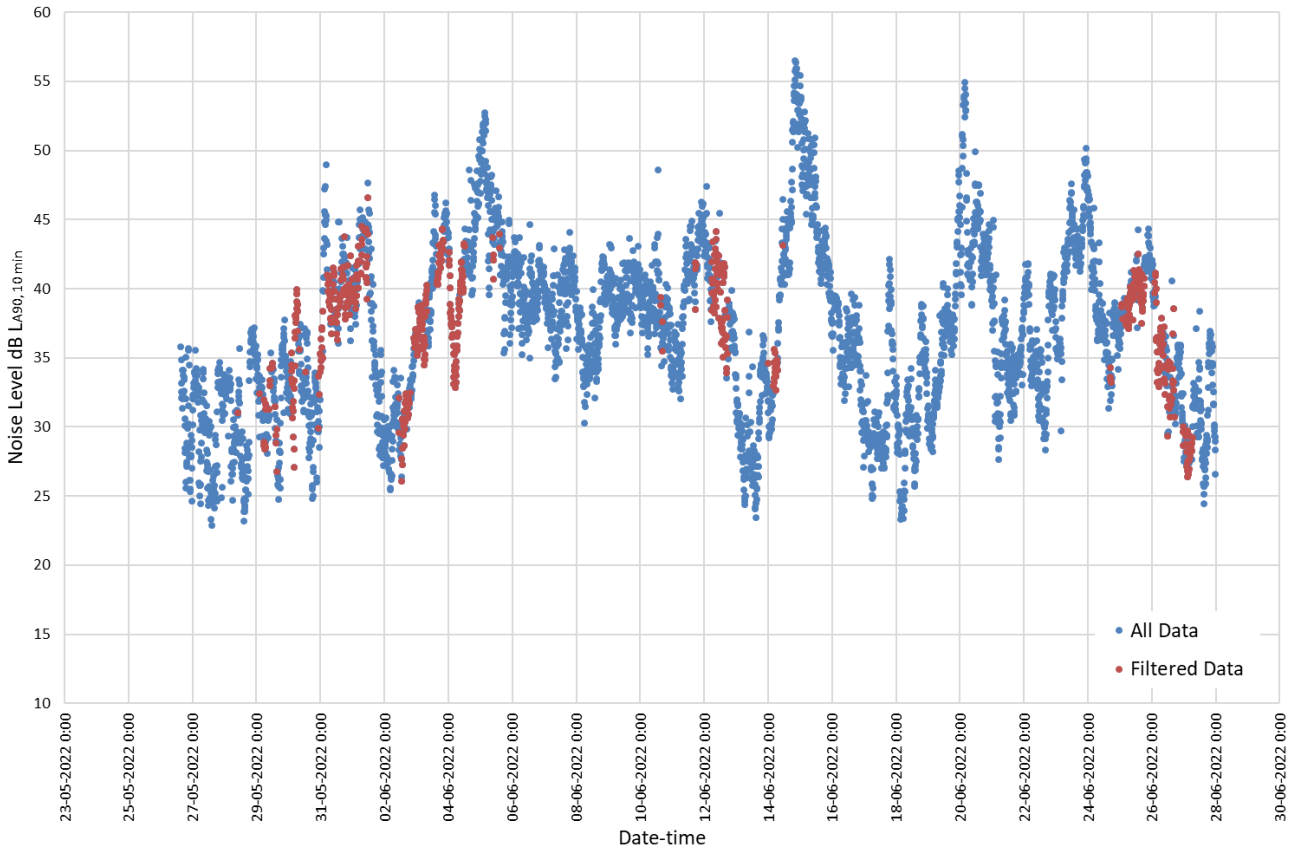
Table 17 M29aa compliance results – all time

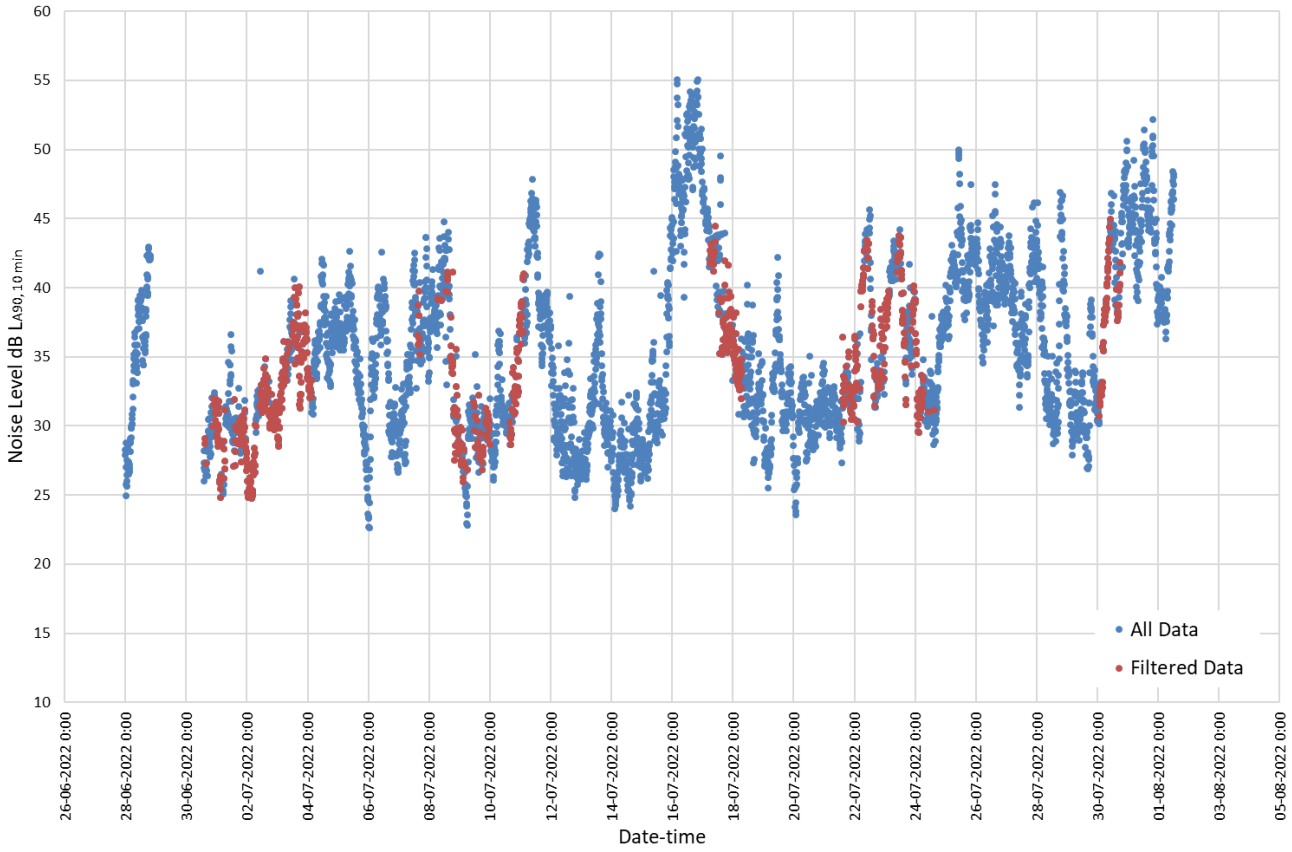
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	27.1	28.0	29.2	30.6	32.2	34.0	35.9	37.9	39.9	42.0	44.1	46.1
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
Background + WTG, dBA	28.0	30.2	32.5	34.6	36.7	38.7	40.4	42.0	43.2	44.1	44.7	44.8
Corrected WTG noise, dBA	21.0	26.3	29.7	32.4	34.8	36.9	38.6	39.8	40.5			
Compliance Margin, dBA	19.0	13.7	10.3	7.6	5.2	3.1	2.3	3.1	4.5			

Table 18 M29aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	26.1	26.2	26.8	27.8	29.2	31.0	33.0	35.2	37.5	39.9	42.4	44.8
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
Background + WTG, dBA	27.5	29.5	31.6	33.8	35.9	37.9	39.7	41.3	42.5	43.4	43.9	43.9
Corrected WTG noise, dBA	21.8	26.8	29.9	32.5	34.8	36.9	38.6	40.0	40.9			
Compliance Margin, dBA	18.2	13.2	10.1	7.5	5.2	3.1	1.4	0.1	1.6			

Figure 25 Time history of measured LA90,10-minutes at M29aa




Noise Level dB LA90, 10 min
60
55
50
45
40
35
30
25
20
15
10
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
22-07-2022 0:00
24-07-2022 0:00
26-07-2022 0:00
28-07-2022 0:00
30-07-2022 0:00
01-08-2022 0:00
03-08-2022 0:00
05-08-2022 0:00
Date-time
All Data
Filtered Data

Location N31ab

Location N31ab is located to the east of the Yendon portion of the Lal Lal Wind Farm, approximately 900m from the nearest WTG. The monitoring location is shown in **Figure 26**.

Figure 26 N31ab measurement location

Looking North

Looking East

Looking South

Looking West

Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 15** and **Figure 16. Table 13** and **Table 14** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 27 N31ab compliance results - all time

