

STRATFORD MINING COMPLEX

Monthly Compliance Noise monitoring
November 2022

Prepared for:

Stratford Coal Pty Ltd
PO Box 168
Gloucester NSW 2442

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia

T: +61 2 4037 3200
E: newcastleau@slrconsulting.com www.slrconsulting.com

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 Stratford Coal Pty Ltd (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.

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| 630.11771-R60-v1.0 | 23 January 2023 | Shannon Harvey | Martin Davenport | Martin Davenport |
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1 Introduction

Stratford Coal Pty Limited (SCPL), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), has commissioned SLR Consulting Australia Pty Ltd (SLR) to conduct monthly noise monitoring for the Stratford Mining Complex (SMC) operations guided by the requirements of the *Stratford Mining Complex (Stratford Extension Project) Noise Management Plan* (NMP), Document No. NMP-R03-A, dated 17 June 2019. This report presents the results and findings from the operator-attended noise surveys conducted between Tuesday 15 November and Wednesday 16 November 2022.

It is understood that the SMC collectively comprises the Bowens Road North Open Cut (BRNOC), Avon North Open Cut, Stratford East Open Cut, Roseville West Open Cut and the associated coal processing and handling facilities. Run-of-mine (ROM) coal from the SCM is processed then loaded and railed on the North Coast Railway to the port of Newcastle.

The objectives of the noise monitoring programme for this operating period were as follows:

- Conduct three rounds of external operator-attended noise measurements at the eight nominated locations in the NMP as well as additional locations, representative of receivers in the area surrounding the SMC. The eight external operator-attended noise measurement locations are:
 - Atkins – Off Wenhams Cox Road, Stratford
 - Clarke – Off Wenhams Cox Road, Stratford
 - Wadland – Off Wenhams Cox Road, Stratford
 - Hall – Upper Avon Road
 - Lowrey – Off Crowthers Road, Stratford
 - Pryce Jones – The Bucketts Way, Craven
 - Van der Drift – Wood Street, Stratford
 - Greenwood – Off Glen Road, Craven

Noise monitoring will occur for a day, evening and night period. The day, evening and night periods being those defined in the NSW *Industrial Noise Policy* (EPA 2000).

- The operator will quantify and characterise the maximum (L_{Amax}) and the intrusive (L_{Aeq} and L_{Ceq}) noise level contributions from SMC operations over a 15 minute measurement period. In addition, the operator will quantify and characterise the overall levels of ambient noise (i.e. L_{Amax} , $LA1$, $LA10$, $LA50$, $LA90$, and L_{Aeq}) over the 15 minute measurement interval.
- Assess the noise emissions of SMC and determine compliance with respect to the limits contained in the NMP.

In addition to monthly noise monitoring at the nominated residential receivers, the NMP requires quarterly noise monitoring of rail activity and verification monitoring of the Real Time Noise Monitor (RTNM) network.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 SMC Noise Criteria

The figures presented in this Section are extracts from the *Stratford Extension Project (SSD-4966) Development Consent* dated 29 May 2015.

2.1 Project Approval Schedule 3 Environmental Performance Conditions

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from an owner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 5-6 of Schedule 4.

Table 1: Land subject to acquisition upon request

| Property ID | |
|-----------------------|----------------|
| 40/51/Cr1 – L. Blanch | 42 – D. Blanch |
| Cr7 – Pryce-Jones | Cr 2 – Boorer |

Note: To interpret the location referred to in Table 1 see the applicable figure in Appendix 5.

However, the obligation to acquire a property does not apply if the Applicant has a negotiated agreement with the owner/s of the relevant land that sets aside acquisition under the terms of this consent, and the Applicant has advised the Department in writing of the terms of this agreement.

ADDITIONAL MITIGATION UPON REQUEST

2. Upon receiving a written request from the owner of any residence on the land listed in Tables 1 and 2, the Applicant shall implement additional noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner. These measures must be reasonable and feasible and directed towards reducing the noise impacts of the development on the residence.

If within 3 months of receiving this request from the owner, the Applicant and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Land subject to additional noise mitigation upon request

| Property ID | Property ID |
|-------------------|------------------------|
| 31(1) – Isaac | 60 – Healy / Greenwood |
| 44 – Cross / Jane | 36 – Wallace |
| 37 – Worth | 29 – Ward |
| 15(3) – Falla | |

Note: To interpret the locations referred to in Table 2 see the applicable figure in Appendix 5.

However, the obligation to implement noise mitigation measures does not apply if the Applicant has a negotiated agreement with the owner/s of the relevant residence or land that sets aside noise mitigation measures under the terms of this consent, and the Applicant has advised the Department in writing of the terms of this agreement.

NOISE

Hours of Operation

3. The Applicant shall comply with the operating hours in Table 3.

Table 3: Operating hours

| Activity | Operating Hours |
|---|---------------------------------|
| <ul style="list-style-type: none"> Open cut mining operations in the Bowens Road North and Roseville West Extension pits Recovery and transport of CHPP rejects for re-processing Construction of the noise mitigation bunds on the western side of the Avon North, Roseville West Extension and Stratford East pits | 7 am to 6 pm, 7 days per week |
| <ul style="list-style-type: none"> Open cut mining operations in the Avon North and Stratford East pits Coal processing, loading and dispatch of product coal trains | 24 hours a day, 7 days per week |
| <ul style="list-style-type: none"> Maintenance activities | week |

Noise Criteria

4. The Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 4 at any residence on privately-owned land.

Table 4: Noise criteria dB(A)

| Land | Day $L_{Aeq}(15 \text{ min})$ | Evening $L_{Aeq}(15 \text{ min})$ | Night $L_{Aeq}(15 \text{ min})$ | Night $L_{A1}(1 \text{ min})$ |
|--------------------------------------|----------------------------------|--------------------------------------|------------------------------------|----------------------------------|
| 40/51/Cr1 – L. Blanch | 43 | 43 | 43 | 50 |
| Cr7 – Pryce-Jones | 43 | 43 | 43 | 49 |
| 42 – D. Blanch | 42 | 42 | 42 | 50 |
| Cr 2 – Boorer | 41 | 41 | 41 | 49 |
| 31(1) – Isaac | 40 | 40 | 40 | 48 |
| 36 – Wallace | 39 | 39 | 39 | 47 |
| 44 – Cross / Jane | | | | |
| 60 – Healy / Greenwood | 39 | 39 | 39 | 45 |
| 37 – Worth | 38 | 38 | 38 | 46 |
| 29 – Ward | 38 | 38 | 37 | 45 |
| 23 – Bagnall | 37 | 37 | 37 | 45 |
| 31(2) – Isaac | | | | |
| 296 – Watson | | | | |
| 297 – Bosma | | | | |
| 298 – Yates | 36 | 36 | 36 | 45 |
| 15(3) – Falla | 39 | 35 | 35 | 45 |
| 15(2) – Falla | 36 | 35 | 35 | 45 |
| Stratford Village | 37 | 36 | 35 | 45 |
| All other privately-owned residences | 35 | 35 | 35 | 45 |

- To interpret the locations referred to in Table 4 see the applicable figure(s) in Appendix 5.
- Stratford village is shown on the figure(s) in Appendix 5.

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 6 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a negotiated agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

2.2 Project Approval Appendix 6: Noise Compliance Assessment

Applicable Meteorological Conditions

1. The noise criteria in Table 4 in Schedule 3 are to apply to a receiver under all meteorological conditions except under:
 - (a) wind speeds greater than 3 m/s at 10 m above ground level; or
 - (b) temperature inversion conditions between 1.5°C and 3°C/100 m and wind speed greater than 2 m/s at 10 m above ground level; or
 - (c) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station required under condition 25 of Schedule 3.

Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
4. This monitoring must be carried out at least 12 times in each calendar year (ie at least once in every calendar month), unless the Secretary directs otherwise.
5. Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment;
 - (c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration; and
 - (d) the use of an appropriate modifying factor for low frequency noise to be applied during compliance testing at any individual residence if low frequency noise is present (in accordance with the INP) and before comparison with the specified noise levels in the consent.

The implementation and transitional arrangements for the NSW Noise Policy for Industry (NPfI) notes the following:

The NSW Industrial Noise Policy (2000) will continue to apply where it is referenced in existing statutory instruments (such as consents and licences), except for the NSW Industrial Noise Policy Section 4 modifying factors, which will be transitioned to the Noise Policy for Industry (2017) Fact Sheet C through a NSW Industrial Noise Policy application note. This approach has been taken because the Noise Policy for Industry (2017) modification factor approach reflects more recent understanding of the impact of tonal and low-frequency noise on the community.

As such appropriate modifying factors such as low frequency noise have been assessed against NPfI requirements.

2.3 EPL Noise Limits – SMC Operations

The noise limits specified in EPL 5161 are consistent with the noise criteria specified in SSD-4966.

2.4 Noise Limits at the Nominated Attended Noise Monitoring Locations

The site-specific noise limits for the eight nominated attended noise monitoring locations are summarised in **Table 1**.

Table 1 Noise Limits for the Nominated Noise Monitoring Locations

| Locality | Intrusiveness Criteria LAeq(15minute) | | | Night LA1(1minute) Criterion |
|--------------------------|---------------------------------------|---------|-------|------------------------------|
| | Day | Evening | Night | Night |
| Atkins ^{1,2} | 35 | 35 | 35 | 45 |
| Clarke ^{1,2} | 37 | 37 | 37 | 45 |
| Wadland ^{1,2} | 37 | 37 | 37 | 45 |
| Hall | 35 | 35 | 35 | 45 |
| Lowrey | 35 | 35 | 35 | 45 |
| Pryce Jones ³ | 43 | 43 | 43 | 49 |
| Van der Drift | 37 | 36 | 35 | 45 |
| Greenwood | 35 | 35 | 35 | 45 |

Note 1: Owned by Stratford Coal Pty Ltd

Note 2: Criteria adopted from Bagnall as a guide only and are not definitive at this location.

Note 3: Land subject to acquisition upon request.

2.5 Rail Noise Goals

The NMP has adopted ARTC's EPL 3142 noise goals as criteria for the assessment of SMC rail transport noise. The noise objectives specified in ARTC's EPL 3142 apply at 1 m from the façade of affected residential properties and are provided in **Table 2**.

Table 2 ARTC EPL 3142 Noise Objectives

| Descriptor | Rail Traffic Goal dBA |
|----------------------------------|-----------------------|
| Daytime/Evening LAeq(15hour) | 65 |
| Night-time LAeq(9hour) | 60 |
| Maximum Pass-by L _{max} | 85 |

3 Operational Noise Monitoring Methodology

3.1 NMP Monitoring Requirements

Noise monitoring will occur for a day, evening and night period. The day, evening and night periods being those defined in the NSW *Industrial Noise Policy* (EPA 2000).

- The operator will quantify and characterise the maximum (L_{Amax}) and the intrusive (L_{Aeq} and L_{Ceq}) noise level contributions from SMC operations over a 15 minute measurement period. In addition, the operator will quantify and characterise the overall levels of ambient noise (i.e. L_{Amax} , LA_1 , LA_{10} , LA_{50} , LA_{90} , and L_{Aeq}) over the 15 minute measurement interval.
- Assess the noise emissions of SMC and determine compliance with respect to the limits contained in the NMP.

Relevant modifying factors are assessed by analysis of the measured SMC L_{Aeq} spectrum where applicable.

3.2 General Requirements

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics—Sound level meters*, AS IEC 60942 2017 *Electroacoustics – Sound calibrators* and carried current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dBA.

All operator-attended noise measurements were conducted using a one-third octave integrating Brüel & Kjær Type 2250L (s/n 3027586) together with a Svantek SV30A acoustical calibrator (s/n 39462).

3.3 Operator-attended Noise Monitoring Locations

Noise monitoring was conducted in accordance with the requirements of the NMP.

Operator-attended noise measurements were conducted during the day, evening and night-time period for a minimum of 15 minutes per period at each of the eight noise monitoring locations. An additional noise monitoring location has been adopted:

- Wadland - has been implemented to enable a robust acoustic relationship between the Clarke and Wadland monitoring locations and the Bagnall residence to the east.

The details of the operator-attended SMC operational noise monitoring locations are contained within **Table 3** and shown generally in **Figure 1**. During the operator-attended noise measurements, the character and relative contribution of ambient noise sources and SMC contributions were determined by observations on site.

Table 3 SMC Operational Noise Monitoring Locations

| Monitoring Location | Receiver Type | Resident / Owner | Monitoring Location - MGA Zone 56 | |
|---------------------|----------------------------------|------------------|-----------------------------------|--------------|
| | | | Easting (m) | Northing (m) |
| Atkins | Mine owned Residence | SCPL | 401544 | 6447134 |
| Clarke | Mine owned Residence | SCPL | 404406 | 6445783 |
| Wadland | Intermediate Monitoring Location | SCPL | 404739 | 6445272 |
| Hall | Residence | Hall | 398269 | 6443709 |
| Lowrey | Residence | Lowrey | 399193 | 6445879 |
| Pryce Jones | Residence | Pryce Jones | 400807 | 6441846 |
| Van der Drift | Residence | SCPL | 400171 | 6445775 |
| Greenwood | Residence | Greenwood | 402617 | 6440457 |

3.4 Extrapolation Methodology for Intermediate Monitoring Locations

The NPfl provides the most contemporary advice on compliance assessment techniques for industrial noise assessment. The NPfl provides a direct commentary on the use of 'alternative or intermediate' locations to determine compliance as follows:

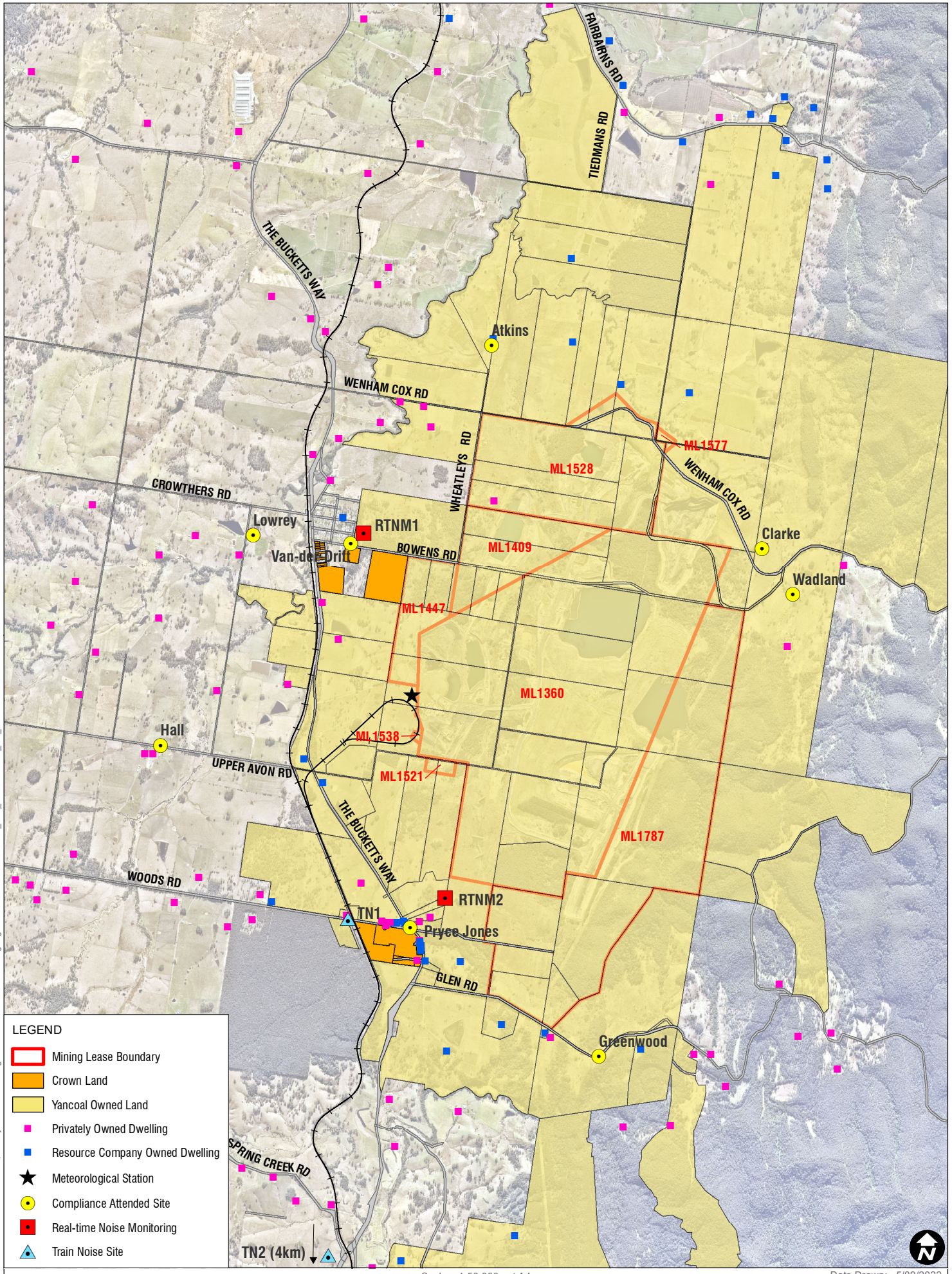
Direct measurement at alternative or intermediate location/s

Where direct measurement of noise at a compliance location is not practical because of poor signal-to-noise ratios (that is, extraneous noise is louder than the noise under investigation), or where access to the location has been denied or is unavailable, measurements at intermediate locations between the source and the receiver location, where signal-to-noise ratios are higher, may be a viable option. For this approach to be effective there needs to be well-established theoretical and/or empirical relationships between the intermediate location and the receiver location in terms of noise exposure. Noise modelling may be one option to establish this relationship. The techniques under the above section 'Direct measurement at a receiver location' would also be relevant in terms of quantifying the level of noise from the source at the intermediate location(s). Where this technique is relied upon, it is the responsibility of the proponent to demonstrate a robust acoustic relationship between the compliance location and the intermediate location.

Where this technique is relied upon, it is the responsibility of the proponent to demonstrate a robust acoustic relationship between the compliance location and the intermediate location.

As such an ENM noise model of typical site operations is used to predict noise levels at the Bagnall residence for all monitoring periods. The noise model is calibrated using the operator attended noise monitoring results (where available) and weather conditions at the time of the Clarke and Wadland noise monitoring.

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LEGEND

- Mining Lease Boundary
- Crown Land
- Yancoal Owned Land
- Privately Owned Dwelling
- Resource Company Owned Dwelling
- ★ Meteorological Station
- Compliance Attended Site
- Real-time Noise Monitoring
- ▲ Train Noise Site

0 1 2 km

Scale: 1:50,000 at A4
Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 5/09/2022
Project Number: 630.11771



Noise Monitoring Locations

FIGURE 1

3.5 Compliance Assessment Protocol

In accordance with the NMP the results of noise monitoring at the compliance attended monitoring sites will be compared against the relevant noise criteria. The comparison will be undertaken following the exclusion of data where meteorological conditions are outside those provided in Appendix 6 of SSD-4966 and extraneous noise sources.

If SMC related noise contributions exceed the noise criteria under applicable meteorological conditions, then in accordance with the NMP:

- The exceedance will be reported to DP&E and EPA in accordance with Section 10 of the NMP;
- A second reading will be undertaken at the location within 75 minutes; and
- The exceedance will be reported in the Monthly Environmental Monitoring Report and Annual Review.

If the second reading is also confirmed to exceed the relevant criteria, then:

- The sustained exceedance will be deemed to be a noise incident;
- The noise incident will be reported to DP&E and EPA as a non-compliance in accordance with Section 10 of the NMP;
- Follow up monitoring will be conducted at the location within one week of the recorded non-compliance; and
- The non-compliance and the outcome of the follow-up monitoring will be reported in the Monthly Environmental Monitoring Report and Annual Review.

A confirmed noise incident (i.e. sustained exceedance and non-compliance) as determined by attended noise monitoring will be deemed to be a breach of the noise criteria.

4 Results

4.1 Operator-attended Noise Monitoring – SMC Operational Activity

Operator-attended noise measurements were conducted across Tuesday 15 November and Wednesday 16 November 2022. Results of the operator-attended noise surveys at residential locations are provided in **Sections 4.1.1 to 4.1.7**.

A summary of the results for the attended noise monitoring are displayed graphically in **Appendix B** showing L_{Amax} , L_{Aeq} , and $L_{Aeq(<1.25kHz)}$ in 1-second intervals throughout the monitoring survey.

Ambient noise levels presented include all noise sources such as transport (roads, rail and aircraft), fauna (insects, frogs, birds, and bats), farm animals (cows, bulls), the natural environment (wind, wind in trees), domestic noises, other industrial operations as well as SMC noise emissions.

Weather data during the monitoring period has been obtained from the weather station located on the SMC site.

The tables provide the following information:

- Date and start time, operator and equipment details.
- Monitoring location.
- Wind velocity (m/s) and temperature (°C) at the measurement location.
- Typical maximum (L_{Amax}) and contributed $L_{Aeq(15minute)}$ noise levels.

4.1.1 Operator-attended Noise Survey Results – ‘Atkins’

Results of the operator-attended noise surveys at ‘Atkins’ are provided in **Table 4**. Monitoring location ‘Atkins’ represents residential receptors located to the north of the site.

Table 4 Operator-attended Noise Survey Results - ‘Atkins’

| Period | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|--|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day | 15/11/2022 14:05 25°C 2.4 m/s SW | 69 | 52 | 49 | 35 | 43 | 43 | No | <i>Site related noise events:</i> SMC: Audible Haul trucks 33-41 L_{Aeq}(15minute) contribution 35 dBA <i>Other noise events:</i> Tractor 40-55 Birdsong 38-54 Rain drops 42-69 |
| Evening | 15/11/2022 20:56 16°C 0.9 m/s WNW | 47 | 42 | 40 | 34 | 37 | 23 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Distant road traffic 26-28 Birds 38-41 Insects/frogs 33-40 Operator 47 |
| Night | 15/11/2022 22:45 14°C 0.9 m/s SSW | 52 | 47 | 44 | 37 | 42 | 40 | No | <i>Site related noise events:</i> SMC: Audible General pit operations 33-50 L_{Aeq}(15minute) contribution 38 dBA L_{Amax} contribution 50 dBA <i>Other noise events:</i> Frogs/insects 38-39 Bird 48-52 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were audible during the day, inaudible during the evening and audible during the night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) noise contribution of 35 dBA during the day and 38 dBA during the night-time period. During the night-time period SMC operations generated L_{Amax} noise levels of up to 50 dBA.

Night-time L_{Aeq}(15minute) noise contribution levels were predicted using an ENM model to the privately owned residences further to the north/north west of the Atkins noise monitoring location. The predicted night-time L_{Aeq}(15minute) and L_{A1}(1minute) noise contribution levels at representative privately owned residences are provided in **Table 5**.

Table 5 Predicted noise contribution levels at the Receivers to the North of ‘Atkins’ Monitoring Location

| Receiver Location | LAeq(15minute) Noise Contribution (dBA) | LA1(1minute) Noise Contribution (dBA) | Propagation Attenuation – Monitoring Location to Receiver (dB) |
|---------------------------------------|---|---------------------------------------|--|
| Measured Noise Level | | | |
| Atkins Measurement Location | 38 | 50 | N/A |
| Predicted Noise Levels | | | |
| 9 (1) – Williams ¹ | 31 | 43 | 7.1 |
| 9 (2) – Williams ¹ | 30 | 42 | 7.5 |
| 10 – Whatmore & Whatmore ¹ | 30 | 42 | 8.3 |
| 11 - Walker ¹ | 30 | 42 | 7.8 |
| 5 (1) – Bagnall ¹ | 28 | 40 | 9.8 |
| 5 (2) – Bagnall ¹ | 28 | 40 | 10.3 |
| Meteorological Conditions | | | |
| Temp 13.9°C | | | |
| Humidity 93.6% | | | |
| Wind Speed 0.9 m/s | | | |
| Wind Direction 209° | | | |
| Lapse Rate 2.8°C/100m | | | |

Note 1: Refer Stratford Extension Project EIS for receiver locations

At the representative privately owned receivers further north/north west of the Atkins noise monitoring location LAeq(15minute) and LA1(1minute) night-time noise contribution levels are predicted to be up to 31 dBA and 43 dBA, respectively. As such SMC operations are considered to be compliant at all receivers located to the north/north west of the Atkins noise monitoring location.

4.1.2 Operator-attended Noise Survey Results - 'Clarke' and 'Wadland'

Results of the operator-attended noise surveys at 'Clarke' and Wadland are provided **Table 6**. These monitoring locations represent residential receptors located to the east of the site and are SMC owned properties. The monitoring results at Clarke and Wadland, under appropriate meteorological conditions, are used to determine SMC contributions at the 'Bagnall' residence located further to the east.

Table 6 Operator-attended Noise Survey Results - 'Clarke' and 'Wadland'

| Period | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|-------------------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|---------------------------------|---|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day – Clarke | 15/11/2022 14:32 25°C 2.1 m/s NNE | 56 | 42 | 35 | 38 | 33 | 30 | N/A | <i>Site related noise events:</i> SMC: Briefly Audible General pit operations 25-29 L_{Aeq}(15minute) contribution <25 dBA <i>Other noise events:</i> Birdsong 36-41 Aeroplane 38-49 Exhaust click 56 |
| Day - Wadland | 15/11/2022 14:50 24°C 1.6 m/s NE | 62 | 43 | 36 | 30 | 36 | 30 | N/A | <i>Site related noise events:</i> SMC Inaudible <i>Other noise events:</i> Birdsong 36-62 Aeroplane 31-40 Rain drops 53 |
| Evening – Clarke | 15/11/2022 21:41 15°C 0.9 m/s NW | 51 | 47 | 44 | 39 | 42 | 39 | No | <i>Site related noise events:</i> SMC: Audible General pit operations 39-51 L_{Aeq}(15minute) contribution 39 dBA <i>Other noise events:</i> Frogs/insects 45-51 |
| Evening - Wadland | 15/11/2022 21:20 16°C 0.9 m/s W | 52 | 50 | 49 | 45 | 47 | 26 | N/A | <i>Site related noise events:</i> SMC: Audible General pit operations 24-29 L_{Aeq}(15minute) contribution 25 dBA <i>Other noise events:</i> Frogs/insects 45-51 Resident 26-33 Aeroplane 27-32 |

| Period | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|-----------------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|--|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (<1.25kHz) | | |
| Night - Clarke | 15/11/2022 22:00 16°C 0.7 m/s NE | 58 | 51 | 47 | 39 | 44 | 42 | No | <i>Site related noise events:</i> SMC: Audible General pit operations 39-58 L_{Aeq}(15minute) contribution 42 dBA L_{A1}(1minute) contribution 56 dBA L_{Amax} contribution 58 dBA <i>Other noise events:</i> Insects/frogs 39-49 |
| Night - Wadland | 15/11/2022 22:21 14°C 1.3 m/s WSW Lapse Rate - 3.2°C/100m | 55 | 53 | 52 | 49 | 51 | 31 | N/A | <i>Site related noise events:</i> SMC: Audible General pit operations 27-39 L_{Aeq}(15minute) contribution 31 dBA L_{Amax} contribution 39 dBA <i>Other noise events:</i> Frogs/insects 50-55 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

At Clarke SMC operations were briefly audible during the day and audible during the evening and night-time periods of the operator attended noise surveys. SMC operations generated an L_{Aeq}(15minute) noise contribution of <25 dBA during the day, 39 dBA during the evening and 42 dBA during the night-time. During the night-time period SMC operations generated L_{A1}(1minute) noise levels of up to 56 dBA at Clarke.

At Wadland SMC operations were inaudible during the day and audible during the evening and night-time periods of the operator attended noise surveys. SMC operations generated an L_{Aeq}(15minute) noise contribution 25 dBA during the evening and 31 dBA during the night-time. During the night-time period SMC operations generated L_{Amax} noise levels of up to 39 dBA at Wadland.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion in excess of 3°C/100m during the night-time period of the operator attended measurement at Wadland. As such, the night-time criteria is not applicable for Wadland during the attended noise survey. Notwithstanding, noise modelling has been conducted to the Bagnall residence using an ENM model for all monitoring periods. The results of the noise modelling is provided **Table 7**.

Table 7 Predicted Noise Levels - Bagnall

| Period and Location | Meteorological Parameters | Noise Level at Monitoring Location | Predicted Noise Level at Bagnal | Propagation Attenuation – Monitoring Location to Bagnal (dB) |
|---------------------|---|------------------------------------|---------------------------------|--|
| Day – Clarke | Temp 25°C Humidity 42.8% Wind Speed 2.1 m/s Wind Direction 25.8° Lapse Rate -0.8°C/100m | <25 dBA | <11 dBA | 14.3 dBA |
| Evening – Clarke | Temp 15°C Humidity 92.5% Wind Speed 0.7 m/s Wind Direction 47.3° Lapse Rate 1.7°C/100m | 39 dBA | 26 dBA | 12.8 dB |
| Evening – Wadland | Temp 16°C Humidity 90.3% Wind Speed 0.9 m/s Wind Direction 273.7° Lapse Rate 0.5°C/100m | 25 dBA | 23 dBA | 2.2 dB |
| Night – Clarke | Temp 15°C Humidity 92.5% Wind Speed 0.7 m/s Wind Direction 47.3° Lapse Rate 1.9°C/100m | 42 dBA | 30 dBA | 12.4 dB |
| | | 56 dBA | 44 dBA | |
| Night - Wadland | Temp 15°C Humidity 92.6% Wind Speed 1.3 m/s Wind Direction 239.9° Lapse Rate 3.2°C/100m | 31 dBA | 29 dBA | 2.2 dB |
| | | 39 dBA | 37 dBA | |

LAeq(15minute) noise levels are predicted to be up to 30 dBA over the monitoring period. The night-time LA1(1minute) noise level is predicted to be up to 44 dBA.