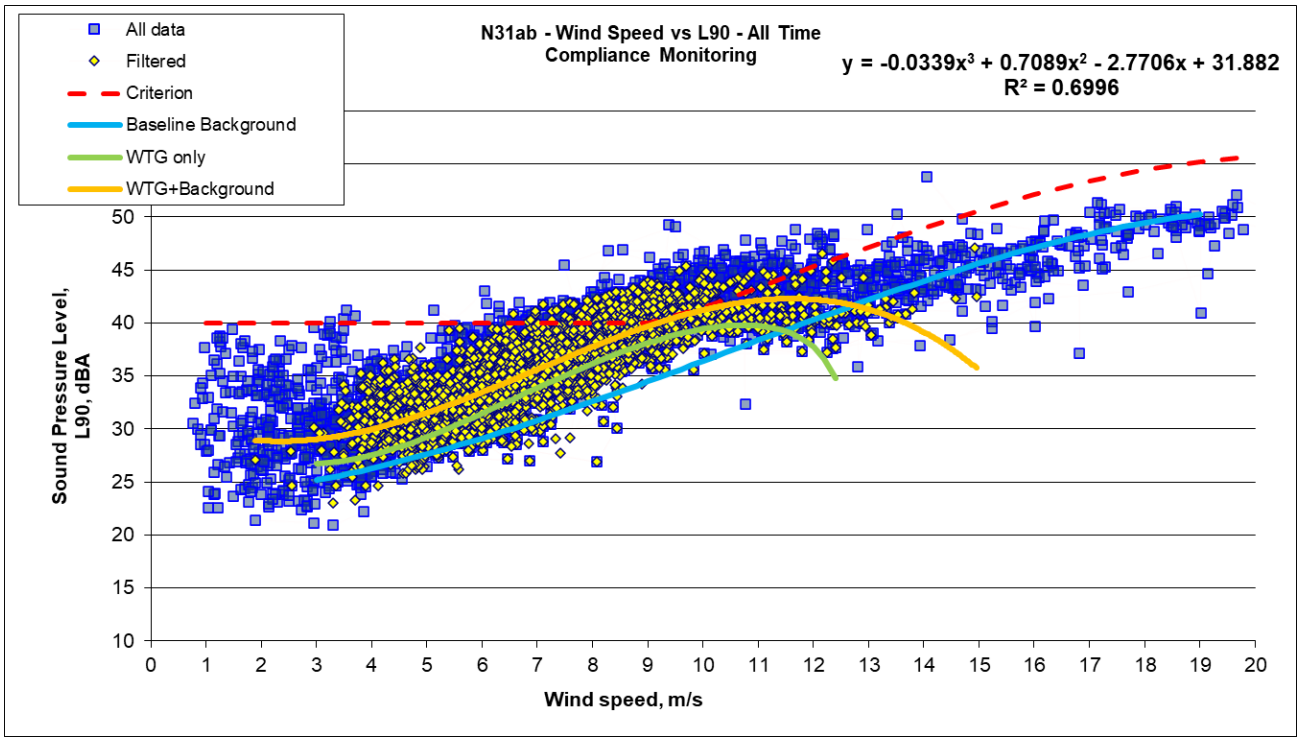


Figure 28 N31ab compliance results – night only

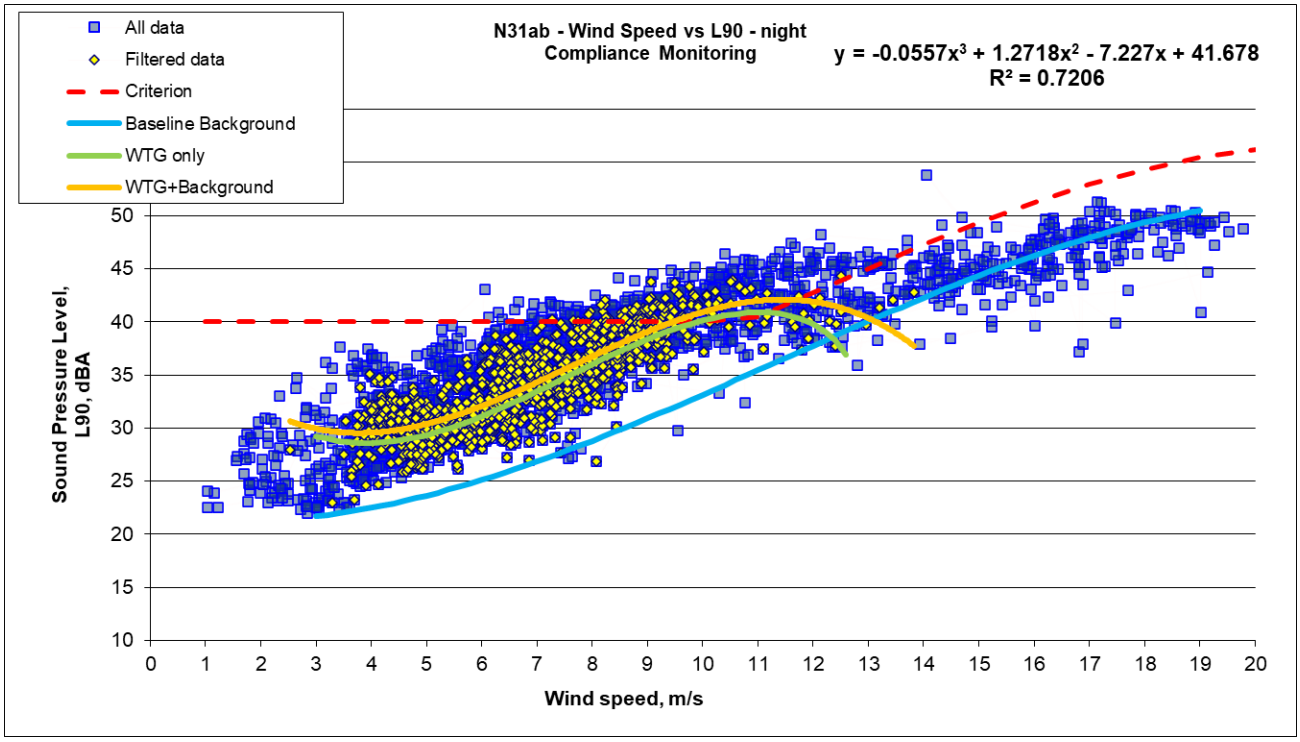


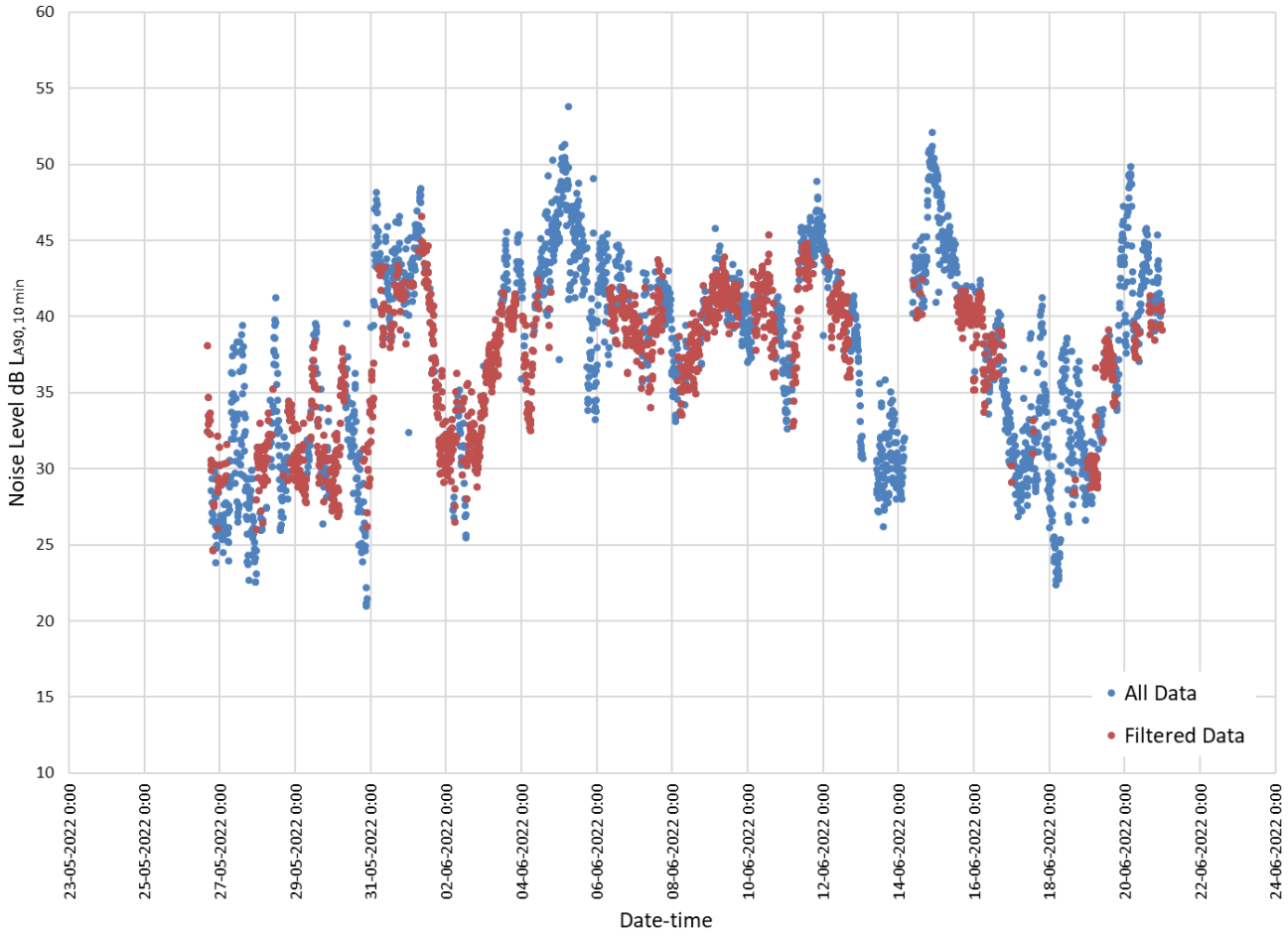
Table 19 N31ab compliance results – all time

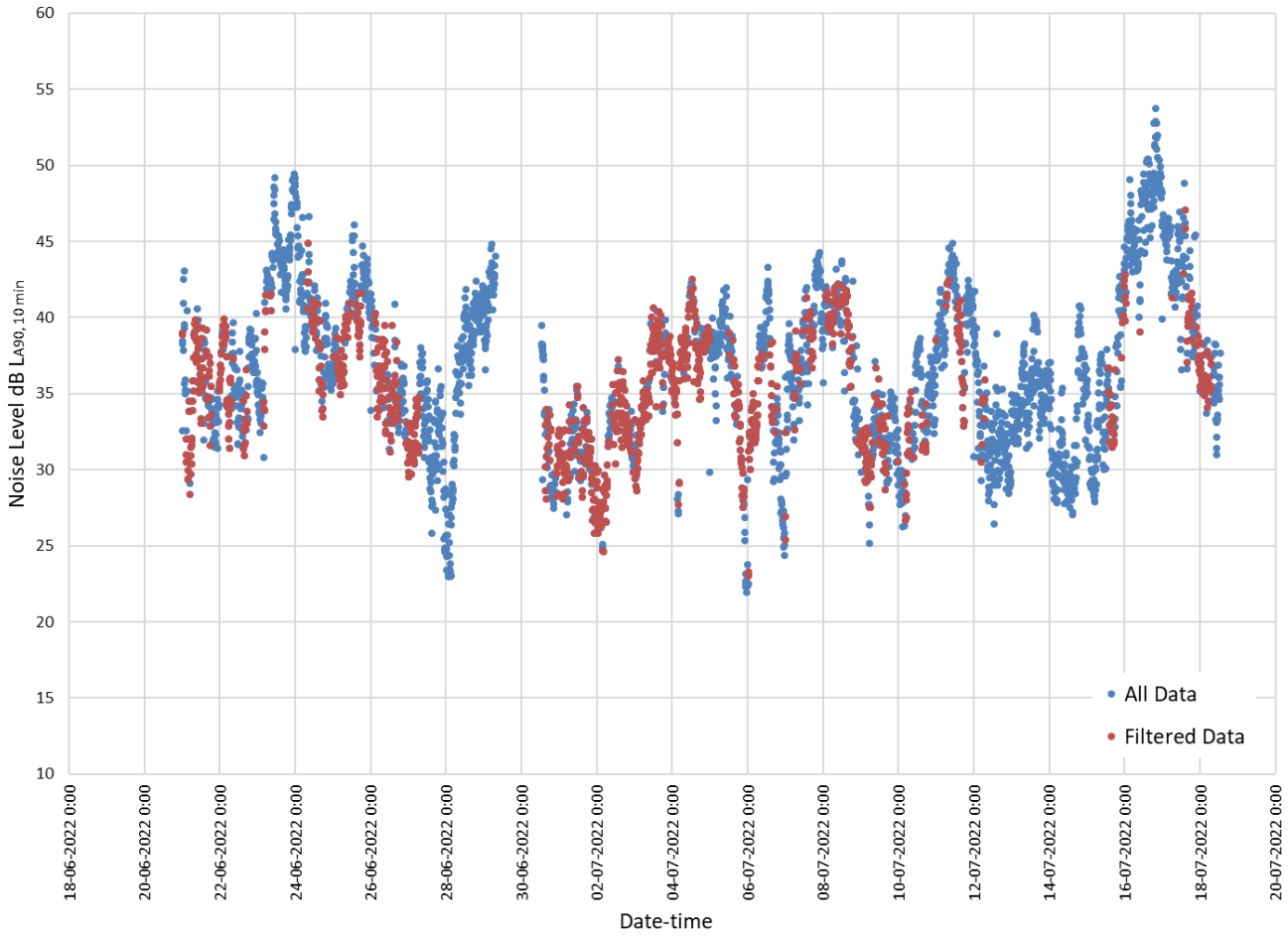
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	26.3	27.6	29.1	30.8	32.6	34.5	36.4	38.4	40.3	42.2	44.0	45.6
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
Background + WTG, dBA	30.0	31.5	33.5	35.6	37.8	39.7	41.2	42.1	42.2	41.3	39.1	35.6
Corrected WTG noise, dBA	27.6	29.3	31.5	33.9	36.2	38.1	39.5	39.7	37.7			
Compliance Margin, dBA	12.4	10.7	8.5	6.1	3.8	1.9	2.0	3.6	7.6			