4.1.3 Operator-attended Noise Survey Results - 'Hall'

Results of the operator-attended noise surveys at 'Hall' are provided in **Table 8**. Monitoring location 'Hall' represents residential receptors located to the southwest of the site.

Table 8 Operator-attended Noise Survey Results - 'Hall'

| Hall | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|---|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (<1.25kHz) | | |
| Day | 15/11/2022 12:54 24°C 2.8 m/s SSW | 72 | 57 | 42 | 30 | 45 | 46 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 36-43 Birdsong 32-40 Vehicle passby 37-72 Aeroplane 36-43 Horse 44-57 Resident 39-52 |
| Evening | 15/11/2022 18:45 19°C 1.6 m/s NNE | 63 | 47 | 44 | 36 | 41 | 39 | No | <i>Site related noise events:</i> SMC: Audible Haul trucks 25-37 L_{Aeq}(15minute) contribution 33 dBA <i>Other noise events:</i> Insects 32-35 Farming ops 28-45 Birds 63 |
| Night | 16/11/2022 00:01 14°C 2.1 m/s NE | 45 | 38 | 35 | 30 | 33 | 22 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Insects/frogs 34-40 Bird 40-45 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were inaudible during the day, audible during the evening and inaudible during the night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) noise contribution of 33 dBA during the evening period.

4.1.4 Operator-attended Noise Survey Results - 'Lowrey'

Results of the operator-attended noise surveys at 'Lowrey' are provided in **Table 9**. Monitoring location 'Lowrey' represents residential receptors located to the west of the site and west of Bucketts Way.

Table 9 Attended Noise Survey Results - 'Lowrey'

| Lowrey | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|---|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day | 15/11/2022 13:41 25°C 3.4 m/s SSW | 58 | 43 | 38 | 32 | 36 | 33 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 33-42 Road work 41 Birdsong 32-46 Roof creaking 58 |
| Evening | 15/11/2022 19:30 17°C 2.8 m/s NE | 71 | 54 | 47 | 38 | 45 | 37 | N/A | <i>Site related noise events:</i> SMC: Audible General pit operations 26-35 L_{Aeq}(15minute) contribution 30 dBA <i>Other noise events:</i> Road traffic 44-47 Insects/frogs 37-57 Aeroplane 41-49 Birdsong 63-71 |
| Night | 15/11/2022 23:11 14°C 1.1 m/s WNW Lapse Rate 6.5°C/100m | 64 | 61 | 60 | 53 | 57 | 34 | N/A | <i>Site related noise events:</i> SMC: Audible Engine noise 25-37 Intermittent clunks 35-42 L_{Aeq}(15minute) contribution 32 dBA L_{Amax} contribution 42 dBA <i>Other noise events:</i> Frogs 57-62 Road traffic 30-42 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were inaudible during the day and inaudible during the evening and night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) noise contribution of 30 dBA during the evening and 32 dBA during the night-time. During the night-time, SMC operations generated an L_{Amax} noise level of up to 42 dBA.

Meteorological data from the onsite SMC automatic weather stations showed temperature inversions in excess of 3°C/100m during the night-time period of the operator attended measurements at this location. As such, the night-time criteria are not applicable for Lowrey during the attended noise survey.

4.1.5 Operator-attended Noise Survey Results - 'Pryce-Jones'

Results of the operator-attended noise surveys at 'Pryce Jones' are provided in **Table 10**. Monitoring location 'Pryce Jones' represents residential receptors located in Craven to the south of the site.

Table 10 Attended Noise Survey Results – 'Pryce Jones'

| Pryce-Jones | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|-------------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|--|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day | 15/11/2022 12:28 24°C 2.8 m/s SSW | 76 | 65 | 56 | 37 | 54 | 52 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 49-75 Wind in trees 34-40 Birdsong 36-56 |
| Evening | 15/11/2022 18:24 20°C 1.6 m/s NE | 71 | 64 | 58 | 33 | 53 | 52 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 40-71 Birdsong 33-45 Insects 32-39 |
| Night | 16/11/2022 00:24 14°C 2.1 m/s NE | 40 | 38 | 37 | 34 | 35 | 26 | N/A | <i>Site related noise events:</i> SMC: Audible General pit operations 24-33 L_{Aeq}(15minute) contribution 26 dBA L_{Amax} contribution 33 dBA <i>Other noise events:</i> Insects/frogs 35-40 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were inaudible during the daytime and evening and audible during the night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) noise contribution of 26 dBA during the night-time with an L_{Amax} noise levels of up to 33 dBA.

4.1.6 Operator-attended Noise Survey Results – ‘Van der Drift’

Results of the operator-attended noise surveys at ‘Van der Drift’ are provided in **Table 11**.

Table 11 Attended Noise Survey Results – ‘Van der Drift’

| Van der Drift | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---------------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|---|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day | 15/11/2022 13:19 25°C 3.1 m/s SSW | 67 | 54 | 44 | 34 | 44 | 42 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 30-34 Birdsong 38-56 Aeroplane 32-34 Vehicle passby 45-67 Road work 30-39 |
| Evening | 15/11/2022 19:08 18°C 3.4 m/s NE | 61 | 47 | 41 | 33 | 39 | 37 | N/A | <i>Site related noise events:</i> SMC: Audible General pit operations 27-39 L_{Aeq}(15minute) contribution 32 dBA <i>Other noise events:</i> Road traffic 26-41 Dogs barking 41-47 Birdsong 32-53 Train passby 40-50 Residential noise 39-43 |
| Night | 15/11/2022 23:35 14°C 0.9 m/s NNE | 44 | 41 | 39 | 37 | 38 | 31 | No | <i>Site related noise events:</i> SMC: Audible General pit operations 25-33 L_{Aeq}(15minute) contribution 29 dBA L_{Amax} contribution 33 dBA <i>Other noise events:</i> Frogs 38-41 Bats 37-43 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were inaudible during the day and audible during the evening night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) noise contribution of 32 dBA during the evening and 29 dBA during the night-time. SMC operations generated an L_{Aeq}(15minute) noise contribution of 26 dBA during the night-time with an L_{Amax} noise levels of up to 33 dBA.

4.1.7 Operator-attended Noise Survey Results – ‘Greenwood’

Results of the operator-attended noise surveys at ‘Greenwood’ are provided in **Table 12**.

Table 12 Attended Noise Survey Results – ‘Greenwood’

| Greenwood | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Modifying Factors Applicable | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|-----------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|------------------------------|--|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | | |
| Day | 15/11/2022 12:28 24°C 2.8 m/s SSW | 74 | 56 | 42 | 32 | 47 | 46 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Birdsong 33-47 Lawn mower 25 Wind in trees 35-44 Vehicle passby 36-74 Distant road traffic 29-34 |
| Evening | 15/11/2022 18:02 21°C 1.5 m/s NNE | 46 | 43 | 38 | 29 | 35 | 29 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Birdsong 33-43 Distant road traffic 26-30 Aeroplane 28-41 |
| Night | 15/11/2022 00:49 14°C 0.9 m/s ESE | 53 | 40 | 37 | 32 | 35 | 19 | N/A | <i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Insects/frogs 32-36 Exhaust clicks 37-53 |

Note 1: N/A = Not Applicable due to non-compliant weather conditions and/or SMC being inaudible or 5 dB or more below the noise criteria.

SMC operations were inaudible during all periods of the operator attended noise surveys at this location.

4.2 RTNM Verification Monitoring

In accordance with NMP Section 7.2.5 quarterly attended noise monitoring is conducted at the real time noise monitoring sites RTNM1 and RTNM2 to validate and calibrate real-time monitoring results over time. Results of the real-time verification noise monitoring are provided in **Table 13**.

Table 13 Verification Noise Survey Results – Real Time Noise Monitoring Locations

| Location and Period | Date/Start Time/ Weather | Primary Noise Descriptor dBA (15 minute) | | | | | | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---------------------|--|--|-----------------|------------------|------------------|------------------|-----------------------------|--|
| | | L _{Amax} | L _{A1} | L _{A10} | L _{A90} | L _{Aeq} | L _{Aeq} (≤1.25kHz) | |
| RTNM1 | 16/11/2022 10:00 18°C 4.2 m/s SSW | Operator Attended Results | | | | | | <i>Site related noise events:</i> SMC: Audible Haul trucks audible in lulls <30-33 L_{Aeq}(15minute) contribution 29 dBA <i>Other noise events:</i> Dogs barking 40-47 Road traffic 35-42 Road work 37-50 Birdsong 40-64 Aeroplane 33-41 Wind in trees 36-40 |
| | | 64 | 52 | 44 | 38 | 42 | 40 | |
| | | RTNM Results | | | | | | |
| | | - | - | - | - | 43 | 36 ¹ | |
| RTNM2 | - | Operator Attended Results | | | | | | - |
| | | - | - | - | - | - | - | |
| | | RTNM Results | | | | | | |
| | | - | - | - | - | - | - | |

Note 1: L_{Aeq} ≤630 Hz

RTNM1

Low-pass filtered noise levels (L_{Aeq}≤630 Hz (15minute)) reported from RTNM1 at the time of verification monitoring was 36 dBA. SMC operations generated an L_{Aeq}(15minute) noise contribution of 29 dBA at RTNM1 at the time of verification monitoring.

RTNM2

Due to restricted site access, attended noise survey results are unavailable for the monitoring location RTNM2. Results will be captured for the monitoring location RTNM2 when access is restored.

5 Performance Assessment

Results of the operator-attended noise measurements compared with the relevant noise criteria contained in the SMC Development Consent are given in **Table 14**.

Table 14 Performance Assessment – Operations

| Location | Estimated SMC LAeq(15minute) Noise Level dBA | | | Noise Criteria LAeq(15minute) dBA | | | Compliance | | |
|--------------------------|--|------------------|------------------|--------------------------------------|-----|-------|------------------|------------------|------------------|
| | Day | Eve | Night | Day | Eve | Night | Day | Eve | Night |
| Atkins ⁵ | 35 | I/A ¹ | 38 | 35 | 35 | 35 | Yes | Yes | Yes |
| 9 (1) Williams | - ⁶ | - ⁶ | 31 | | | | | | |
| 9 (2) - Williams | - ⁶ | - ⁶ | 30 | 35 | 35 | 35 | Yes | Yes | Yes |
| 10 – Whatmore & Whatmore | - ⁶ | - ⁶ | 30 | 35 | 35 | 35 | Yes | Yes | Yes |
| 11 – Walker | - ⁶ | - ⁶ | 30 | 35 | 35 | 35 | Yes | Yes | Yes |
| 5 (1) – Bagnall | - ⁶ | - ⁶ | 28 | 35 | 35 | 35 | Yes | Yes | Yes |
| 5 (2) – Bagnall | - ⁶ | - ⁶ | 28 | 35 | 35 | 35 | Yes | Yes | Yes |
| Clarke ^{2,5} | <25 | 39 | 42 | 37 | 37 | 37 | N/A ⁵ | N/A ⁵ | N/A ⁵ |
| Wadland ^{2,5} | I/A ¹ | 25 | 31 ⁷ | 37 | 37 | 37 | N/A ⁵ | N/A ⁵ | N/A ⁵ |
| Bagnall ³ | <11 | 26 | 30 | 37 | 37 | 37 | Yes | Yes | Yes |
| Hall | I/A ¹ | 33 | I/A ¹ | 35 | 35 | 35 | Yes | Yes | Yes |
| Lowrey | I/A ¹ | 30 | 32 ⁷ | 35 | 35 | 35 | Yes ⁸ | Yes | Yes |
| Pryce Jones | I/A ¹ | I/A ¹ | 26 | 43 | 43 | 43 | Yes | Yes | Yes |
| Van der Drift | I/A ¹ | 32 ⁷ | 29 | 37 | 36 | 35 | Yes | Yes | Yes |
| Greenwood | I/A ¹ | I/A ¹ | I/A ¹ | 35 | 35 | 35 | Yes | Yes | Yes |

Note 1: I/A = Inaudible.

Note 2: Owned by Stratford Coal Pty Ltd. Criteria adopted from Bagnall.

Note 3: Modelled result.

Note 4: Not Measurable

Note 5: Criteria adopted as a guide only.

Note 6: Not modelled. Compliance achieved at representative monitoring location therefore noise levels would comply at this receiver, or criteria not applicable due to non-compliant weather conditions.

Note 7: Criteria not applicable due to non-compliant weather conditions.

6 Sleep Disturbance

Results of the night period sleep disturbance measurements compared with the relevant noise criteria contained in the Development Consent are given in **Table 15**.

Table 15 Performance Assessment – Sleep Disturbance

| Location | SMC LA1(1minute) Contribution | Noise Criteria LA1(1minute) | Compliance |
|--------------------------|-------------------------------|-----------------------------|------------------|
| Atkins ⁴ | 50 | 45 | Yes |
| 9 (1) Williams | 43 | 45 | Yes |
| 9 (2) - Williams | 42 | 45 | Yes |
| 10 – Whatmore & Whatmore | 42 | 45 | Yes |
| 11 – Walker | 42 | 45 | Yes |
| 5 (1) – Bagnall | 40 | 45 | Yes |
| 5 (2) – Bagnall | 40 | 45 | Yes |
| Clarke ^{2,4} | 58 | 45 | N/A ⁴ |
| Wadland ^{2,4} | 39 ⁵ | 45 | N/A ⁴ |
| Bagnall ³ | | 45 | Yes |
| Hall | I/A ¹ | 45 | Yes |
| Lowrey | 42 ⁵ | 45 | Yes |
| Pryce Jones | 33 | 45 | Yes |
| Van der Drift | 33 | 45 | Yes |
| Greenwood | I/A ¹ | 45 | Yes |

Note 1: I/A = Inaudible.

Note 2: Owned by Stratford Coal Pty Ltd. Criteria adopted from Bagnall.

Note 3: Modelled result.

Note 4: Criteria adopted as a guide only.

Note 5: Criteria not applicable due to non-compliant weather conditions.

7 Conclusion

SLR was engaged by Stratford Coal Pty Limited to conduct monthly noise monitoring for the Stratford Mining Complex (SMC) operations guided by the requirements of the *Stratford Mining Complex Noise Management Plan* (NMP), Document No. NMP-R03-A, dated 17 June 2019.