Table 20 N31ab compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	22.5	23.6	25.1	26.8	28.8	30.9	33.1	35.4	37.7	40.0	42.2	44.3
6808 noise limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
Background + WTG, dBA	29.6	30.4	32.1	34.3	36.8	39.1	40.9	42.0	41.9	40.4	37.0	31.5
Corrected WTG noise, dBA	28.6	29.3	31.1	33.5	36.0	38.3	40.1	40.9	39.8			
Compliance Margin, dBA	11.4	10.7	8.9	6.5	4.0	1.7	-0.1	-0.5	3.0			

Figure 29 Time history of measured LA90,10-minutes at N31ab

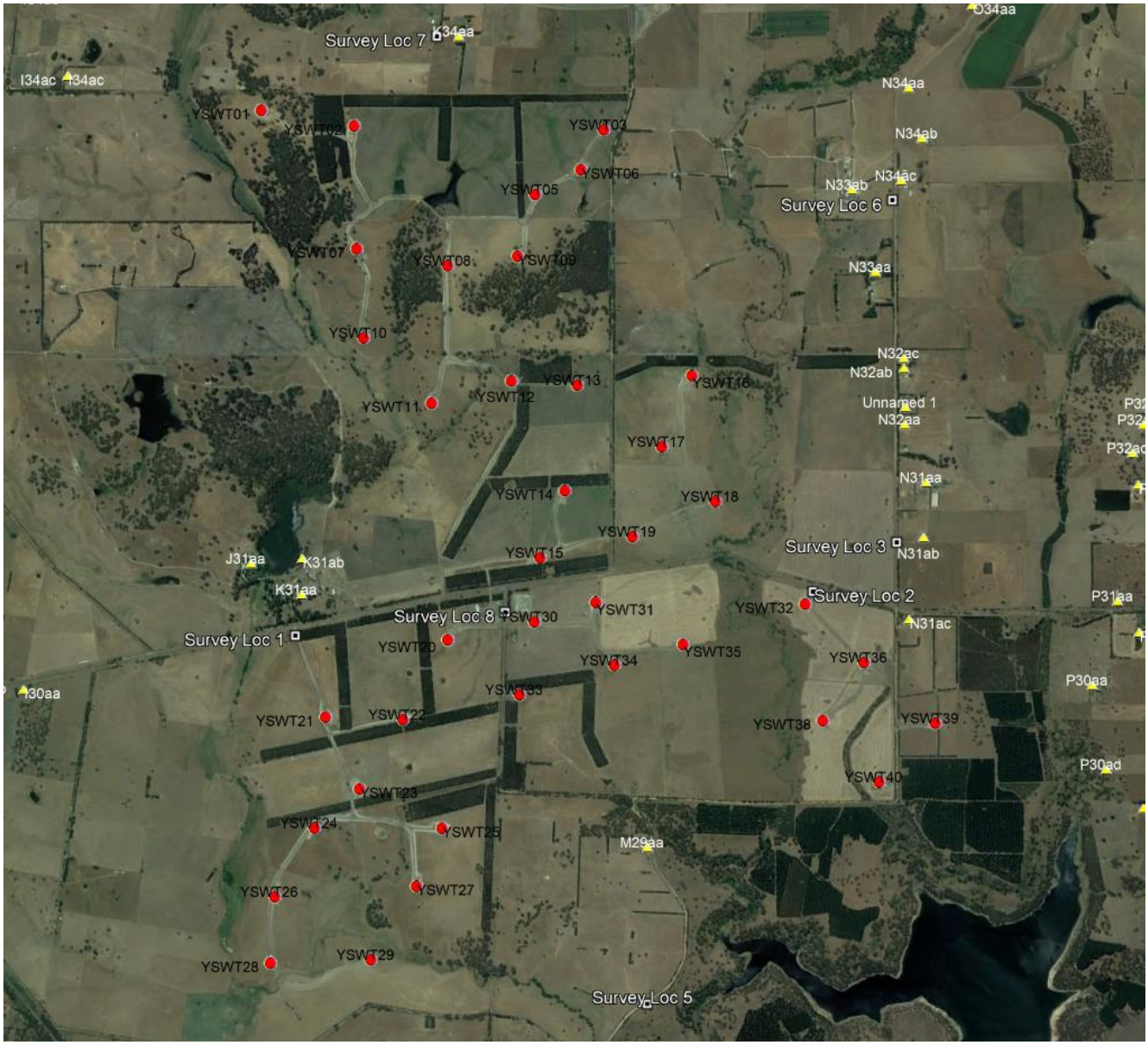



Noise Level dB LA90,10 min
60
55
50
45
40
35
30
25
20
15
10
18-06-2022 0:00
20-06-2022 0:00
22-06-2022 0:00
24-06-2022 0:00
26-06-2022 0:00
28-06-2022 0:00
30-06-2022 0:00
02-07-2022 0:00
04-07-2022 0:00
06-07-2022 0:00
08-07-2022 0:00
10-07-2022 0:00
12-07-2022 0:00
14-07-2022 0:00
16-07-2022 0:00
18-07-2022 0:00
20-07-2022 0:00
Date-time
All Data
Filtered Data

APPENDIX D

Attended subjective listening surveys

Figure 30 Receptor & survey locations - Yendon



Location, Date/Time, Weather Conditions	Listening test observations
M29aa 26 May 2022 : 15.05pm – 15.35pm Broken cloud, no rain Local wind N 1 m/s Temperature 15^{0}C HH wind ~5.3m/s@330^o	Bird calls Breeze in trees Wind Farm audible, occasional aero swish audible hum ~330Hz L90 ~33.9 dBA
K34aa 26 May 2022 : 15.40pm – 16.10pm Overcast & drizzling rain Local wind gusty NW 2-3 m/s Temperature 14^{0}C HH wind ~5.5/s@336^o	Frogs continuous Distant traffic Wind in trees Birds Old farm wind mill at rear (north) squeaking as it operates during gusts Train Cattle & dogs Wind Farm inaudible L90 ~34.8 dBA
N31ab 26 May 2022 : 16.15pm – 16.45pm cloudy Local wind gusty NW 3-5 m/s Temperature 12^{0}C HH wind ~6.3m/s@330^o	Insects & frogs Birds and chooks Neighbors quad bike WTG's just audible Slight hum
M29aa 26 May 2022 : 10.00pm – 27 May 2022 : 6.00am Local wind calm	Wind farm not operating
K34aa 26 May 2022 : 10.00pm – 27 May 2022 : 6.00am Local wind calm	Wind farm not operating

Location, Date/Time, Weather Conditions	Listening test observations
K34aa 26 May 2022 : 10.00pm – 27 May 2022 : 6.00am Local wind calm	Wind farm not operating
M29aa 27 May 2022 : 10.00am 27 May 2022 : 14.00am Local wind calm	Wind farm not operating
K34aa 27 May 2022 : 10.00am 27 May 2022 : 14.00am Local wind calm	Wind farm not operating
K34aa 27 May 2022 : 10.00am 27 May 2022 : 14.00am Local wind calm	Wind farm not operating
K34aa 16 June 2022 : 16.40pm – 17.10pm Low cloud, light rain intermittent Local wind SW 2-3 m/s Temperature 10^0C HH wind ~6.2m/s@213°	Frogs wind in trees train Wind Farm just audible No tone or hum L90 ~34.2 dBA
M29aa 16 June 2022 : 17.15pm – 17.45pm Low cloud, light rain intermittent Local wind SW 2-3 m/s Temperature 10^0C HH wind ~7.1m/s@226°	Frogs prominent wind in trees Wind Farm audible, occasional aero swish No tone or hum L90 ~37.2 dBA

Location, Date/Time, Weather Conditions	Listening test observations
N31ab 16 June 2022 : 17.50pm – 18.20pm Low cloud, light rain Local wind SW 1-2 m/s Temperature 10^0C HH wind ~7.5m/s@212°	Frogs wind in trees Wind Farm audible, aero swish No tone or hum L90 ~38.7 dBA
K34aa 17 June 2022 : 12.00am – 12.20am Light cloud, no rain Local wind S 1-2 m/s Temperature 9^0C HH wind ~5.1m/s@225°	Frogs Diesel loco slow pass, then loco idle at lights, then loco move off Wind Farm just audible Hum audible L90 ~49.1 dBA
K34aa 17 June 2022 : 12.20am – 12.40am Light cloud, no rain Local wind S 1-2 m/s Temperature 9^0C HH wind ~4.6m/s@228°	Frogs dominant Occasional birds - plovers No train Wind Farm just audible Broadband hum just audible L90 ~48.8 dBA
N31ab 17 June 2022 : 12.50am – 1.20am Light cloud, no rain Local wind SW 2-3 m/s Temperature 9^0C HH wind ~5.7m/s@229°	Passing cars Distant frogs Wind Farm audible Broadband hum just audible L90 ~36.3 dBA

Location, Date/Time, Weather Conditions	Listening test observations
Adjacent (~180m) to WTG YSTW36 S -37.633472° E 144.051416° 1.25am Light cloud, no rain Local wind SW 2-3 m/s Temperature 9^{0}C HH wind ~5.9m/s@229°	WTG dominant over frogs Multiple WTGs audible Broadband hum 285Hz, 360Hz, 520Hz, 890Hz
M29aa 17 June 2022 : 1.30am – 1.55am Light cloud, no rain Local wind WSW 0.5 m/s Temperature 9^{0}C HH wind ~4.7m/s@226°	Frogs Wind farm audible Faint broadband hum Distant train audible & dominant for >5 minutes L90 ~36.8 dBA
Corner of Racecourse Road & Yendon – Lal Lal Road S -37.654071° E 143.992295° 17 June 2022 : 2.10am – 2.30am Light cloud, no rain Local wind SW 0.5 m/s Temperature 10^{0}C HH wind ~5.3m/s@223°	quiet distant frogs Wind farm just audible No hum L90 ~30.3 dBA

Location, Date/Time, Weather Conditions	Listening test observations
K34aa 17 June 2022 : 13.20pm – 13.50pm partly cloudy, no rain Local wind SW 1-1.5 m/s Temperature 12^{0}C HH wind ~3.5m/s@204°	Frogs dominant insects birds train passby Wind Farm audible Faint broadband hum L90 ~30.4 dBA
N31ab 17 June 2022 : 14.00pm – 14.30pm partly cloudy, no rain Local wind SSW 0.5-1 m/s Temperature 12^{0}C HH wind ~4.3m/s@216°	Insects & birds traffic Wind Farm audible Faint broadband hum L90 ~31.3 dBA
M29aa 17 June 2022 : 14.40pm – 15.10pm sunny Local wind SSW 0.5 m/s Temperature 17^{0}C HH wind ~4.6m/s@215°	birds cockatoos frogs Wind Farm occasionally audible Very faint broadband hum L90 ~30.8 dBA

APPENDIX E

Wake free wind speed derivation

Aurecon Australasia Pty Ltd
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Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008
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Memorandum

To	**Felix Rohde** **Lal Lal Wind Farms Nom Co Pty Ltd**	From	**Simon Faulkner**
Copy		Reference	**503228**
Date	**2021-09-10**	Pages (including this page)	**2**
Subject	**Wind data for noise monitoring at Lal Lal Wind Farm**		

Aurecon was requested to provide wind data to be used in the noise modelling for Lal Lal Wind Farm. The wind data needs to include the freestream (wake-free) wind speed and generally to be representative of the closest turbine locations to each noise receptor. However, in this case the wind data needs to be equivalent to the data measured at the pre-construction masts, for consistency with the processing of the background noise data that was collected prior to the construction of the wind farm.

The pre-construction masts have been removed and new masts have been installed in different locations for the purpose of power curve testing and wind farm operations. These masts are free of turbine wake for some wind directions, but not all, and therefore the data set needs to be adjusted to remove the wake effect. The site is fairly flat and wind resource does not vary significantly between these mast and turbine locations, so data from the new power curve test masts can be used without adjustment related to flow modelling (terrain).

The process to remove the effect of wake, ie adjust the mast data to free-stream equivalent, was:

- Check the provided data and remove incorrect or invalid data, apply any other adjustments as required (eg some Elaine direction data needed to be adjusted by 180°)
- Select turbines near to each mast and obtain nacelle wind speed data (this data is adjusted in the SCADA to approximate free-stream equivalent as confirmed by comparison to the mast data)
- Remove wake-affected data from the mast and turbine data (on a directional basis ie remove data when the wind direction is such that the data is affected by wake from a nearby turbine)
- Average the unaffected mast and turbine wind speed data to provide un-waked data for all wind directions (this process gives higher wind speeds and also increased data coverage).

Figure 1 and Figure 2 show the met. masts, turbines used (yellow highlight ESWT01, 02, YSWT32, 36, 38, 39, 40), and the approximate pre-construction mast locations (green circles).

The requested data covers two periods: 30/10/2020 – 01/12/2020 inclusive and 09/03/2021 to 15/05/2021 inclusive. The wind data produced included mast wind speed, mast direction, and adjusted free-stream wind speed, and also turbine wind speeds and directions for reference.

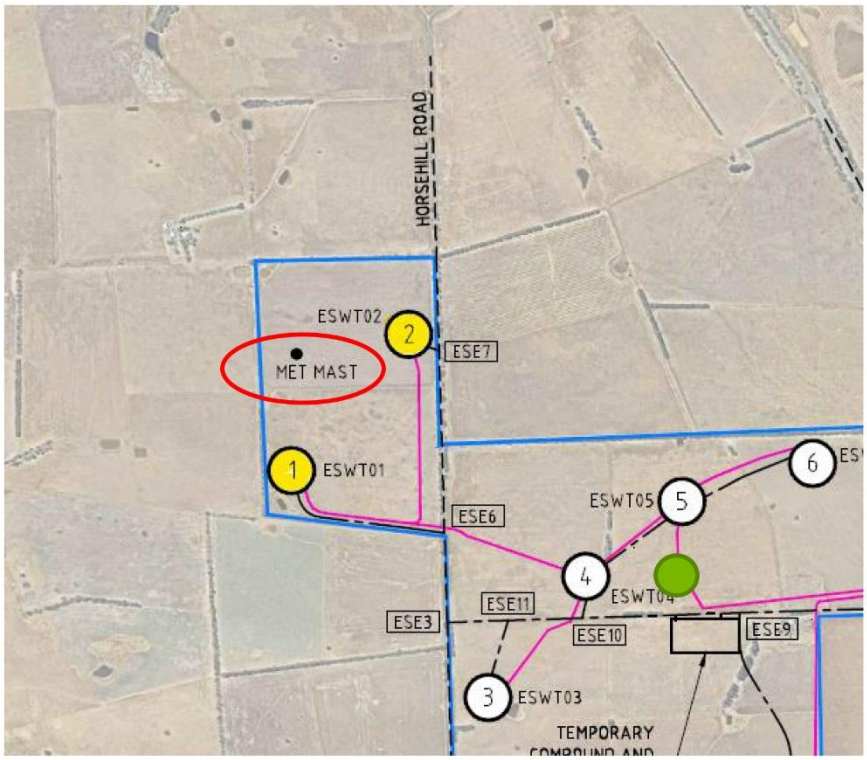


Figure 1 Elaine mast and turbines (approx. pre-construction mast location shown in green)

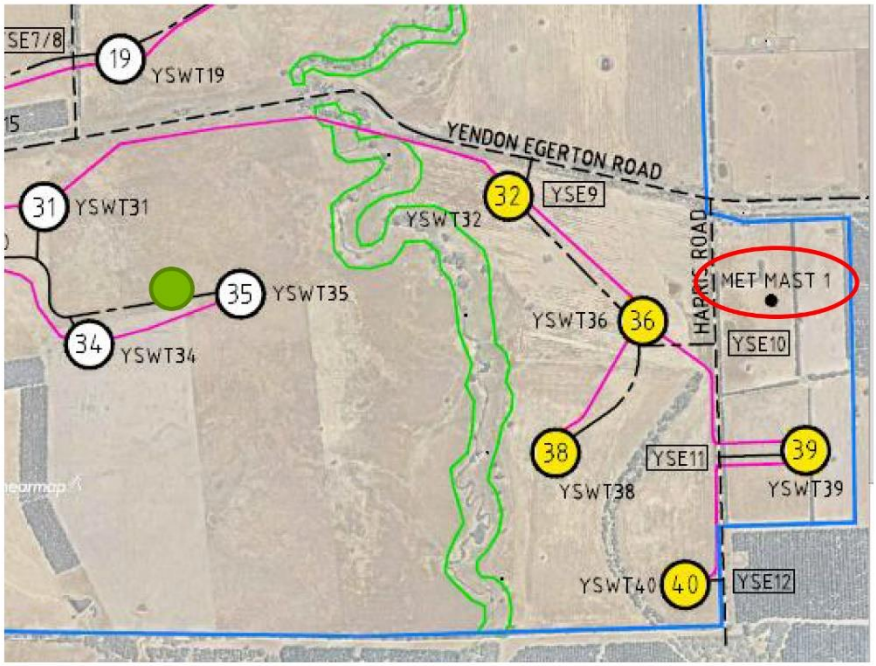


Figure 2 Yendon mast and turbines (approx. pre-construction mast location shown in green)