Operator-attended noise monitoring was conducted at eight residential receiver locations. Monitoring was conducted between Tuesday 15 November and Wednesday 16 November 2022 in order to determine the noise performance of the SMC operations against the Development Consent conditions.

Based on the measured SMC noise contribution, compliance with the relevant operational noise criteria was achieved at all noise monitoring locations during the day, evening and night monitoring periods under applicable weather conditions.

Based on the measured SMC noise contribution, compliance with the relevant sleep disturbance noise criteria was achieved at all privately owned noise monitoring locations during the night-time noise monitoring period under applicable weather conditions.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. ‘A’ Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source | Subjective Evaluation |
|----------------------------|--|-----------------------|
| 130 | Threshold of pain | Intolerable |
| 120 | Heavy rock concert | Extremely noisy |
| 110 | Grinding on steel | |
| 100 | Loud car horn at 3 m | Very noisy |
| 90 | Construction site with pneumatic hammering | Loud |
| 80 | Kerbside of busy street | |
| 70 | Loud radio or television | |
| 60 | Department store | Moderate to quiet |
| 50 | General Office | |
| 40 | Inside private office | Quiet to very quiet |
| 30 | Inside bedroom | |
| 20 | Recording studio | Almost silent |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

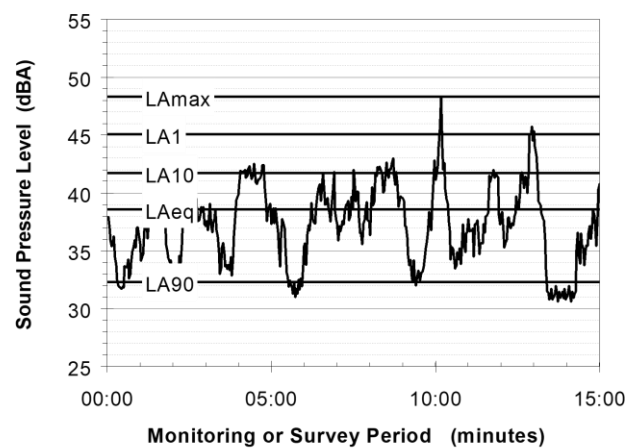
3. Sound Power Level

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

- LA1 The noise level exceeded for 1% of the 15 minute interval.
- LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
- LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
- LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

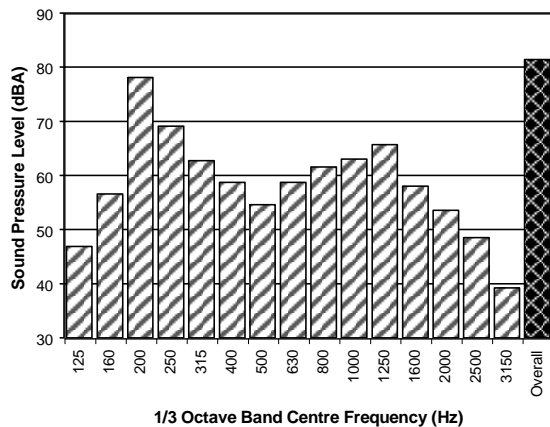
The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