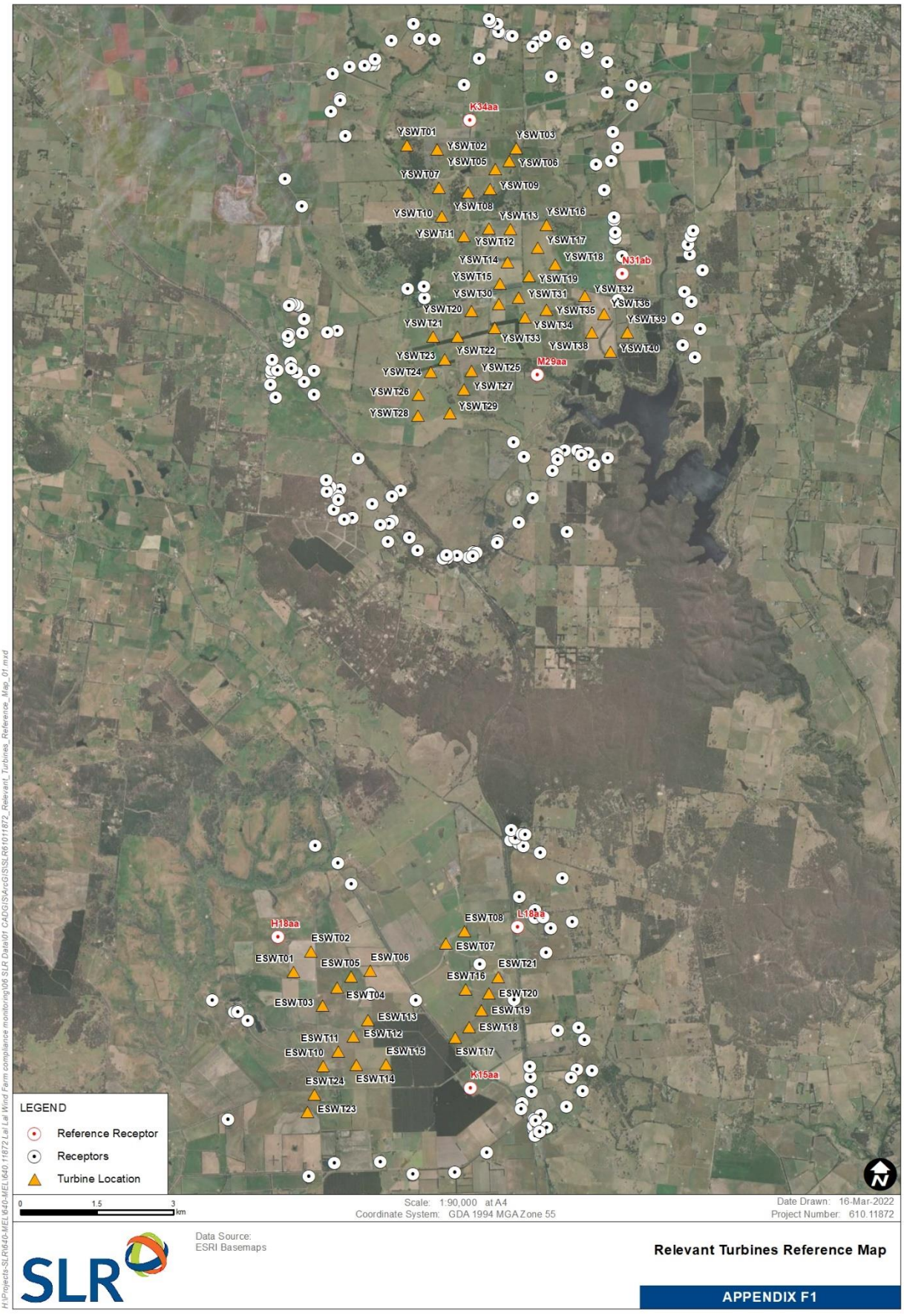
APPENDIX F

Relevant Turbines Table

	Elaine receptors												Yendon receptors											
Turbine	NCTP 0.1dB method						0.5 dB method						NCTP 0.1dB method						0.5 dB method					
	H18aa		K15aa		L18aa		H18aa		K15aa		L18aa		M29aa		N31ab		K34aa		M29aa		N31ab		K34aa	
ESWT01	YES	0.8	YES	4.2	YES	4.5	YES	0.8	NO	4.2	NO	4.5	NO	12.7	NO	15.2	NO	17.1	NO	12.7	NO	15.2	NO	17.1
ESWT02	YES	0.7	NO	4.1	YES	4.1	YES	0.7	NO	4.1	NO	4.1	NO	12.2	NO	14.7	NO	16.7	NO	12.2	NO	14.7	NO	16.7
ESWT03	YES	1.6	YES	3.3	YES	4.1	NO	1.6	NO	3.3	NO	4.1	NO	13.1	NO	15.6	NO	17.7	NO	13.1	NO	15.6	NO	17.7
ESWT04	YES	1.5	YES	3.3	YES	3.7	YES	1.5	NO	3.3	NO	3.7	NO	12.7	NO	15.1	NO	17.3	NO	12.7	NO	15.1	NO	17.3
ESWT05	YES	1.6	YES	3.2	YES	3.4	NO	1.6	NO	3.2	NO	3.4	NO	12.4	NO	14.8	NO	17.0	NO	12.4	NO	14.8	NO	17.0
ESWT06	YES	1.9	YES	3.0	YES	3.0	NO	1.9	NO	3.0	NO	3.0	YES	12.2	NO	14.6	NO	16.8	NO	12.2	NO	14.6	NO	16.8
ESWT07	YES	3.3	YES	2.9	YES	1.4	NO	3.3	NO	2.9	YES	1.4	YES	11.3	NO	13.6	NO	16.2	NO	11.3	NO	13.6	NO	16.2
ESWT08	YES	3.7	YES	3.1	YES	1.0	NO	3.7	NO	3.1	YES	1.0	YES	11.0	NO	13.3	NO	16.0	NO	11.0	NO	13.3	NO	16.0
ESWT10	YES	2.7	YES	2.9	YES	4.7	NO	2.7	NO	2.9	NO	4.7	NO	14.2	NO	16.7	NO	18.8	NO	14.2	NO	16.7	NO	18.8
ESWT11	YES	2.5	YES	2.7	YES	4.3	NO	2.5	NO	2.7	NO	4.3	NO	13.9	NO	16.3	NO	18.5	NO	13.9	NO	16.3	NO	18.5
ESWT12	YES	2.5	YES	2.5	YES	3.9	NO	2.5	YES	2.5	NO	3.9	NO	13.5	NO	15.9	NO	18.2	NO	13.5	NO	15.9	NO	18.2
ESWT13	YES	2.4	YES	2.4	YES	3.5	NO	2.4	YES	2.4	NO	3.5	NO	13.1	NO	15.5	NO	17.8	NO	13.1	NO	15.5	NO	17.8
ESWT14	YES	3.0	YES	2.3	YES	4.2	NO	3.0	YES	2.3	NO	4.2	NO	14.0	NO	16.4	NO	18.7	NO	14.0	NO	16.4	NO	18.7
ESWT15	YES	3.3	YES	1.7	YES	3.7	NO	3.3	YES	1.7	NO	3.7	NO	13.9	NO	16.2	NO	18.6	NO	13.9	NO	16.2	NO	18.6
ESWT16	YES	3.8	YES	1.9	YES	1.6	NO	3.8	YES	1.9	YES	1.6	YES	12.2	NO	14.4	NO	17.1	NO	12.2	NO	14.4	NO	17.1
ESWT17	YES	4.0	YES	1.0	YES	2.5	NO	4.0	YES	1.0	NO	2.5	NO	13.1	NO	15.4	NO	18.1	NO	13.1	NO	15.4	NO	18.1
ESWT18	YES	4.2	YES	1.2	YES	2.2	NO	4.2	YES	1.2	NO	2.2	NO	12.9	NO	15.1	NO	17.8	NO	12.9	NO	15.1	NO	17.8
ESWT19	YES	4.3	YES	1.6	YES	1.8	NO	4.3	YES	1.6	NO	1.8	NO	12.5	NO	14.7	NO	17.5	NO	12.5	NO	14.7	NO	17.5
ESWT20	YES	4.3	YES	1.9	YES	1.4	NO	4.3	YES	1.9	YES	1.4	NO	12.2	NO	14.4	NO	17.2	NO	12.2	NO	14.4	NO	17.2
ESWT21	NO	4.4	YES	2.3	YES	1.1	NO	4.4	YES	2.3	YES	1.1	YES	11.9	NO	14.0	NO	16.9	NO	11.9	NO	14.0	NO	16.9
ESWT23	YES	3.5	YES	3.2	YES	5.5	NO	3.5	NO	3.2	NO	5.5	NO	15.2	NO	17.6	NO	19.8	NO	15.2	NO	17.6	NO	19.8
ESWT24	YES	3.2	YES	3.1	YES	5.2	NO	3.2	NO	3.1	NO	5.2	NO	14.8	NO	17.2	NO	19.4	NO	14.8	NO	17.2	NO	19.4
YSWT01	NO	15.8	NO	18.6	NO	15.5	NO	15.8	NO	18.6	NO	15.5	YES	5.2	YES	4.9	YES	1.3	NO	5.2	NO	4.9	YES	1.3
YSWT02	NO	15.8	NO	18.5	NO	15.4	NO	15.8	NO	18.5	NO	15.4	YES	4.9	NO	4.4	YES	0.9	NO	4.9	NO	4.4	YES	0.9
YSWT03	NO	16.2	NO	18.5	NO	15.3	NO	16.2	NO	18.5	NO	15.3	YES	4.5	YES	3.2	YES	1.1	NO	4.5	NO	3.2	YES	1.1
YSWT05	NO	15.7	NO	18.1	NO	14.9	NO	15.7	NO	18.1	NO	14.9	YES	4.1	YES	3.2	YES	1.1	NO	4.1	NO	3.2	YES	1.1
YSWT06	NO	15.9	NO	18.3	NO	15.1	NO	15.9	NO	18.3	NO	15.1	YES	4.2	YES	3.1	YES	1.1	NO	4.2	NO	3.1	YES	1.1
YSWT07	NO	15.1	NO	17.7	NO	14.6	NO	15.1	NO	17.7	NO	14.6	YES	4.2	YES	4.0	YES	1.5	NO	4.2	NO	4.0	YES	1.5
YSWT08	NO	15.1	NO	17.6	NO	14.5	NO	15.1	NO	17.6	NO	14.5	YES	3.8	YES	3.4	YES	1.4	NO	3.8	NO	3.4	YES	1.4
YSWT09	NO	15.3	NO	17.7	NO	14.5	NO	15.3	NO	17.7	NO	14.5	YES	3.8	YES	3.1	YES	1.4	NO	3.8	NO	3.1	YES	1.4
YSWT10	NO	14.5	NO	17.2	NO	14.1	NO	14.5	NO	17.2	NO	14.1	YES	3.6	YES	3.7	YES	2.0	NO	3.6	NO	3.7	NO	2.0
YSWT11	NO	14.3	NO	16.8	NO	13.6	NO	14.3	NO	16.8	NO	13.6	YES	3.1	YES	3.2	YES	2.3	NO	3.1	NO	3.2	NO	2.3
YSWT12	NO	14.5	NO	16.9	NO	13.8	NO	14.5	NO	16.9	NO	13.8	YES	3.0	YES	2.8	YES	2.2	NO	3.0	NO	2.8	NO	2.2
YSWT13	NO	14.7	NO	16.9	NO	13.7	NO	14.7	NO	16.9	NO	13.7	YES	2.9	YES	2.4	YES	2.3	NO	2.9	NO	2.4	NO	2.3
YSWT14	NO	14.0	NO	16.3	NO	13.1	NO	14.0	NO	16.3	NO	13.1	YES	2.3	YES	2.3	YES	2.9	NO	2.3	NO	2.3	NO	2.9
YSWT15	NO	13.6	NO	15.8	NO	12.7	NO	13.6	NO	15.8	NO	12.7	YES	1.9	YES	2.4	YES	3.3	YES	1.9	NO	2.4	NO	3.3
YSWT16	NO	15.0	NO	17.0	NO	13.8	NO	15.0	NO	17.0	NO	13.8	YES	3.0	YES	1.8	YES	2.6	NO	3.0	YES	1.8	NO	2.6
YSWT17	NO	14.5	NO	16.6	NO	13.4	NO	14.5	NO	16.6	NO	13.4	YES	2.5	YES	1.7	YES	2.8	NO	2.5	YES	1.7	NO	2.8
YSWT18	NO	14.3	NO	16.3	NO	13.1	NO	14.3	NO	16.3	NO	13.1	YES	2.2	YES	1.3	YES	3.3	NO	2.2	YES	1.3	NO	3.3
YSWT19	NO	13.9	NO	16.0	NO	12.8	NO	13.9	NO	16.0	NO	12.8	YES	1.9	YES	1.8	YES	3.3	YES	1.9	YES	1.8	NO	3.3
YSWT20	NO	12.9	NO	15.3	NO	12.2	NO	12.9	NO	15.3	NO	12.2	YES	1.8	YES	3.1	YES	3.8	YES	1.8	NO	3.1	NO	3.8
YSWT21	NO	12.2	NO	14.8	NO	11.7	NO	12.2	NO	14.8	NO	11.7	YES	2.2	YES	3.9	YES	4.3	NO	2.2	NO	3.9	NO	4.3
YSWT22	NO	12.3	NO	14.8	NO	11.7	NO	12.3	NO	14.8	NO	11.7	YES	1.7	YES	3.5	YES	4.3	YES	1.7	NO	3.5	NO	4.3
YSWT23	NO	11.8	NO	14.3	NO	11.3	NO	11.8	NO	14.3	NO	11.3	YES	1.8	YES	3.9	YES	4.7	YES	1.8	NO	3.9	NO	4.7
YSWT24	NO	11.5	NO	14.1	NO	11.0	NO	11.5	NO	14.1	NO	11.0	YES	2.1	YES	4.2	YES	5.0	YES	2.1	NO	4.2	NO	5.0
YSWT25	NO	11.8	NO	14.1	NO	11.0	NO	11.8	NO	14.1	NO	11.0	YES	1.3	YES	3.5	YES	4.9	YES	1.3	NO	3.5	NO	4.9
YSWT26	NO	11.0	NO	13.7	NO	10.7	NO	11.0	NO	13.7	NO	10.7	YES	2.4	YES	4.7	YES	5.5	NO	2.4	NO	4.7	NO	5.5
YSWT27	NO	11.4	NO	13.7	NO	10.6	NO	11.4	NO	13.7	NO	10.6	YES	1.5	YES	3.9	YES	5.3	YES	1.5	NO	3.9	NO	5.3
YSWT28	NO	10.6	NO	13.3	NO	10.2	NO	10.6	NO	13.3	NO	10.2	YES	2.5	YES	4.9	NO	5.9	NO	2.5	NO	4.9	NO	5.9
YSWT29	NO	10.8	NO	13.3	NO	10.2	NO	10.8	NO	13.3	NO	10.2	YES	1.9	YES	4.4	YES	5.8	NO	1.9	NO	4.4	NO	5.8
YSWT30	NO	13.2	NO	15.4	NO	12.3	NO	13.2	NO	15.4	NO	12.3	YES	1.6	YES	2.5	YES	3.7	YES	1.6	NO	2.5	NO	3.7
YSWT31	NO	13.4	NO	15.6	NO	12.4	NO	13.4	NO	15.6	NO	12.4	YES	1.6	YES	2.1	YES	3.6	YES	1.6	YES	2.1	NO	3.6
YSWT32	NO	14.0	NO	15.7	NO	12.5	NO	14.0	NO	15.7	NO	12.5	YES	1.8	YES	0.9	YES	4.1	NO	1.8	YES	0.9	NO	4.1
YSWT33	NO	12.7	NO	15.0	NO	11.8	NO	12.7	NO	15.0	NO	11.8	YES	1.2	YES	2.7	YES	4.1	YES	1.2	NO	2.7	NO	4.1
YSWT34	NO	13.1	NO	15.2	NO	12.0	NO	13.1	NO	15.2	NO	12.0	YES	1.2	YES	2.1	YES	4.0	YES	1.2	NO	2.1	NO	4.0
YSWT35	NO	13.4	NO	15.4	NO	12.1	NO	13.4	NO	15.4	NO	12.1	YES	1.3	YES	1.6	YES	4.0	YES	1.3	YES	1.6	NO	4.0
YSWT36	NO	13.8	NO	15.5	NO	12.2	NO	13.8	NO	15.5	NO	12.2	YES	1.8	YES	0.9	YES	4.6	YES	1.8	YES	0.9	NO	4.6
YSWT38	NO	13.4	NO	15.0	NO	11.8	NO	13.4	NO	15.0	NO	11.8	YES	1.4	YES	1.3	YES	4.8	YES	1.4	YES	1.3	NO	4.8
YSWT39	NO	13.7	NO	15.2	NO	11.9	NO	13.7	NO	15.2	NO	11.9	YES	2.0	YES	1.2	NO	5.2	YES	2.0	YES	1.2	NO	5.2
YSWT40	NO	13.2	NO	14.7	NO	11.5	NO	13.2	NO	14.7	NO	11.5	YES	1.5	YES	1.6	YES	5.3	YES	1.5	YES	1.6	NO	5.3

Notes: table shows distance to WTG in km

YES = WTG is a relevant WTG for that receptor


K34aa
YSWT01
YSWT02
YSWT03
YSWT05
YSWT06
YSWT07
YSWT09
YSWT08
YSWT10
YSWT13
YSWT16
YSWT11
YSWT12
YSWT17
YSWT14
YSWT18
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YSWT19
YSWT30
YSWT31
YSWT32
YSWT20
YSWT35
YSWT36
YSWT21
YSWT34
YSWT39
YSWT33
YSWT38
YSWT40
YSWT23
YSWT22
M29aa
YSWT24
YSWT25
YSWT26
YSWT27
YSWT28
YSWT29
H18aa
L18aa
ESWT08
ESWT02
ESWT07
ESWT01
ESWT05
ESWT06
ESWT21
ESWT16
ESWT04
ESWT20
ESWT03
ESWT19
ESWT13
ESWT18
ESWT11
ESWT12
ESWT10
ESWT15
ESWT17
K15aa
ESWT24
ESWT14
ESWT23
LEGEND
Reference Receptor
Receptors
Turbine Location
0
1.5
3
km
Scale: 1:90,000 at A4
Coordinate System: GDA 1994 MGA Zone 55
Date Drawn: 16-Mar-2022
Project Number: 610.11872
Data Source:
ESRI Basemaps
Relevant Turbines Reference Map
APPENDIX F1
H:\Projects-SLR\640-MEL\640-MEL\640 11872 Lal Lal Wind Farm compliance monitoring\06 SLR Data\01 CAD\GIS\ArcGIS\SLR\610\11872_Relevant_Turbines_Reference_Map_01.mxd

APPENDIX F

Insect/Frog Noise Screening Analysis

SLR has reviewed selected samples of the data set to investigate the effectiveness of the NCTP extraneous noise filtering method and any residual influence of insect/frog noise on the data set.