APPENDIX B

Operator Attended Noise Survey Charts

Figure B1 – Day Period – ‘Atkins’ Operator Attended Noise Survey Results

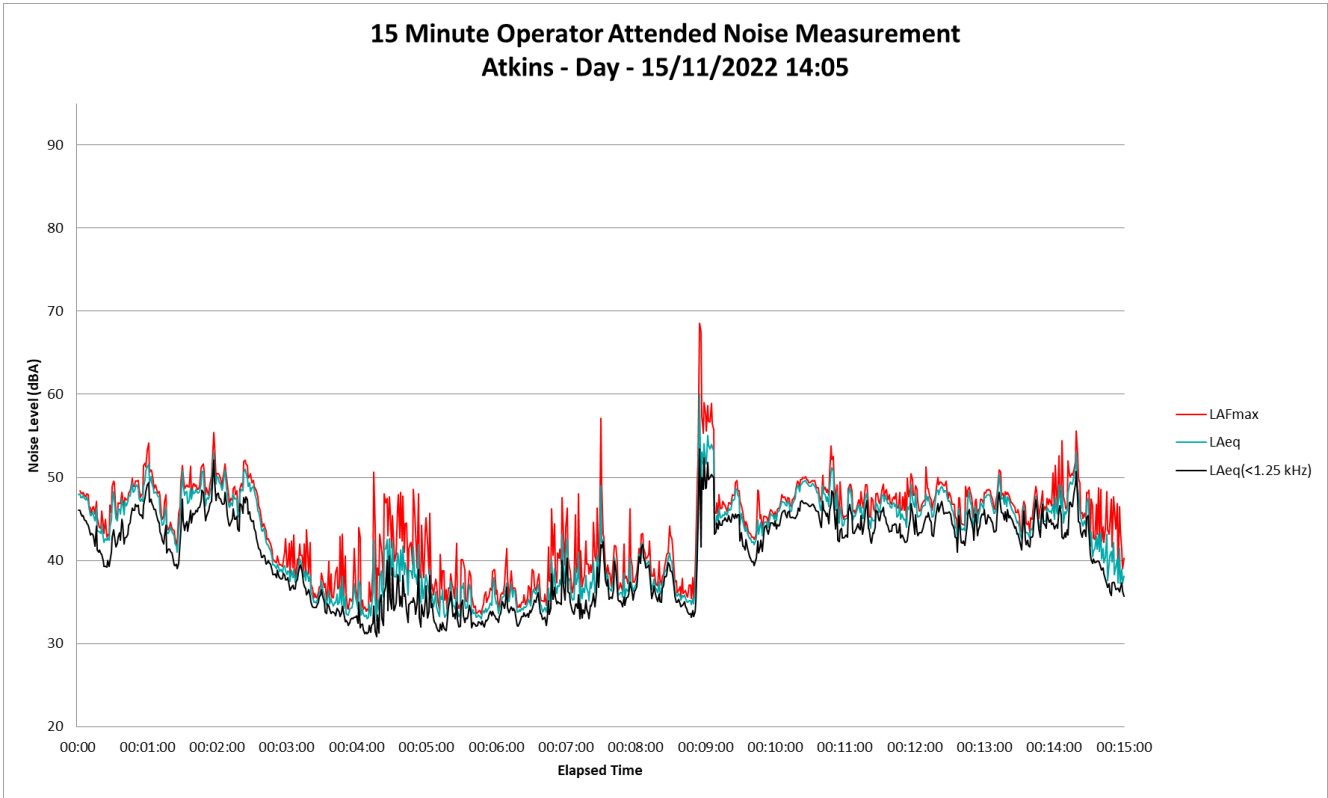


Figure B2 – Evening Period – ‘Atkins’ Operator Attended Noise Survey Results

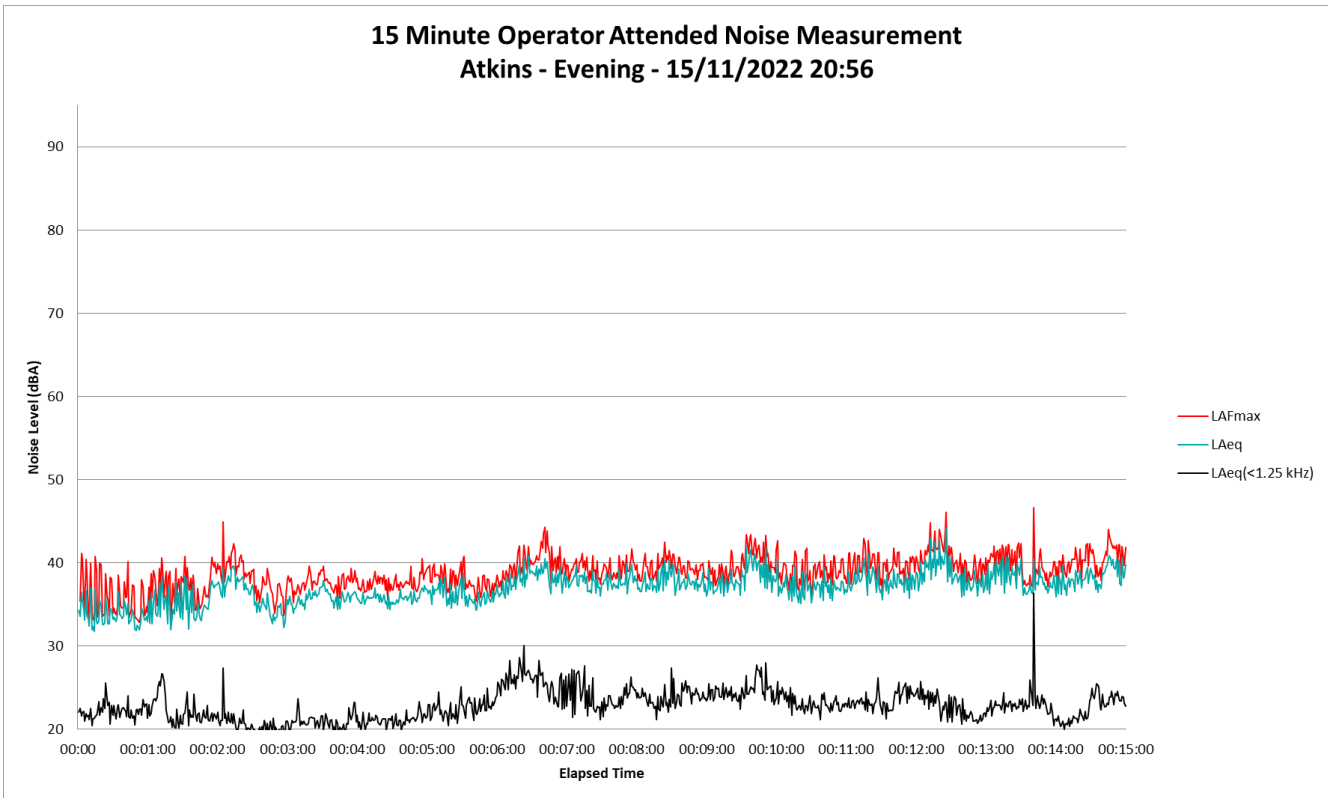


Figure B3 – Night Period – ‘Atkins’ Operator Attended Noise Survey Results

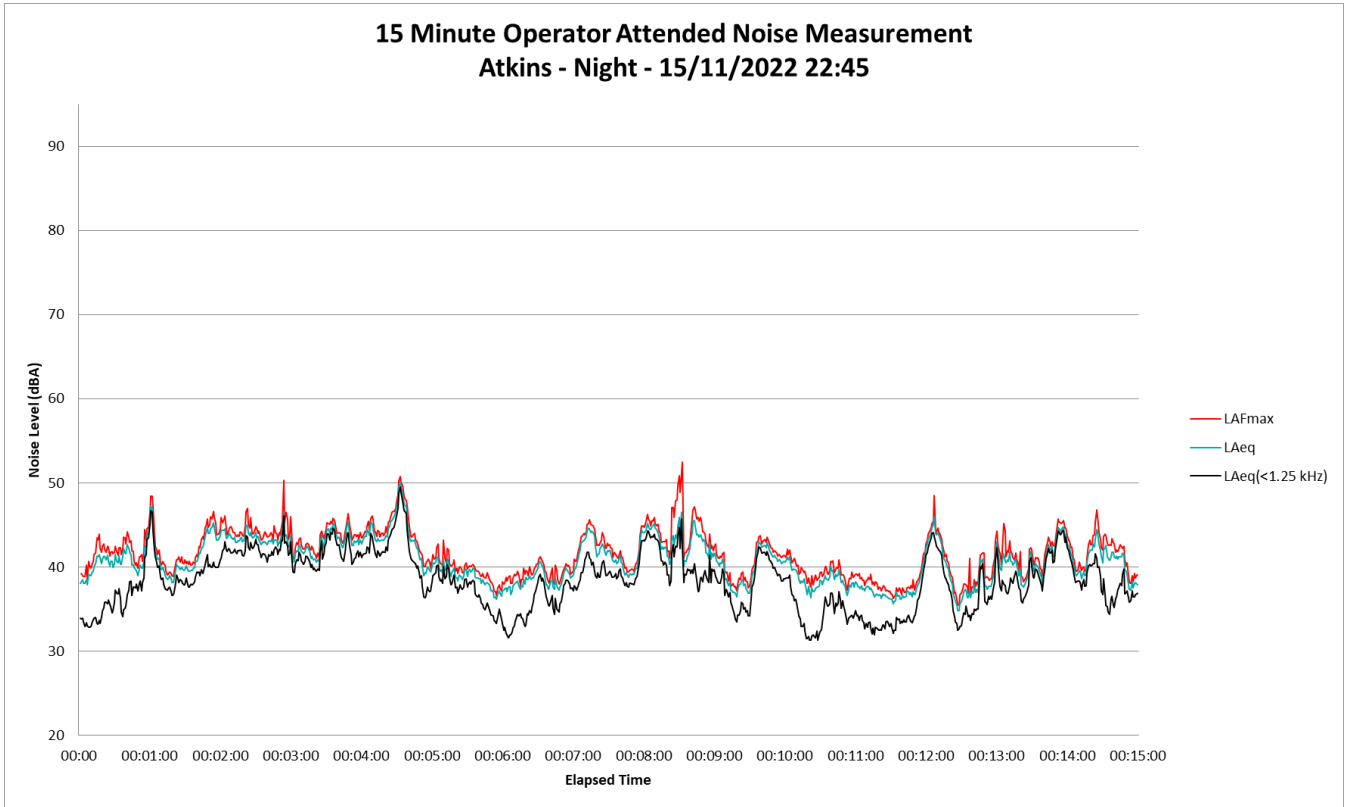


Figure B4 – Day Period – ‘Clarke’ Operator Attended Noise Survey Results

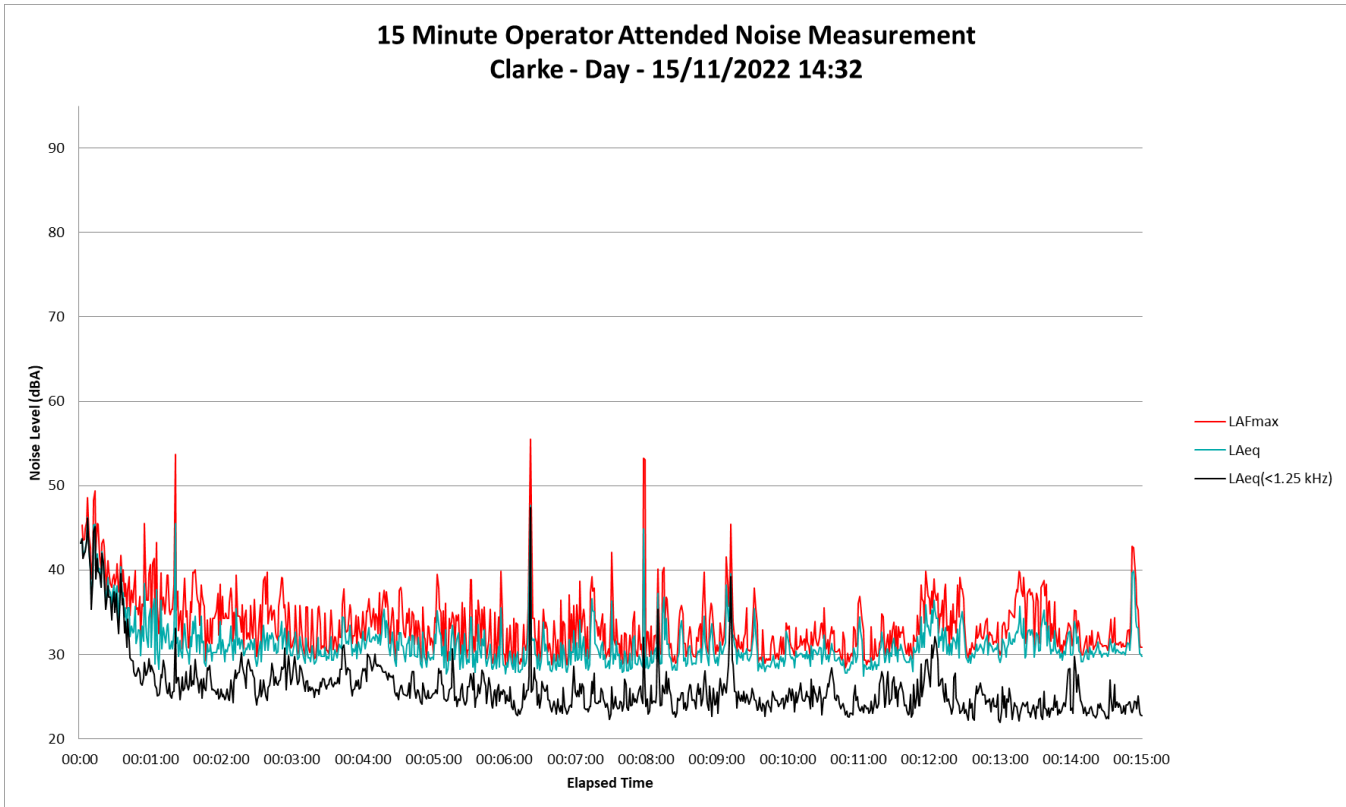


Figure B5 – Evening Period – ‘Clarke’ Operator Attended Noise Survey Results

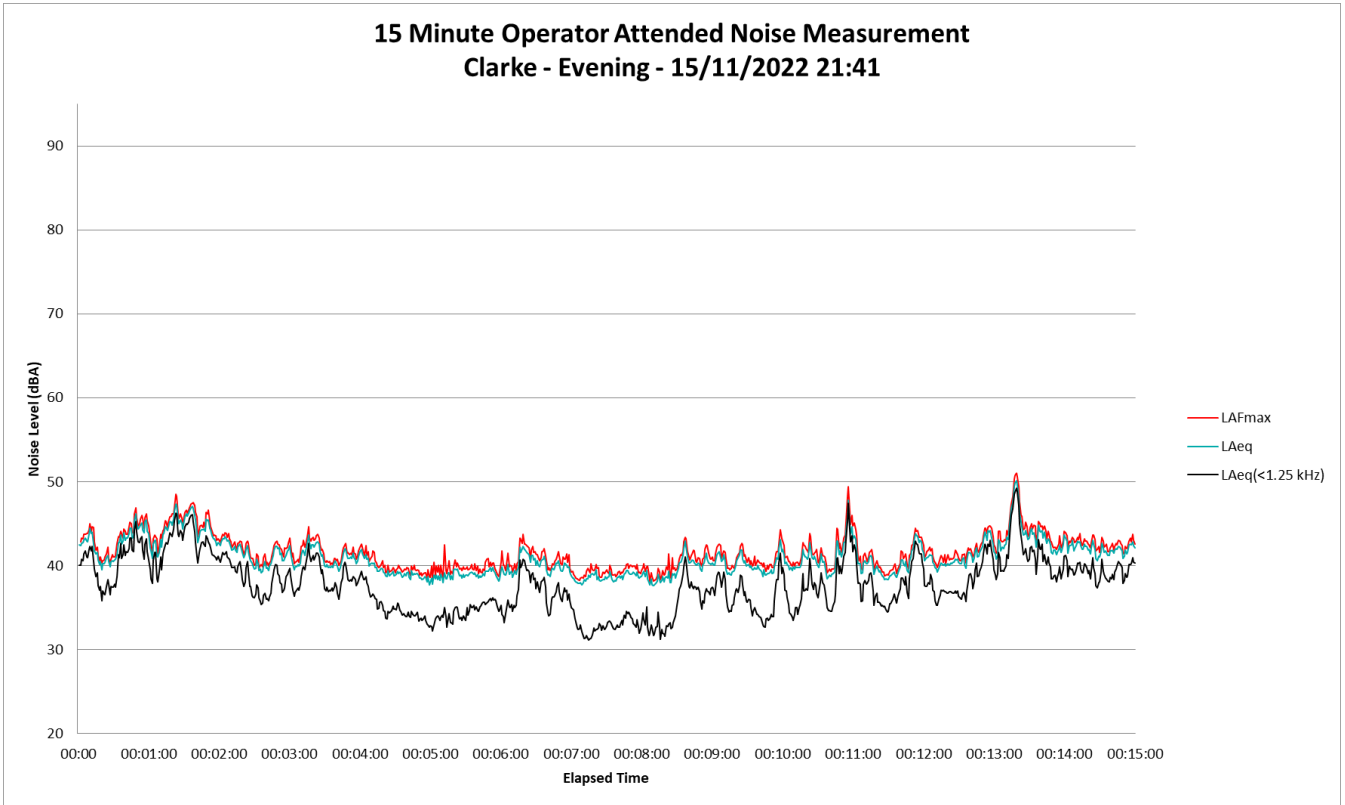