Three investigation time periods were selected from receptor K34aa which are:

1. 28-05-2022 8:30 AM to 28-05-2022 1:30 PM
2. 12-06-2022 4:20 PM to 13-06-2022 1:10 AM
3. 22-06-2022 7:40 PM to 22-06-2022 9:10 PM

Periods of calibrated audio within these investigation periods were subjectively auditioned using studio monitoring headphones to understand the makeup of the noise environment and contributing noise sources during the investigated period.

Results

The coloured plot figures below present the following information:

a. Date/time of measurement interval

b. Local wind speed (m/s)

c. Local rainfall in (mm)

d. overall L_{A90} (dBA)

e. L_{Aeq} (dBA)

f. L_{A90} in one third octave bands from 12.5 Hz to 20 kHz

g. Insect/frog noise screening method logic, including:

- Max 1/3 octave level
- Frequency band of max
- Check if frequency is > 1000Hz
- Check if level is >20dB
- Check if max L90 within 5 dB of OA
- Exclusion Assessment

h. The LA90 overall level calculated from frequency bins (L_{fr})

i. The LA90 level from just frequency range which excludes those one third octaves which appear to correlate with insect/frog noise, ($L_{fr,\ filtered}$)

j. DELTA, which is the difference between $L_{fr,filtered}$ and L_{fr}

k. The LA90 overall minus 5 dB,

l. Comment index, which links to **Table 21** for the subjective listening comments of the audio

Table 21 Subjective Listening Comments from Audio Monitoring

Comment Index	Audible Sources of Noise	Wind Farm Audible
1	Birds, distant traffic	Inconclusive
2	Crickets, birds, distant traffic	Occasionally slightly discernible
3	Crickets, birds, distant traffic	Occasionally slightly discernible
4	Distant traffic, birds, occasional frog	Inconclusive
5	Frogs, wind	Inconclusive
6	Frogs, wind	Occasionally slightly discernible
7	Frogs, distant traffic	Inconclusive
8	Frogs, slightly louder	Inconclusive

The DELTA (difference between $L_{fr,\ filtered}$ and $L_{fr)}$ has been included to approximate the degree to which high frequency extraneous noise from insects/frogs have affected the overall L_{A90} noise level. The more negative the difference is, the greater the degree to which insect/frogs are likely affecting the overall L_{A90} noise level. It's important to highlight that this is likely only an approximate method of the level of influence as it is likely that whilst it may be clear which bands contain the signature of insect/frog noise, there is quite likely additional energy from these sources that are influencing other frequency bands to a lesser extent.

Period 1 28-05-2022 8:30 AM to 28-05-2022 1:30 PM

Figure 31 depicts the first investigation time period is characterised by cricket noise in the 6.3 kHz and 8 kHz one third octave bands whilst the other two investigation periods are characterised by frog noise predominately in the 2kHz and 2.5kHz one third octave bands.

The first investigation period shows that only two 10 minute assessment periods were excluded using the frog/insect screening method where it is clear from the coloured spectrum plot and reviewed audio that cricket noise is a feature of the noise environment between 9:50 AM to 12:40 AM, equating to a total of 18 assessment periods. The DELTA for the two excluded intervals was 8 dB and 9dB respectively, which were greater than the other intervals in this period, and sufficient to indicate that the overall L_{A90} noise level was almost entirely dominated by cricket noise. However, during the remaining 16 assessment intervals in this period, which were not excluded from the analysis data set by the NCTP extraneous noise screening, the DELTA ranged between 1 dB and 6 dB with an approximate 4 dB average.

Immediately prior to the above period whilst there were no insects prevalent the DELTA was 0 dB.

This indicates that for those periods in which cricket noise was present but were not excluded from the analysis data set by the NCTP extraneous noise screening method, the overall L_{A90} noise level was 4 dB higher as a result of the extraneous noise.

Figure 31 Investigation Period 1

Date	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022	28-05-2022
Time	8:30:00 AM	8:40:00 AM	8:50:00 AM	9:00:00 AM	9:10:00 AM	9:20:00 AM	9:30:00 AM	9:40:00 AM	9:50:00 AM	10:00:00 AM	10:10:00 AM	10:20:00 AM	10:30:00 AM	10:40:00 AM	10:50:00 AM	11:00:00 AM	11:10:00 AM	11:20:00 AM	11:30:00 AM	11:40:00 AM	11:50:00 AM	12:00:00 PM	12:10:00 PM	12:20:00 PM	12:30:00 PM	12:40:00 PM	12:50:00 PM	1:00:00 PM	1:10:00 PM	1:20:00 PM	1:30:00 PM
Local wind speed	1.3	1.7	1.5	1.7	1.8	1.7	1.8	1.8	2.3	2.4	1.9	2.1	2.3	2.6	2.9	3.1	3.3	2.7	2.7	2.1	2.2	1.6	1.5	2.1	2.1	2.2	2	1.6	1.4	1.7	1.5
Local Rain Exclusions, >mm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90, dBA	32	32	31	30	33	34	32	32	34	35	37	38	39	38	39	40	39	37	41	40	37	34	33	36	36	34	32	32	33	32	33
LAeq	43	41	39	37	47	42	39	38	39	39	50	44	44	45	40	43	41	43	45	42	40	42	40	43	41	41	41	37	40	40	40
12.5Hz																															
16Hz																															
20Hz																-4	-4														
25Hz			-4	-2	-2	-1	-2	-3	-2	-3	-2	-2	-0	-2	0.9	1.9	1	0.7	-0.4	-1	-1	-1									
31.5Hz		-3	-2	-2	-1	-1	-0	-2	-2	-0	1.1	0.8	2.1	1.4	5.2	7.9	5.7	5.8	5.4	2.3	2.9	5.4	-1	-1	-3	-3	-1		0.2	-2	-1
40Hz	1.7	2.4	2.1	2.1	2.5	4	4	1.6	2.8	3.6	5.1	5	5.9	5.2	6	8.6	6.7	5.8	5	5.3	5.3	3.7	2.3	2.5	2.1	3.6	6.3	4.9	5.8	4.4	3.8
50Hz	8.6	11	10	9.1	11	11	12	9.6	10	10	10	10	11	9.9	9.7	13	9.7	10	8.5	8.8	9.7	8.5	12	8.2	8.3	11	11	9.6	11	11	11
63Hz	12	15	13	12	13	14	14	13	13	14	15	15	16	16	16	20	16	16	15	15	15	15	15	13	13	13	15	12	15	14	15
80Hz	8.8	11	9.1	9.2	11	12	13	9.5	10	10	12	12	14	14	18	19	18	18	17	13	15	17	11	9.7	10	12	13	11	14	13	13
100Hz	9.6	10	9.8	9.3	11	12	12	10	11	10	14	13	13	14	15	17	15	15	14	13	13	14	14	9.8	9.8	11	12	9.5	13	13	15
125Hz	11	11	11	12	12	13	13	12	12	12	15	13	14	14	16	17	16	16	15	14	13	15	13	11	11	11	12	9.2	12	13	15
160Hz	7	7.1	9.5	9.7	11	11	11	11	11	10	12	12	12	11	18	20	20	20	19	12	13	20	15	8.9	9.2	9	9.1	7.3	9.5	11	10
200Hz	7.1	7	11	11	11	12	12	12	12	12	17	13	12	11	15	17	16	16	15	11	12	14	11	9.1	8.6	8.2	8.3	6.2	8.2	9.7	8.1
250Hz	9.1	9	8.9	9	9.9	10	10	11	11	11	14	13	12	13	13	15	15	13	12	12	14	13	9.9	10	8.4	8.6	8.9	8.1	9.2	9.5	8.5
315Hz	16	13	11	12	15	16	17	16	16	18	17	18	19	18	18	19	19	17	17	17	19	18	16	17	16	17	17	17	19	18	16
400Hz	16	16	13	14	15	16	16	15	16	18	18	20	21	22	22	24	22	21	20	20	21	21	16	19	16	16	18	16	18	18	16
500Hz	17	17	15	16	16	17	17	16	17	18	18	19	22	22	23	25	24	22	21	20	21	21	17	19	17	17	19	16	18	18	17
630Hz	18	19	18	19	19	20	19	18	19	20	20	20	23	23	23	25	24	24	22	20	22	22	19	21	19	19	21	18	20	20	19
800Hz	20	21	20	20	21	22	22	20	20	22	22	21	25	24	23	25	23	25	24	20	23	23	19	21	19	19	23	18	22	20	21
1kHz	23	23	22	21	23	24	23	22	22	23	24	22	27	25	23	25	23	25	24	20	23	22	20	21	20	20	23	18	23	20	22
1.25kHz	23	24	22	20	23	24	22	21	22	22	24	23	26	23	21	23	22	23	23	19	21	21	19	19	18	18	21	16	21	17	20
1.6kHz	19	20	19	17	21	22	19	18	20	19	21	21	22	20	18	20	19	19	19	16	18	17	16	16	15	14	18	14	18	15	18
2kHz	15	16	15	14	19	19	16	14	16	16	17	17	17	16	14	16	15	15	15	12	14	13	12	13	11	11	14	10	14	12	14
2.5kHz	14	15	14	13	17	16	13	12	14	14	14	14	13	13	12	14	13	13	12	10	11	11	10	12	9.5	9.4	11	9.4	10	9.9	11
3.15kHz	12	14	12	11	15	14	11	11	12	11	12	11	11	11	11	12	12	11	11	9.5	10	10	9.4	11	9.4	9.5	9.8	9.6	9.7	10	10
4kHz	12	12	10	10	13	11	10	9.9	11	10	11	10	10	10	11	12	11	10	11	9.4	9.5	9.7	9.2	10	9.4	9.5	9.4	9.4	9.2	9.4	9.4
5kHz	9.4	9.5	9.4	9.3	10	9.7	9.3	9.4	11	11	12	13	13	14	15	15	16	14	15	14	12	10	11	13	13	12	11	10	10	9.3	9.4
6.3kHz	8.7	8.9	9.1	9	9.3	9.7	10	15	22	22	26	30	31	31	33	33	34	29	36	34	28	22	21	30	31	28	24	22	18	14	14
8kHz	8.2	8.2	8.2	8.2	8.5	9.8	10	18	26	27	30	32	32	31	33	34	34	28	37	35	26	17	15	28	29	24	17	16	14	1	
10kHz	7.1	7.1	7.1	7.1	7.2	7.3	7.4	9.3	16	19	20	20	21	19	21	21	21	16	27	24	12	8.2	8.2	15	16	12	8.3	8.5	8	7	
12.5kHz	6	6	6	6.1	6.1	6.1	6.1	6.2	7.3	8	8.6	10	10	11	11	12	12	10	13	13	9.8	7.3	7.5	11	11	9.5	7.5	7.3	6.7	6.2	6.2
16kHz	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.2	5.2	5.5	6.3	7.1	6.7	7.1	7.4	8	8.1	6.2	8.8	8.5	6	4.6	4.5	6.3	6.5	5.5	4.4	4.4	4.2	4.1	4.2
20kHz	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.4	2.9	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3	3.1	3.1	3.1	3.1	3	3.1	3	3	3
Max 1/3 octave L90 A-weighted	23	24	22	21	23	24	23	22	26	27	30	32	32	31	33	34	34	29	37	35	28	23	21	30	31	28	24	22	23	20	22
Max L90 Freq	1250	1250	1250	1000	1250	1000	1000	1000	8000	8000	8000	8000	8000	8000	8000	8000	6300	6300	8000	8000	6300	800	6300	6300	6300	6300	6300	6300	1000	1000	1000
Is Freq >1000 Hz	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 >20dB	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE
Is Max L90 within 5dB of LA90	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Excluded	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
LA90 overall from frequency (Lfr)	30	30	29	29	31	32	30	30	32	33	35	36	37	36	38	39	38	35	40.2	39	34	32	30	34	34	32	31	29	31	29	30
LA90 from frequency (25Hz-5kHz & 12.5kHz-20kHz) (Lfr,filtered)	30	30	29	29	31	32	30	29	30	30	31	31	34	32	32	34	33	33	32.2	30	31	31	29	29	28	28	30	27	30	29	29
DELTA (Lfr,filtered - Lfr)	0	0	0	0	0	0	0	1	2	2	3	5	3	4	5	5	6	3	8	9	2	1	1	5	6	4	1	1	0	0	0
LA90 overall - 5 dB	27	27	26	25	28	29	27	27	29	30	32	33	34	33	34	35	34	32	36	35	32	29	28	31	31	29	27	27	28	27	28
Comment			1													2			3												

insects

Period 2 12-06-2022 4:20 PM to 13-06-2022 1:10 AM

Figure 32 depicts the second investigation period. During this period 20 assessment periods were excluded using the NCTP frog/insect screening method however it is clear from the coloured spectrum plot and reviewed audio that frog noise is a feature of the noise environment between 6:20 PM and 1:10 PM, equating to at least 43 assessment periods.