Figure B6 – Night Period – ‘Clarke’ Operator Attended Noise Survey Results

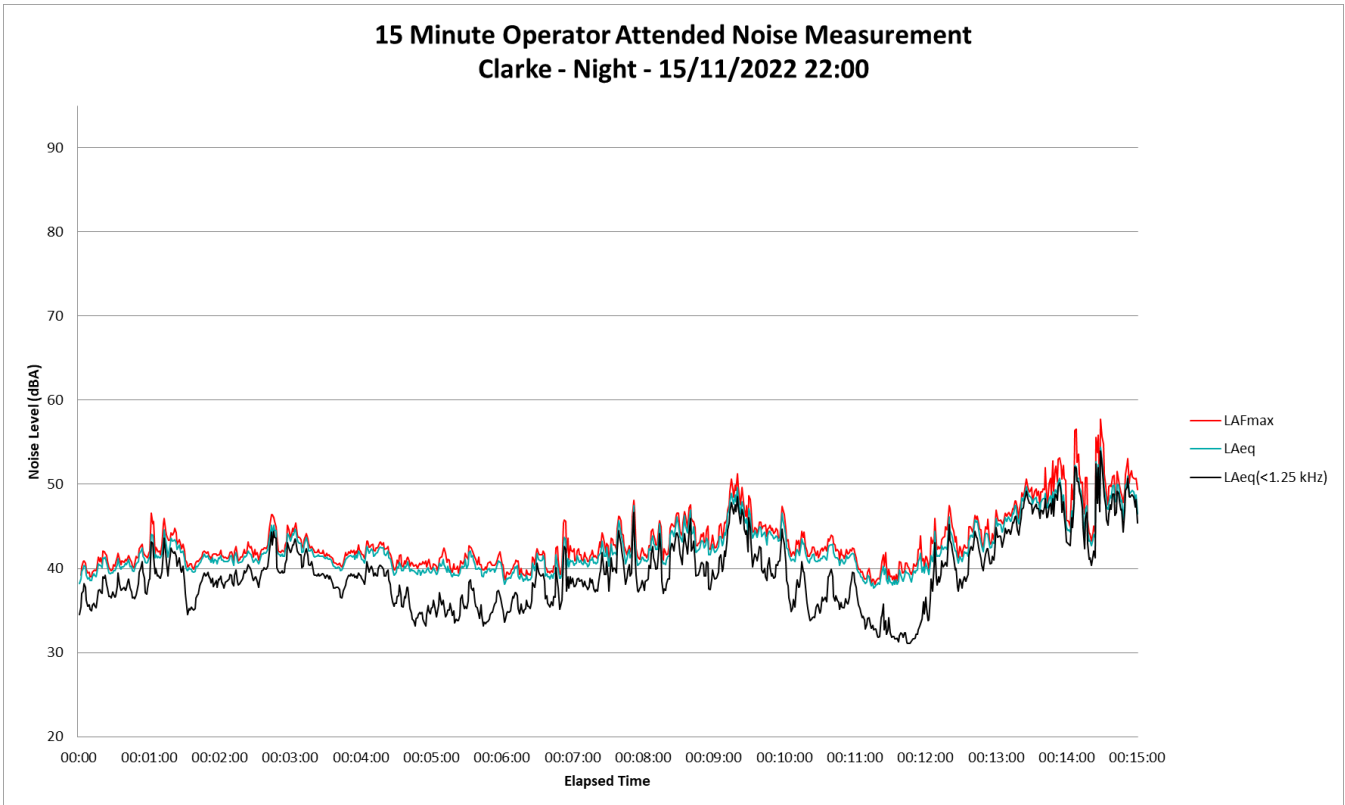


Figure B7 – Day Period – ‘Hall’ Operator Attended Noise Survey Results

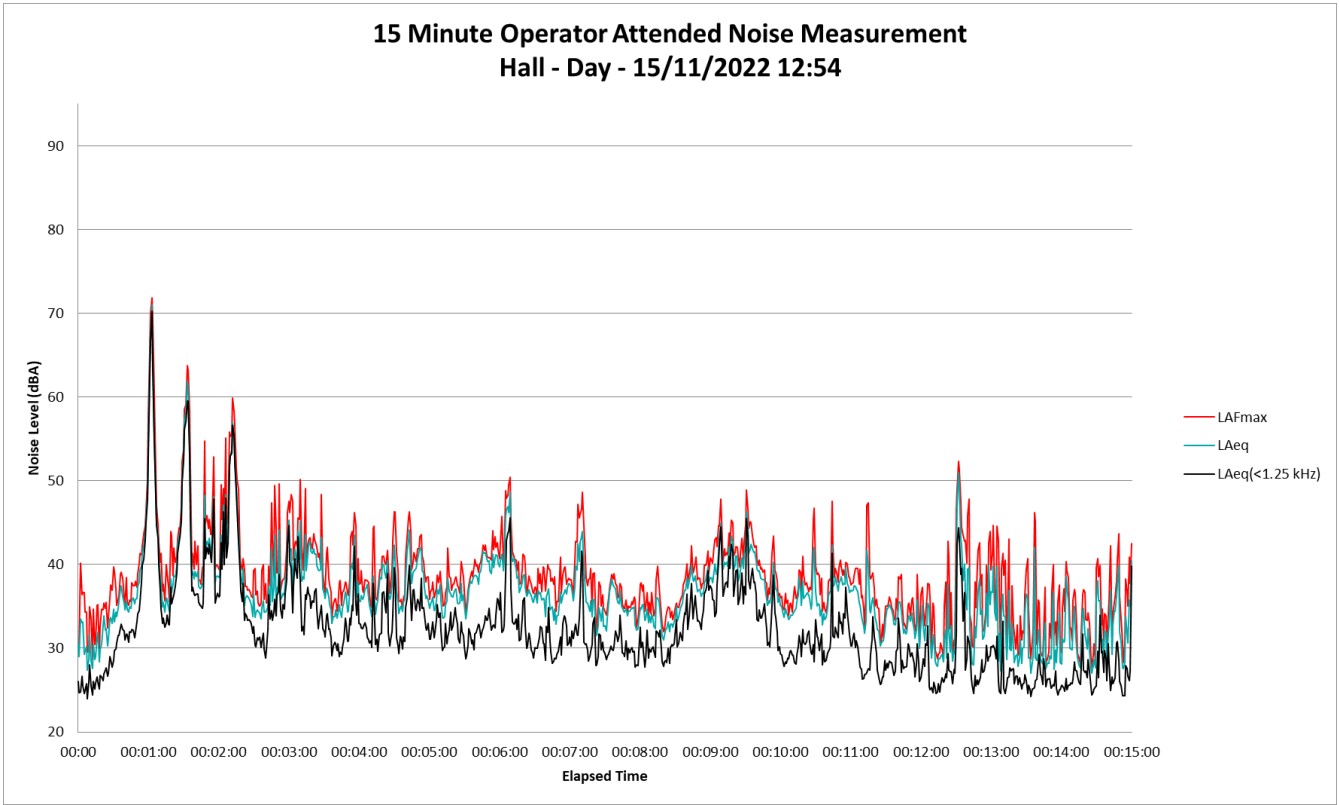


Figure B8 – Evening Period – ‘Hall’ Operator Attended Noise Survey Results

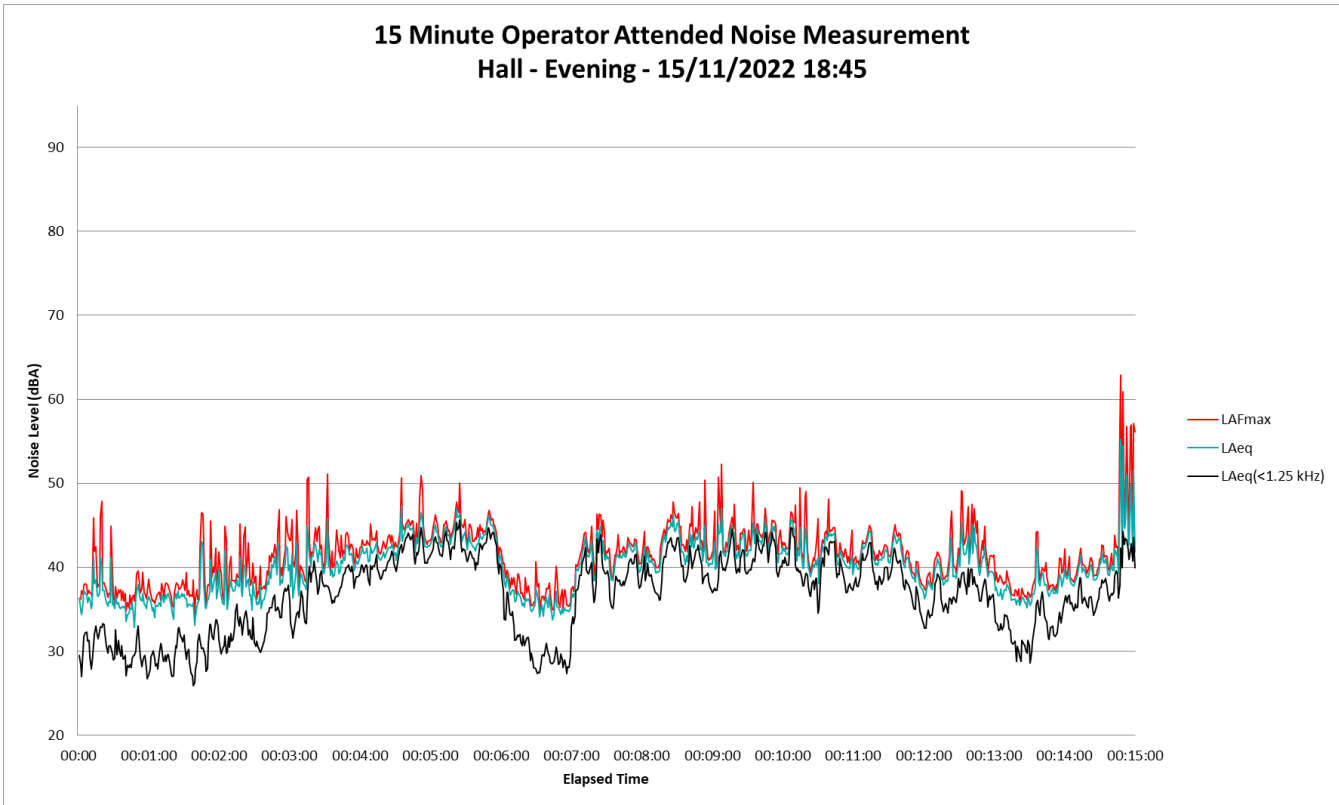


Figure B9 – Night Period – ‘Hall’ Operator Attended Noise Survey Results

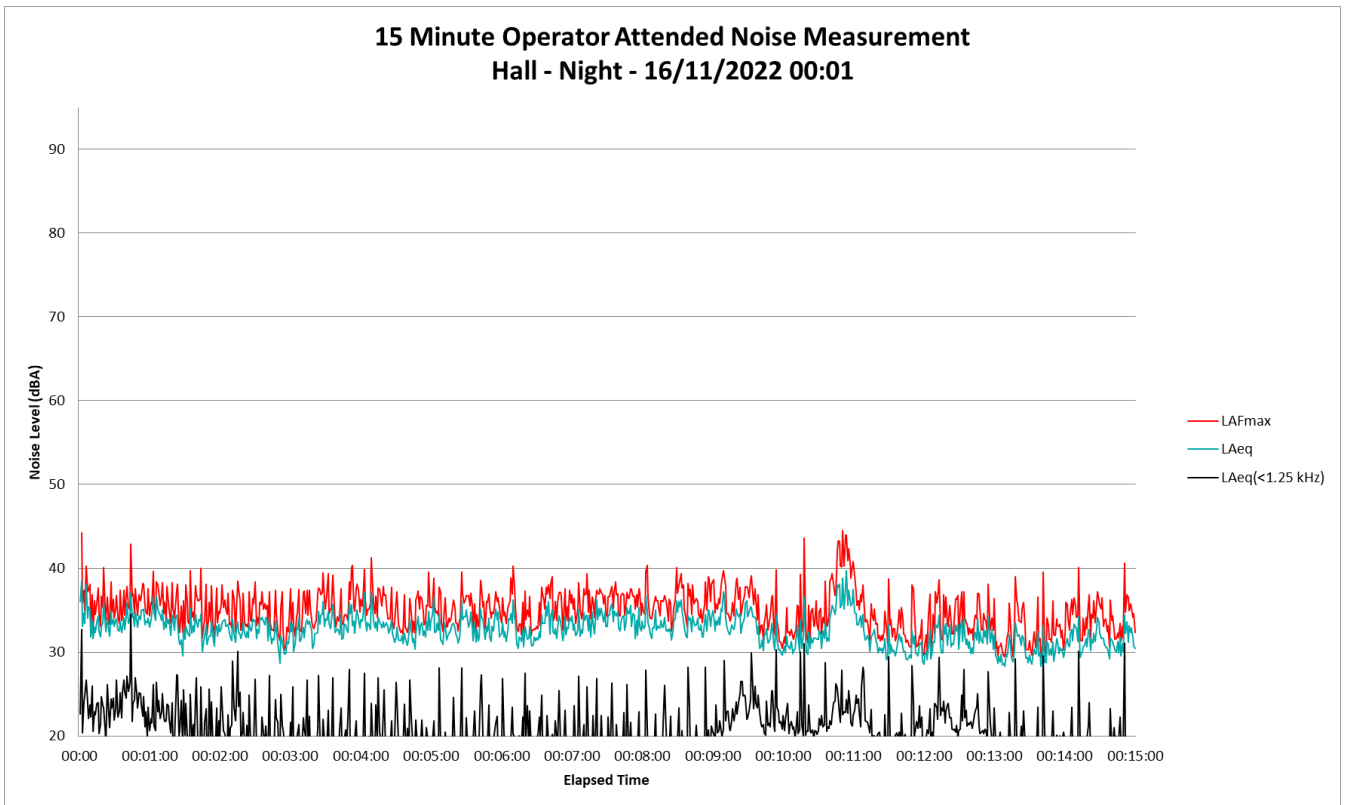


Figure B10 – Day Period – ‘Lowrey’ Operator Attended Noise Survey Results

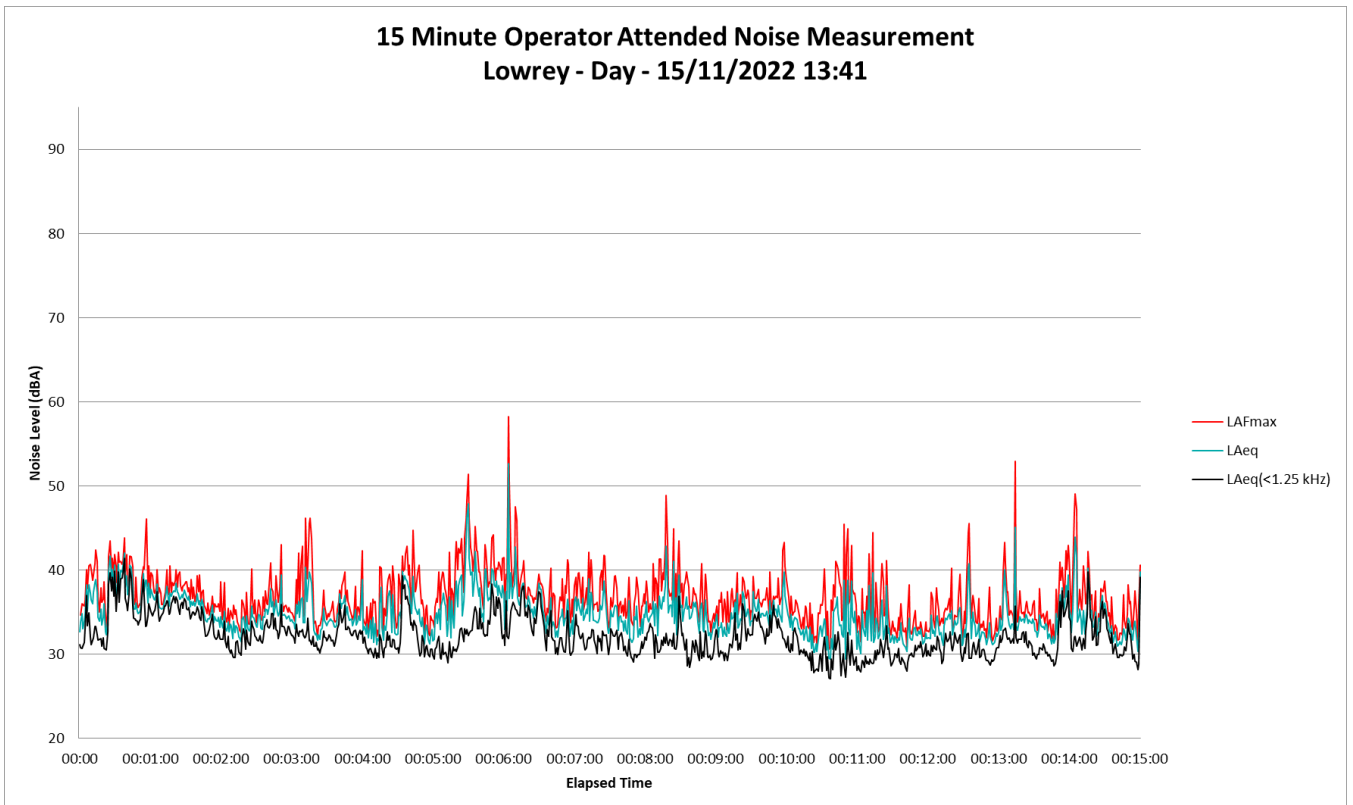


Figure B11 – Evening Period – ‘Lowrey’ Operator Attended Noise Survey Results

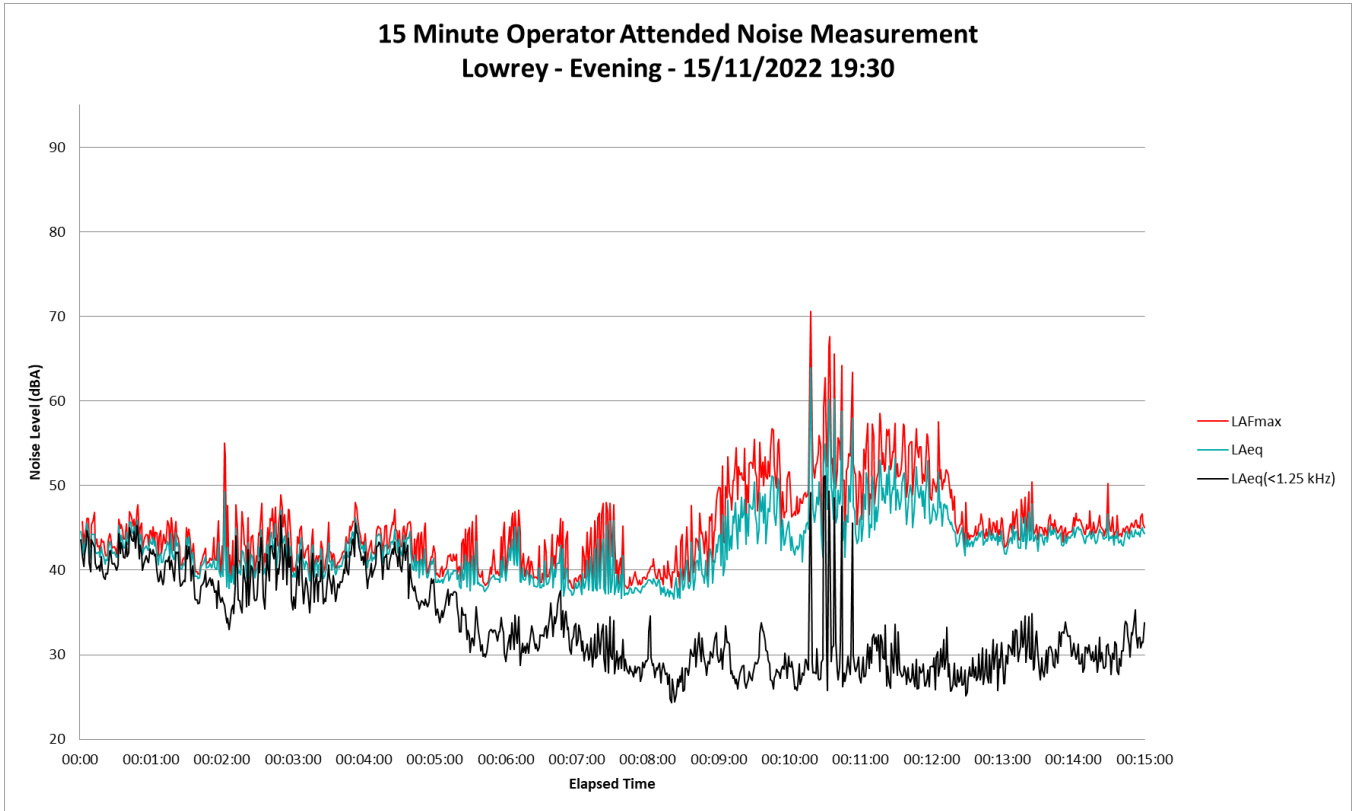


Figure B12 – Night Period – ‘Lowrey’ Operator Attended Noise Survey Results

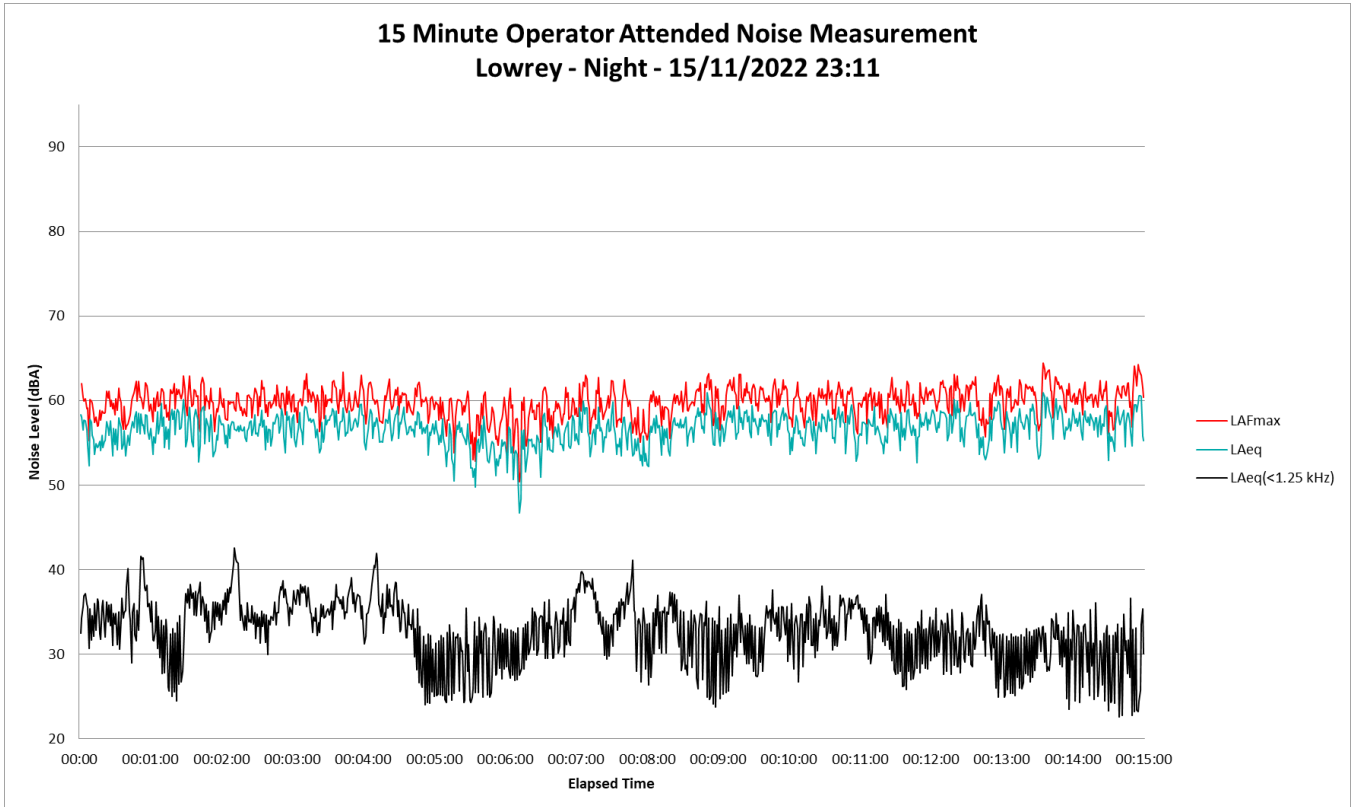


Figure B13 – Day Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

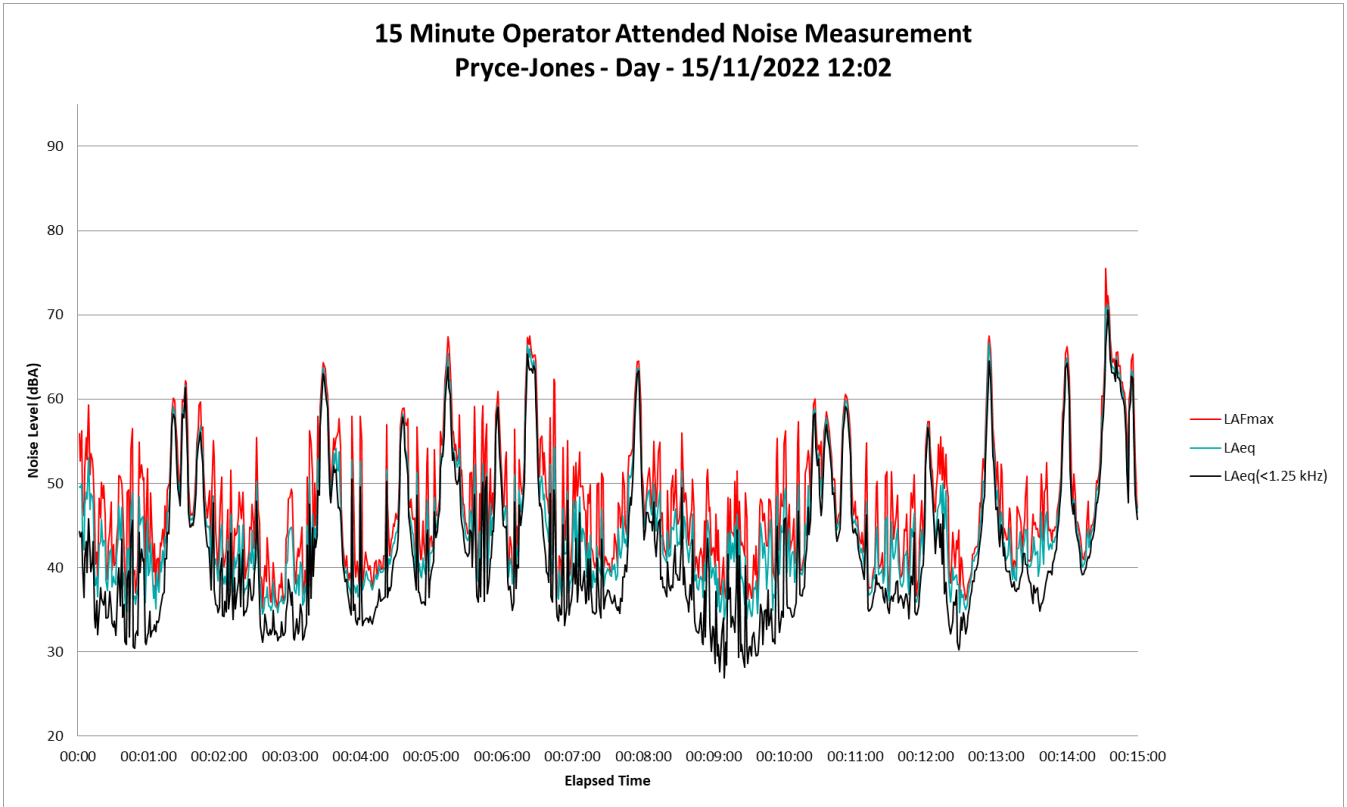


Figure B14 – Evening Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

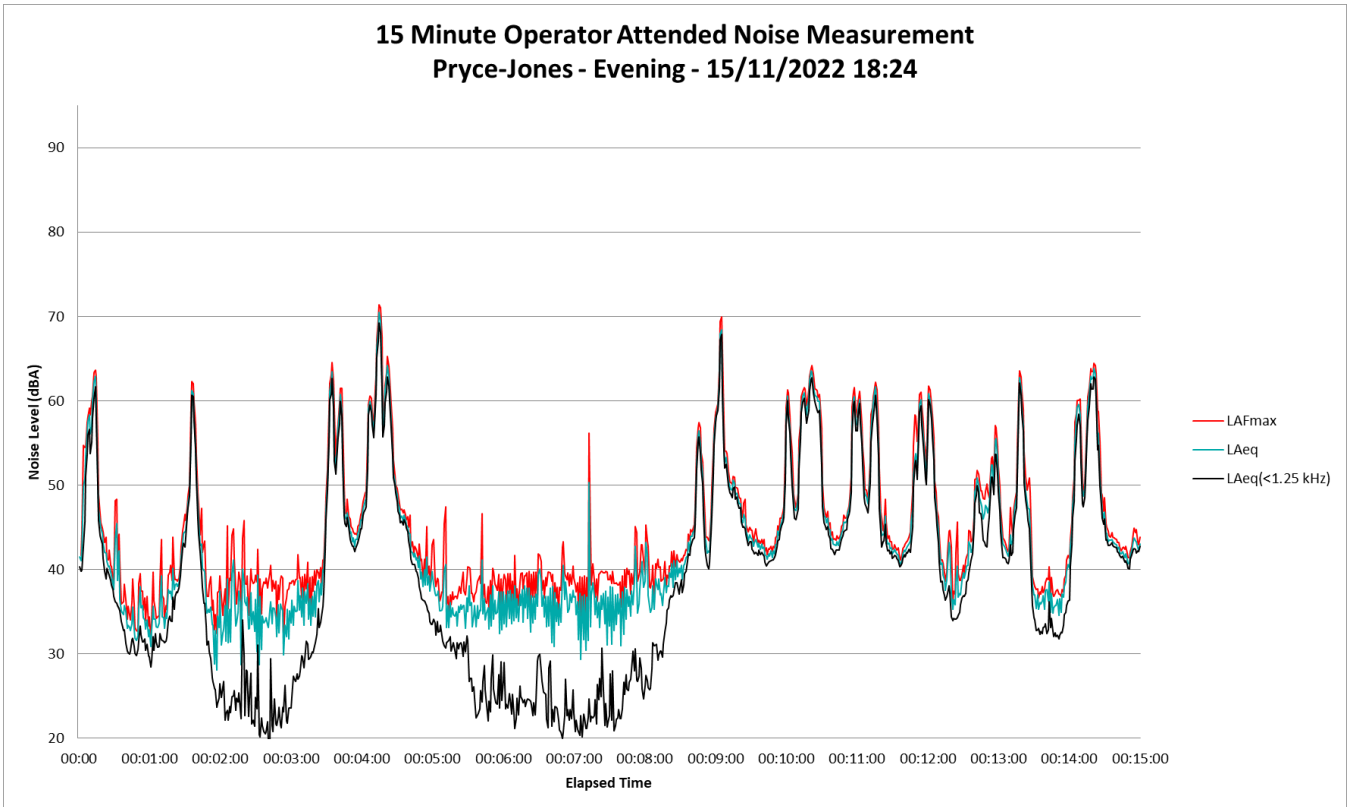


Figure B15 – Night Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

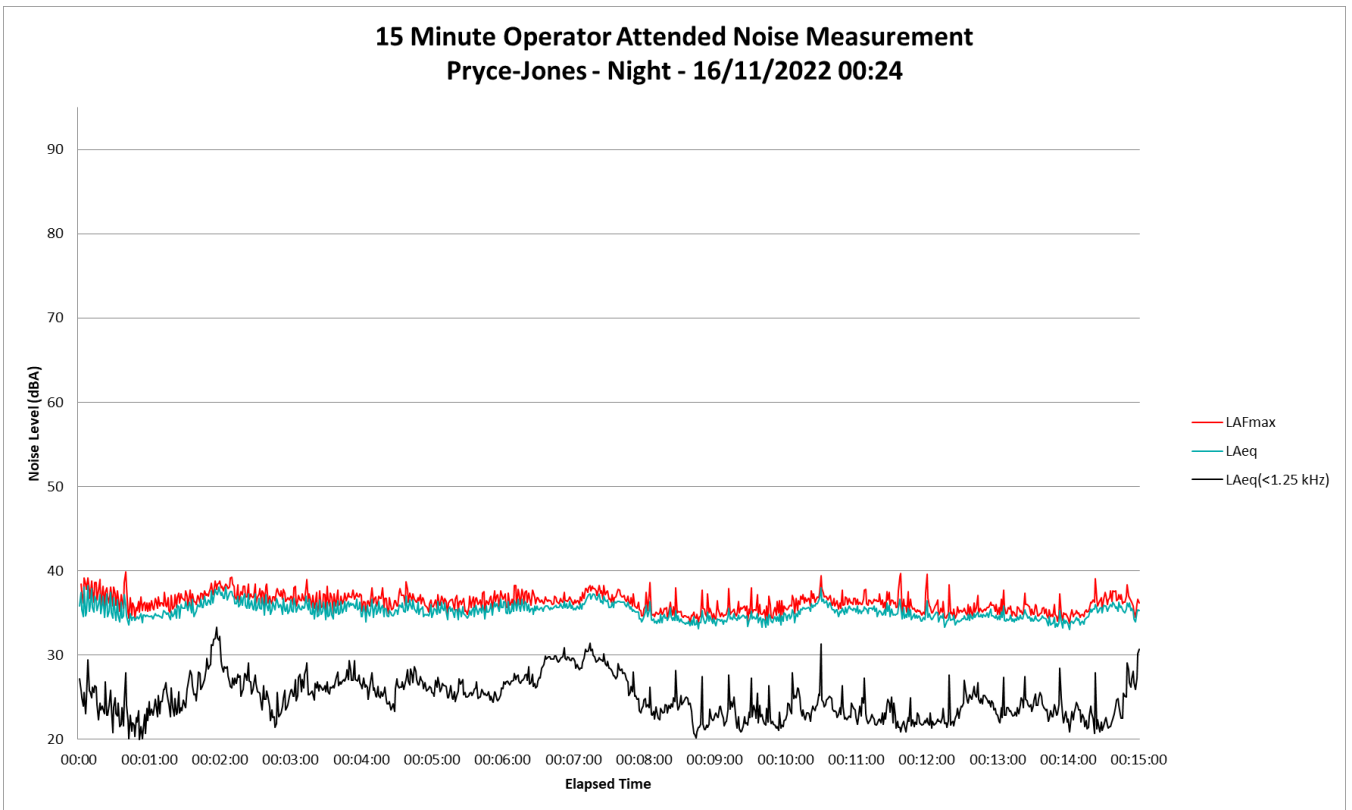


Figure B16 – Day Period – ‘Van der Drift’ Operator Attended Noise Survey Results

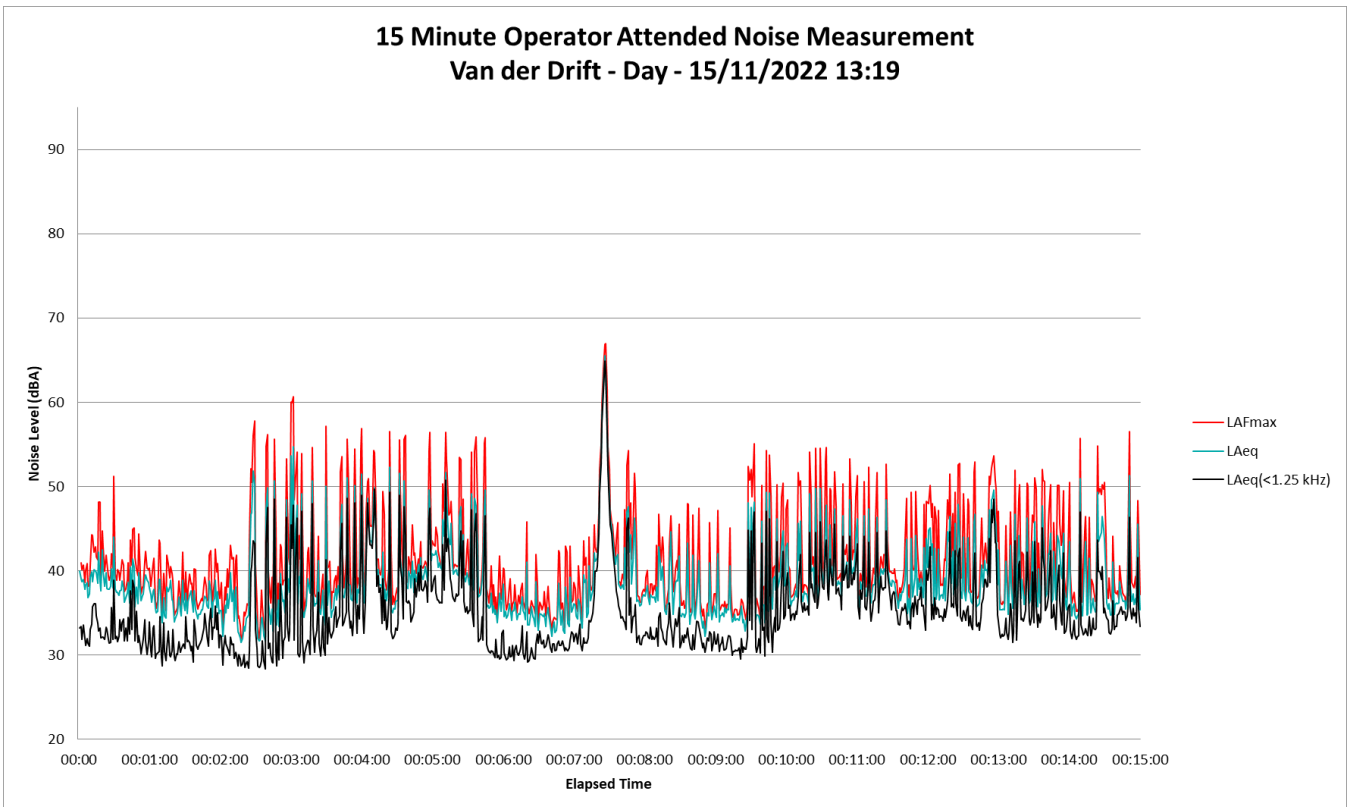


Figure B17 – Evening Period – ‘Van der Drift’ Operator Attended Noise Survey Results