The range of DELTA for the 20 excluded intervals was between 9 dB and 4dB with an average DELTA of excluded periods of approximately 6 dB.

However, during the remaining assessment intervals in this period, which were not excluded from the analysis data set by the NCTP extraneous noise screening, the DELTA ranged between 2 dB and 4 dB with an approximate 3 dB average.

Immediately prior to the above period whilst there were no frog noise prevalent the DELTA was 0 dB.

This indicates that for those periods in which frog noise was present but were not excluded from the analysis data set by the NCTP extraneous noise screening method, the overall L_{A90} noise level was 3 dB higher as a result of the extraneous noise.

Figure 32 Investigation Period 2

Date	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022
Time	4:20:00 PM	4:30:00 PM	4:40:00 PM	4:50:00 PM	5:00:00 PM	5:10:00 PM	5:20:00 PM	5:30:00 PM	5:40:00 PM	5:50:00 PM	6:00:00 PM	6:10:00 PM	6:20:00 PM	6:30:00 PM	6:40:00 PM	6:50:00 PM	7:00:00 PM	7:10:00 PM
Local wind speed	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Local Rain Exclusions, >mm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90, dBA	37	40	36	36	36	37	37	40	38	38	38	38	41	41	41	40	40	41
LAeq	45	46	43	44	44	43	43	46	41	44	44	43	44	45	43	45	43	44
12.5Hz																		
16Hz	-1	-2	-3	-3	-3	-2	-2	0	-1	-2	-2	-3	0	-0	-2	-2	-2	-2
20Hz	3	2	1	1	1	2	2	5	3	2	2	1	4	4	2	2	2	2
25Hz	7	6	5	5	5	5	5	8	7	6	6	4	8	7	6	5	5	6
31.5Hz	10	10	8	9	8	9	9	12	11	9	9	8	11	11	9	9	9	9
40Hz	14	14	12	12	12	13	13	16	15	13	13	12	15	15	14	13	13	13
50Hz	17	18	16	16	16	16	17	20	18	16	17	16	18	19	17	17	16	17
63Hz	23	24	22	22	22	22	22	25	23	22	22	21	23	24	22	22	22	22
80Hz	20	21	19	19	19	19	20	22	20	19	19	19	20	21	20	19	19	19
100Hz	21	21	18	18	19	19	20	22	20	19	19	19	20	21	20	19	19	20
125Hz	21	20	17	18	19	18	20	21	19	18	18	18	19	20	20	19	19	19
160Hz	19	18	16	17	17	17	18	19	18	17	17	17	18	19	18	18	18	18
200Hz	18	18	15	16	17	17	18	19	18	17	17	17	18	19	19	18	18	18
250Hz	19	19	17	18	19	18	20	21	20	18	19	19	20	22	21	20	20	20
315Hz	23	23	21	22	23	22	24	25	24	23	23	23	24	26	25	24	24	24
400Hz	26	26	24	25	25	25	27	28	27	26	25	25	26	28	27	26	26	26
500Hz	27	28	25	26	25	25	26	29	27	26	26	26	27	28	27	26	26	27
630Hz	27	29	25	25	25	26	26	30	27	27	25	25	27	28	27	26	26	27
800Hz	26	30	25	26	25	26	26	30	27	27	25	24	27	27	27	25	25	27
1kHz	26	30	26	26	25	26	26	30	26	26	24	24	27	27	26	24	25	26
1.25kHz	25	29	26	25	24	25	25	28	25	25	22	22	25	25	24	22	23	24
1.6kHz	23	26	24	23	21	23	23	26	22	22	19	20	22	23	22	20	21	22
2kHz	20	22	21	19	18	20	20	24	22	26	25	28	31	32	32	32	32	33
2.5kHz	18	19	18	17	15	18	20	24	25	29	29	33	35	35	34	35	36	36
3.15kHz	15	16	14	13	12	15	16	19	19	20	19	20	21	20	20	19	19	19
4kHz	13	13	11	11	10	11	12	12	12	12	11	11	12	11	12	11	11	11
5kHz	11	11	10	10	9	10	10	10	10	10	9	9	10	10	10	9	10	10
6.3kHz	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
8kHz	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
10kHz	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12.5kHz	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
16kHz	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Max 1/3 octave L90 A-weighted	27	30	26	26	25	26	27	30	27	29	29	33	35	35	34	35	36	36
Max L90 Freq	500	800	1000	1000	400	800	400	800	630	2500	2500	2500	2500	2500	2500	2500	2500	2500
Is Freq >1000 Hz	####	####	TRUE	TRUE	####	####	####	####	####	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 >20dB	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 within 5dB of LA90	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE
Excluded	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE
LA90 overall from frequency (Lfr)	36	38	35	35	35	35	36	39	37	37	36	37	39	40	39	39	39	40
LA90 from frequency (excluding 2kHz-3.15kHz) (Lfr,filtered)	36	38	35	35	35	35	36	38	36	35	34	34	36	37	36	35	35	36
DELTA (Lfr,filtered - Lfr)	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.3	0.6	1.4	1.5	2.9	3.2	3.1	3.2	4.2	4.3	4.5
LA90 overall - 5 dB	32	35	31	31	31	32	32	35	33	33	33	33	36	36	36	35	35	36
Comment	4																	

Date	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022
Time	7:20:00 PM	7:30:00 PM	7:40:00 PM	7:50:00 PM	8:00:00 PM	8:10:00 PM	8:20:00 PM	8:30:00 PM	8:40:00 PM	8:50:00 PM	9:00:00 PM	9:10:00 PM	9:20:00 PM	9:30:00 PM	9:40:00 PM	9:50:00 PM	10:00:00 PM	10:10:00 PM
Local wind speed	3	2	2	2	2	1	2	2	2	2	2	2	3	2	2	2	2	2
Local Rain Exclusions, >mm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90, dBA	41	41	41	40	39	39	39	39	40	40	38	38	39	39	39	38	39	38
LAeq	44	43	44	44	43	41	42	42	43	43	41	41	42	41	42	43	41	41
12.5Hz																		
16Hz	-2	-3	-4						-3	-4					-4			
20Hz	2	1	1	-1	-3		-4	-3	0	-1		-4	-2	-2	-1	-2	-1	-2
25Hz	5	5	4	2	1	-1	1	1	4	3	-1	0	2	2	3	1	3	2
31.5Hz	9	8	8	6	5	2	4	4	7	6	2	4	5	5	6	5	6	5
40Hz	13	12	12	10	9	6	8	8	11	10	6	7	9	9	10	9	10	9
50Hz	17	16	15	15	14	12	12	13	15	14	11	12	13	13	14	13	14	13
63Hz	22	21	21	20	20	18	18	19	21	20	17	18	19	19	20	19	19	19
80Hz	19	19	18	18	17	15	16	17	18	17	15	16	17	17	17	17	17	17
100Hz	19	19	18	18	16	14	15	16	19	17	14	15	17	17	18	16	17	17
125Hz	19	19	18	18	17	15	16	17	18	17	15	15	18	17	18	17	17	18
160Hz	18	18	17	17	15	14	15	16	17	16	13	14	17	16	17	16	16	16
200Hz	18	18	17	17	15	13	14	15	17	17	13	13	16	15	17	16	16	16
250Hz	20	20	19	19	16	13	15	16	19	19	14	15	18	17	19	17	18	18
315Hz	23	24	23	23	20	18	19	20	23	23	19	19	22	21	23	21	22	22
400Hz	26	26	25	25	23	21	22	23	26	25	21	22	24	23	25	24	25	24
500Hz	26	26	25	25	23	20	22	23	26	24	21	23	25	24	25	24	25	24
630Hz	26	25	25	25	21	19	21	22	25	24	20	20	24	23	25	24	24	23
800Hz	26	25	24	24	21	19	20	22	24	24	19	20	23	22	24	24	24	23
1kHz	25	24	24	23	20	18	20	21	23	23	19	19	22	22	23	23	23	22
1.25kHz	24	22	22	22	18	16	18	20	21	21	17	18	20	20	22	22	21	20
1.6kHz	22	21	20	20	17	16	17	18	20	20	16	17	19	18	20	19	19	18
2kHz	33	33	33	33	32	32	32	32	32	33	32	31	31	32	31	30	30	30
2.5kHz	37	36	36	35	35	36	35	35	35	36	35	34	34	35	34	32	33	34
3.15kHz	19	19	19	18	18	17	18	18	18	19	17	16	17	17	16	16	17	17
4kHz	11	11	10	10	10	9	10	10	10	11	9	10	10	10	11	11	10	10
5kHz	10	9	9	9	9	9	9	9	9	10	9	9	9	9	10	10	9	9
6.3kHz	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
8kHz	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
10kHz	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12.5kHz	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
16kHz	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Max 1/3 octave L90 A-weighted	37	36	36	35	35	36	35	35	35	36	35	34	34	35	34	32	33	34
Max L90 Freq	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Is Freq >1000 Hz	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 >20dB	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 within 5dB of LA90	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE
Excluded	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE
LA90 overall from frequency (Lfr)	40	40	40	39	38	38	38	38	39	39	37	37	38	38	38	37	37	37
LA90 from frequency (excluding 2kHz-3.15kHz) (Lfr,filtered)	35	35	34	34	31	30	31	32	34	33	30	31	33	32	34	33	33	33
DELTA (Lfr,filtered - Lfr)	4.8	5	5.5	5	6.9	8.5	7.3	6.4	4.7	5.5	7.6	6.4	4.9	5.6	4.2	3.8	4	4.5
LA90 overall - 5 dB	36	36	36	35	34	34	34	34	35	35	33	33	34	34	34	33	34	33
Comment										5								

Date	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	12-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022	13-06-2022
Time	10:20:00 PM	10:30:00 PM	10:40:00 PM	10:50:00 PM	11:00:00 PM	11:10:00 PM	11:20:00 PM	11:30:00 PM	11:40:00 PM	11:50:00 PM	12:00:00 AM	12:00:00 AM	12:10:00 AM	12:20:00 AM	12:30:00 AM	12:40:00 AM	12:50:00 AM	1:00:00 AM	1:10:00 AM
Local wind speed	2	2	2	2	1	2	2	3	2	1	1	1	1	1	1	1	1	1	1
Local Rain Exclusions, >mm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90, dBA	38	37	37	35	35	36	36	34	33	32	31	31	31	32	32	32	31	31	31
LAeq	40	39	41	38	40	41	39	36	36	35	36	35	37	37	37	36	35	35	35
12.5Hz																			
16Hz	-4	-4																	
20Hz	-0	0	-2	-4			-2												
25Hz	3	3	2	0	-1	0	1	-1	-4										
31.5Hz	6	7	5	3	2	4	4	2	-1		-4			-2	-2	-2	-3	-3	-3
40Hz	10	11	8	7	6	7	8	6	3	-1	0	-1	-0	1	1	1	0	1	1
50Hz	14	14	13	11	11	11	11	10	9	9	9	9	8	10	10	9	9	9	10
63Hz	20	20	19	17	17	18	18	17	16	15	16	14	15	17	17	17	16	16	16
80Hz	18	18	17	15	15	15	16	15	12	7	9	8	9	10	10	11	9	11	10
100Hz	18	18	17	15	14	15	16	15	12	8	10	9	10	10	10	11	10	11	11
125Hz	18	18	17	16	15	16	16	16	13	9	11	10	11	11	11	12	11	12	12
160Hz	17	17	16	15	14	14	15	15	11	8	9	8	9	9	9	10	9	10	10
200Hz	16	17	15	13	12	13	15	14	11	7	8	7	8	9	9	10	8	9	9
250Hz	18	18	17	15	14	14	17	16	12	6	8	7	8	9	11	11	9	10	10
315Hz	23	22	22	20	18	19	22	20	17	15	16	16	16	15	16	16	16	16	16
400Hz	25	25	24	22	21	22	24	22	20	15	16	15	16	18	19	19	18	18	18
500Hz	25	25	24	22	22	22	24	23	19	15	15	15	15	17	17	17	15	16	16
630Hz	24	25	23	21	20	21	23	21	18	15	16	15	15	17	17	17	15	16	16
800Hz	24	24	23	20	20	21	23	21	18	15	15	15	15	17	17	16	15	16	16
1kHz	23	23	22	20	20	20	22	20	18	15	16	15	15	17	16	16	16	16	16
1.25kHz	21	21	20	18	18	18	20	18	15	12	13	12	12	14	14	14	12	13	13
1.6kHz	19	19	18	16	16	16	18	16	13	11	11	14	11	12	12	12	11	11	11
2kHz	28	26	27	26	25	26	26	23	23	23	22	21	22	22	22	22	21	19	20
2.5kHz	32	31	31	30	29	29	29	27	27	27	26	26	26	25	25	27	26	23	24
3.15kHz	16	15	15	14	14	14	15	13	12	12	13	12	12	12	13	13	13	12	13
4kHz	10	9	10	9	9	9	9	9	9	8	9	8	9	9	9	9	9	9	9
5kHz	9	9	9	9	9	9	9	9	9	8	9	8	9	9	9	9	8	9	9
6.3kHz	9	9	9	8	8	8	9	9	8	8	8	8	8	8	8	8	8	8	8
8kHz	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
10kHz	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12.5kHz	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
16kHz	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Max 1/3 octave L90 A-weighted	32	31	31	30	29	29	29	27	27	27	26	26	26	25	25	27	26	23	24
Max L90 Freq	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Is Freq >1000 Hz	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 >20dB	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 within 5dB of LA90	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Excluded	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
LA90 overall from frequency (Lfr)	36	36	36	34	33	34	35	33	31	30	30	29	30	30	30	31	30	29	29
LA90 from frequency (excluding 2kHz-3.15kHz) (Lfr,filtered)	34	34	33	31	30	31	33	31	28	25	26	25	26	27	27	27	26	27	27
DELTA (Lfr,filtered - Lfr)	2.9	2.2	2.8	3.4	3.2	3.3	2.3	1.8	3.1	5	3.7	4.1	4.1	3	3	3.7	3.7	2.2	2.7
LA90 overall - 5 dB	33	32	32	30	30	31	31	29	28	27	26	26	26	27	27	27	26	26	26
Comment					6														

frogs

Period 3 22-06-2022 7:40 PM to 22-06-2022 9:10 PM

Figure 33 depicts the third investigation period includes a total of 10 assessment intervals where only a single interval was excluded.

The period that was excluded does not have a higher noise level in the maximum L90 one third octave band than the periods prior, and afterwards. The reason that this 8:40 PM period was excluded, appears to be that the overall LA90 decreased slightly during that period. From listening to the audio, it is not clear why this is the case. It was not conclusive either from the listening of the audio whether WTG noise was a feature of the noise environment, and more specifically, whether the WTG noise level changed over this investigation period causing the fluctuations in the overall LA90. It's noted that the DELTA of the excluded period at 8:40 was the same as the remaining periods. This suggests that slight differences in the noise environment can influence the insect/frog screening outcome. Likewise, it indicates that a similar level of noise influence of frog noise on the overall LA90 noise level occurred during excluded and included periods for this investigation period.

Figure 33 Investigation Period 3

Date	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022	22-06-2022
Time	7:40:00 PM	7:50:00 PM	8:00:00 PM	8:10:00 PM	8:20:00 PM	8:30:00 PM	8:40:00 PM	8:50:00 PM	9:00:00 PM	9:10:00 PM
Local wind speed	2.43	2.67	3.15	2.98	2.87	2.77	2.17	2.21	2.48	2.49
Local Rain Exclusions, >mm	0	0	0	0	0	0	0	0	0	0
L90, dBA	39	39	39	38	38	37	37	37	37	37
LAeq	42	42	42	41	41	41	41	41	40	40
12.5Hz										
16Hz	0	-1	0	-1	-2	-3		-4	-3	-2
20Hz	4	4	4	3	2	1	0	0	1	2
25Hz	7	8	7	6	5	4	4	4	5	6
31.5Hz	11	11	11	10	9	8	8	8	9	10
40Hz	15	15	14	14	12	12	11	11	12	13
50Hz	18	17	17	17	16	15	15	15	15	16
63Hz	22	21	21	20	20	19	19	19	20	21
80Hz	21	21	20	20	20	19	19	19	19	19
100Hz	20	21	21	20	20	19	19	19	20	20
125Hz	20	21	21	20	20	19	19	19	19	20
160Hz	19	19	20	19	19	19	19	19	19	19
200Hz	18	18	19	19	18	18	18	17	18	18
250Hz	18	18	19	18	17	17	16	17	17	17
315Hz	21	21	21	20	20	19	18	19	20	20
400Hz	25	25	25	24	23	23	22	22	23	23
500Hz	28	28	27	26	25	25	24	24	25	25
630Hz	27	28	27	26	25	24	24	24	25	25
800Hz	26	26	26	25	24	23	23	22	23	24
1kHz	26	26	25	24	23	23	22	22	22	23
1.25kHz	23	24	23	23	21	21	20	20	21	21
1.6kHz	21	21	21	20	19	19	18	18	18	19
2kHz	27	27	27	27	26	26	26	26	26	26
2.5kHz	33	33	32	32	32	32	32	32	31	31
3.15kHz	17	17	18	17	17	18	18	18	17	18
4kHz	10	10	11	11	10	10	10	10	10	10
5kHz	9	9	10	10	10	9	9	9	9	9
6.3kHz	9	9	9	9	9	9	9	9	9	9
8kHz	8	8	8	8	8	8	8	8	8	8
10kHz	7	7	7	7	7	7	7	7	7	7
12.5kHz	6	6	6	6	6	6	6	6	6	6
16kHz	4	4	4	4	4	4	4	4	4	4
20kHz	2	2	2	2	2	2	2	2	2	2
Max 1/3 octave L90 A-weighted	33	33	32	32	32	32	32	32	31	31
Max L90 Freq	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Is Freq >1000 Hz	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 >20dB	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Is Max L90 within 5dB of LA90	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
Excluded	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
LA90 overall from frequency (Lfr)	38	38	38	37	36	36	36	36	36	36
LA90 from frequency (excluding 2kHz & 2.5 kHz) (Lfr,filtered)	36	36	35	35	34	33	33	33	33	34
DELTA (Lfr,filtered - Lfr)	2	2	2	2	3	3	3	3	2	2
LA90 overall - 5 dB	34	34	34	33	33	32	32	32	32	32
Comment			7				8			

frogs

Summary

A sample of data from one reference receptor was reviewed for the purposes of analysing the effectiveness of the NCTP extraneous (frog/insect) noise screening method. The screening method has correctly identified periods of significant cicada and frog noise but has not triggered during periods where there is still frog/insect noise affecting the overall L_{A90} noise level. Based on this sample analysis data set, the influence of frog/insect noise has not been entirely removed from the valid data set and is therefore elevating the regression result.

It should be noted that the pre-construction baseline monitoring surveys utilised the same screening algorithms and therefore also may have included some residual influence of insects/frogs. However, the degree to which such residual influence affects the data will depend upon the level of activity of insects and frogs, e.g. where frog & insect activity is generally low then the residual influence is likely quite low and conversely where frog & insect activity is high then the residual influence is likely higher.

Given that the difference in pre-construction baseline monitoring and post construction compliance monitoring is used to determine the WTG noise level it is clear that such seasonal variability in insect frog activity can adversely impact the assessment. It is not possible to evaluate the degree to which such residual influence affects the assessment without changing the screening algorithm and re-processing all data sets used for pre-construction baseline. However, it is evident that the extremely wet season leading into and during the June-July 2022 monitoring campaign has led to very high levels of frog activity and hence the residual influence of such extraneous noise serves to artificially increase the determined WTG noise level.

APPENDIX G

Assessment against erroneous NCTP noise limits

NCTP noise limit assessment

As discussed in **Section 5,** as a result of a transcription error there is an inconsistency in the NZS 6808 limits presented in the Background Report and the limits contained in the NCTP.

It should be noted that:

- the NCTP limits are up to 2.4 dBA high for K34aa
- the NCTP limits are up to 0.5 dBA high for M29aa
- the NCTP limits are up to 5.5 dBA high for N31ab

Whilst this report focusses primarily on the technically correct NZS 6808 limits in accordance with condition 23 of the permit, the assessment is completed separately against the limits specified in the NCTP for completeness in this Appendix.

NCTP screening method

A summary table showing the compliance margin is shown in **Table 22** and **Table 23**.

Table 22 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	12.2	11.5	9.7	7.2	4.6	4.4	4.6	6.0	10.5	-	-	-
M29aa	20.0	15.1	11.4	8.2	5.4	3.1	2.8	3.8	6.4	16.0	-	-
K34aa	12.6	10.8	8.3	5.7	3.2	2.9	4.5	7.9	19.8	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 23 Compliance margin – Night Only

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	13.1	11.4	9.4	7.1	4.9	2.8	3.2	2.7	3.8	6.6	16.2	-
M29aa	20.7	14.4	10.8	7.9	5.3	3.2	1.6	1.2	4.2	13.4	-	-
K34aa	13.5	11.2	8.5	5.7	3.2	1.2	0.8	5.7	16.5	4.2	4.7	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

0.5 dB screening method

A summary table showing the compliance margin is shown in **Table 24** and **Table 25**.

Table 24 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	12.4	10.7	8.5	6.1	3.8	3.9	4.4	5.7	9.3	-	-	-
M29aa	19.0	13.7	10.3	7.6	5.2	3.1	2.8	3.6	4.9	7.2	13.2	-
K34aa	11.8	10.0	7.9	5.5	3.2	2.9	4.2	6.6	11.4	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

Table 25 Compliance margin – Night Only

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
N31ab	11.4	10.7	8.9	6.5	4.0	1.7	2.1	2.1	5.0	17.8		
M29aa	18.2	13.2	10.1	7.5	5.2	3.1	1.4	0.3	1.8	4.2	8.6	
K34aa	11.9	10.6	8.6	6.1	3.6	1.3	0.4	4.5	10.6			

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

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