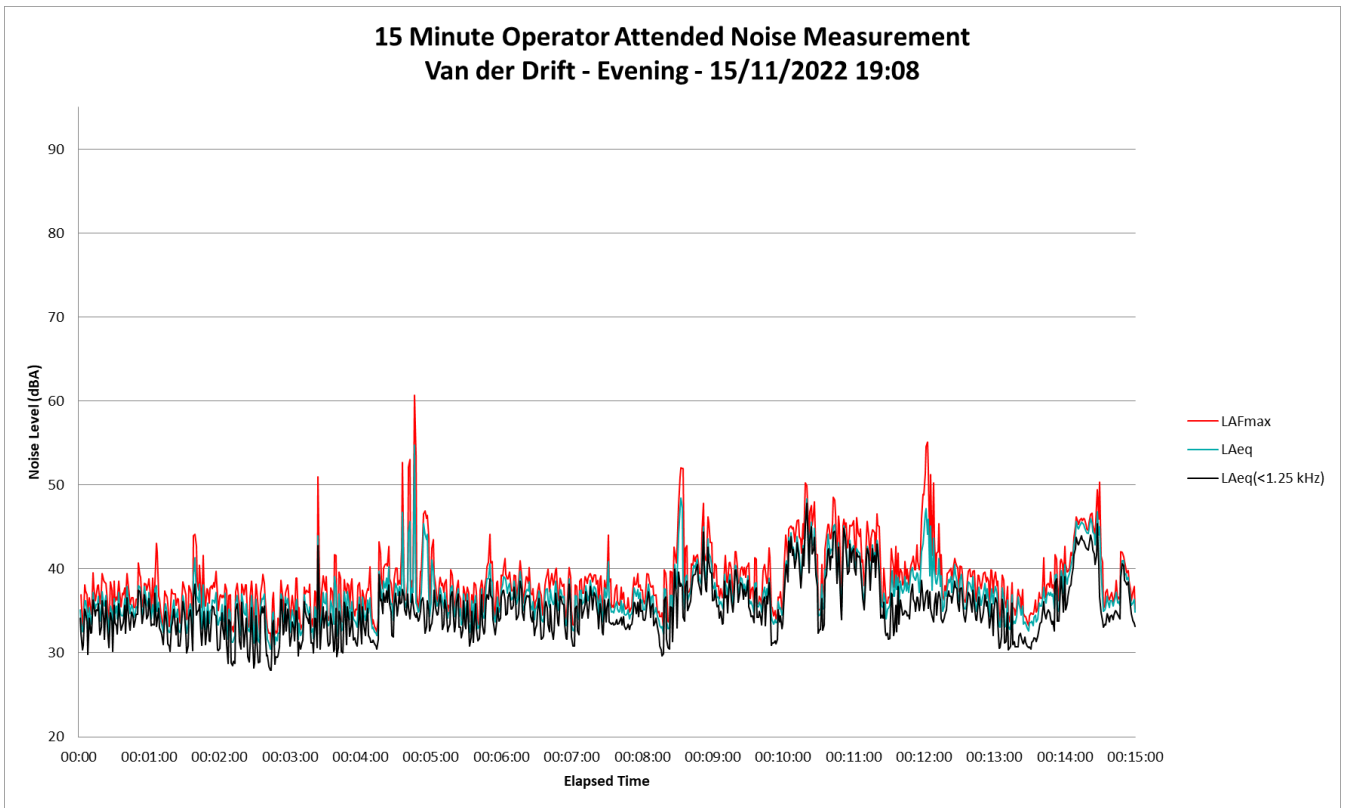


Figure B18 – Night Period – ‘Van der Drift’ Operator Attended Noise Survey Results

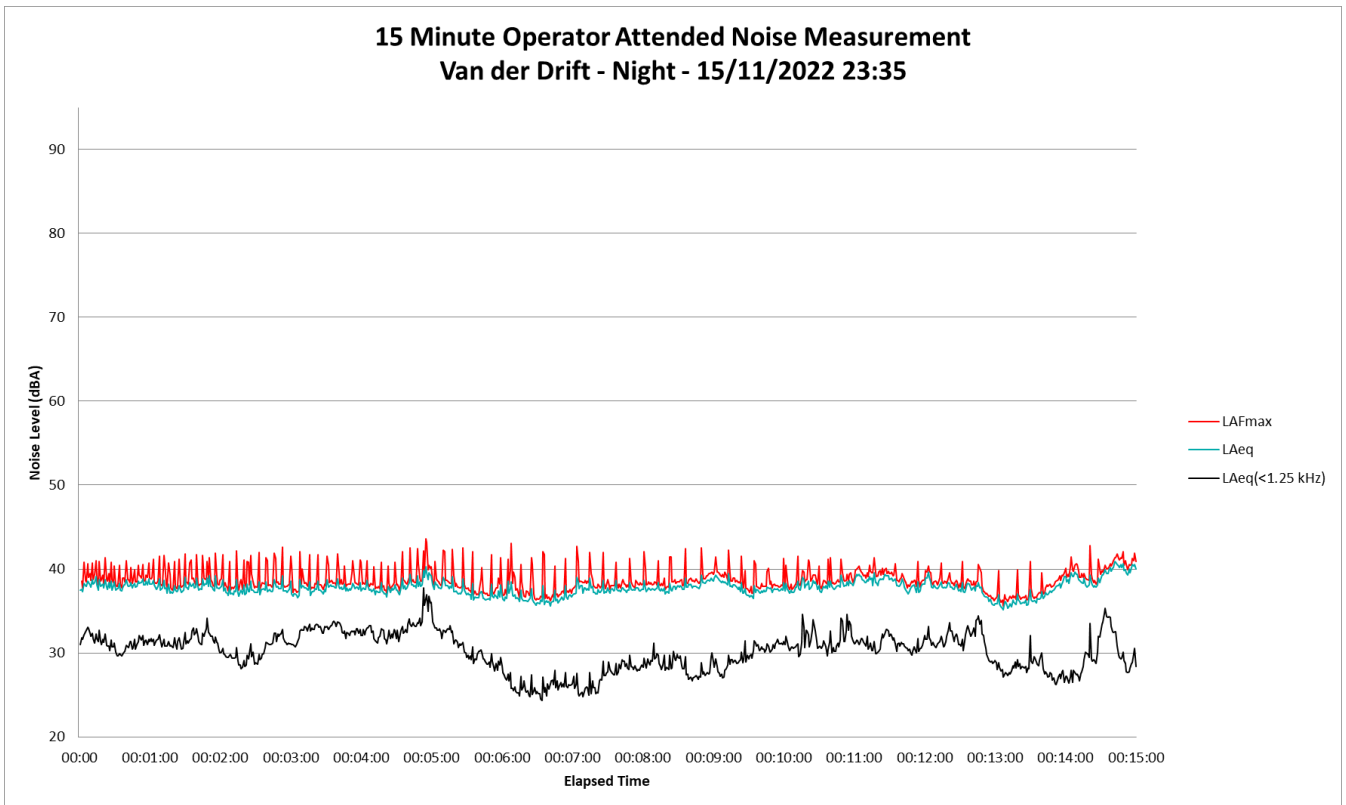


Figure B19 – Day Period – ‘Greenwood’ Operator Attended Noise Survey Results

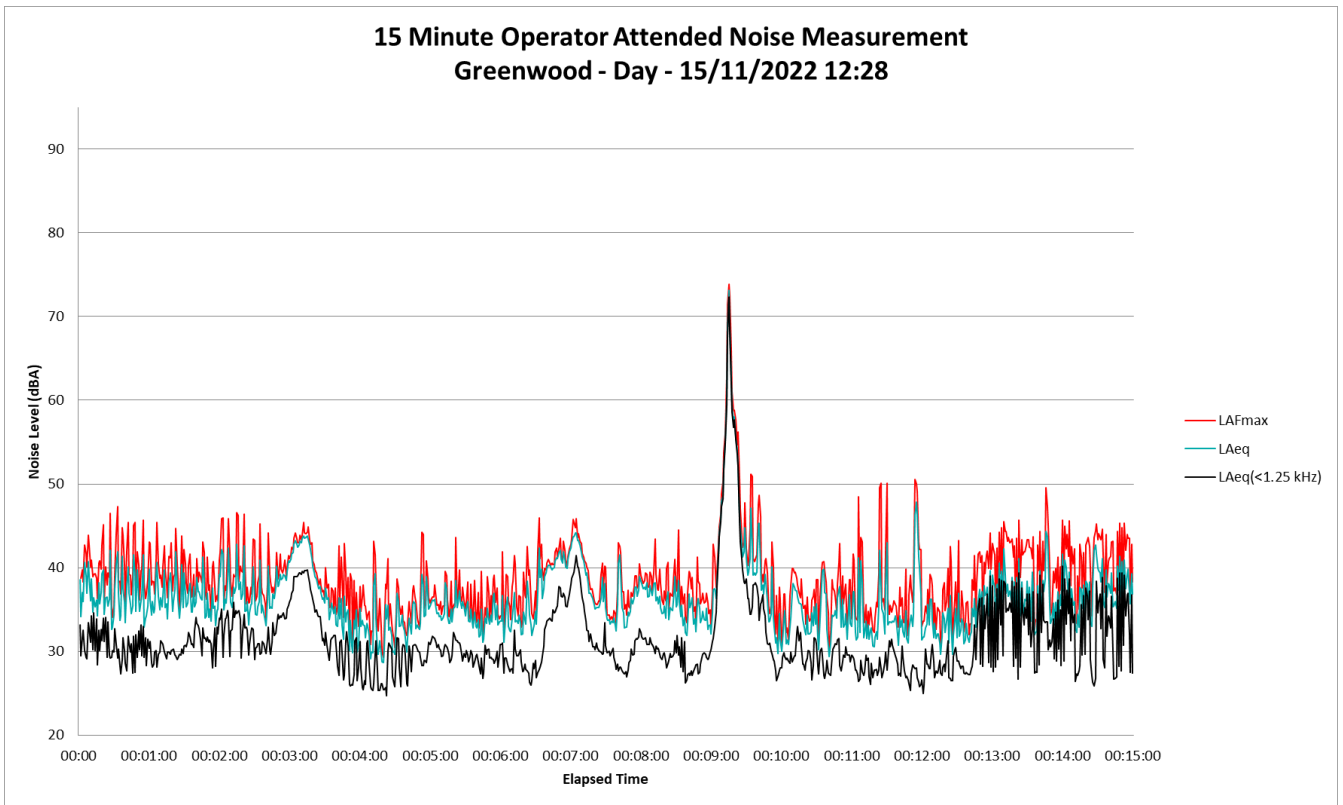


Figure B20 – Evening Period – ‘Greenwood’ Operator Attended Noise Survey Results

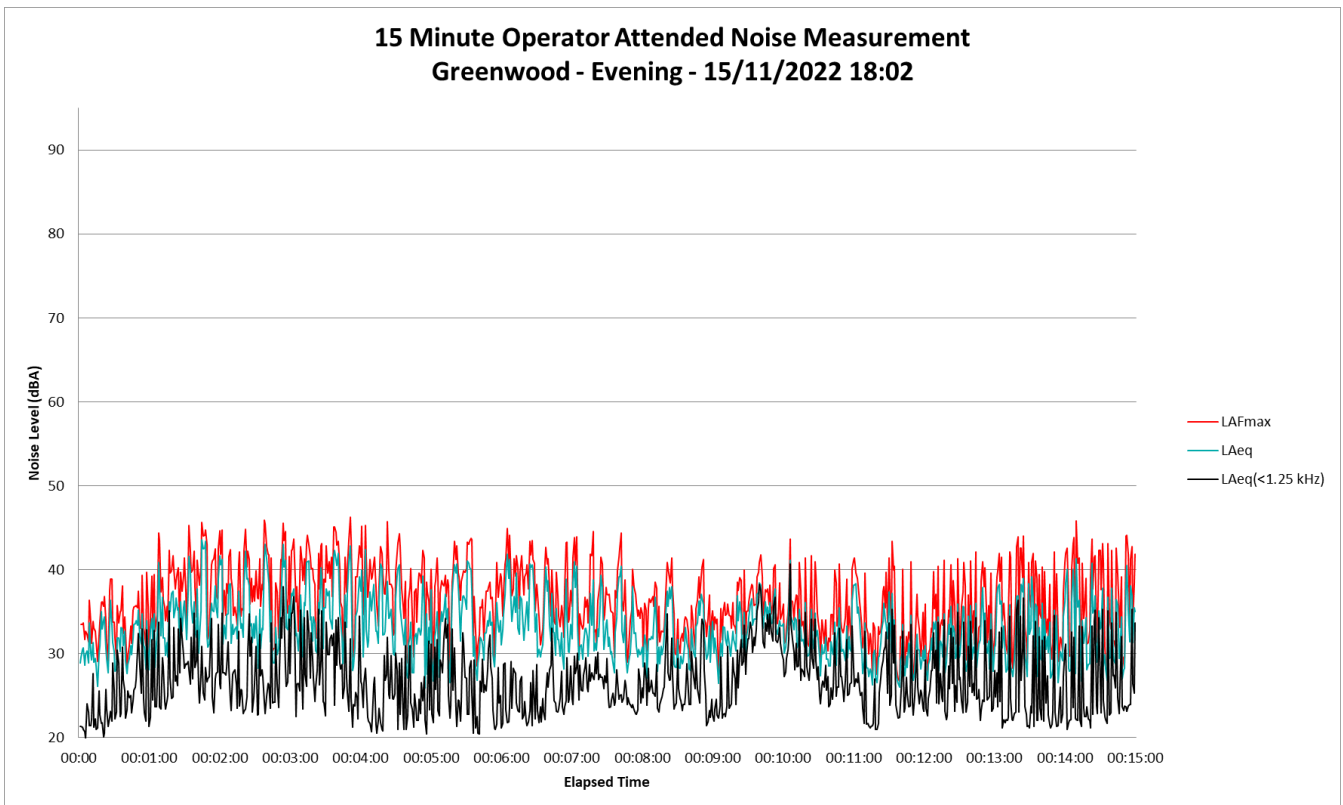


Figure B21 – Night Period – ‘Greenwood’ Operator Attended Noise Survey Results

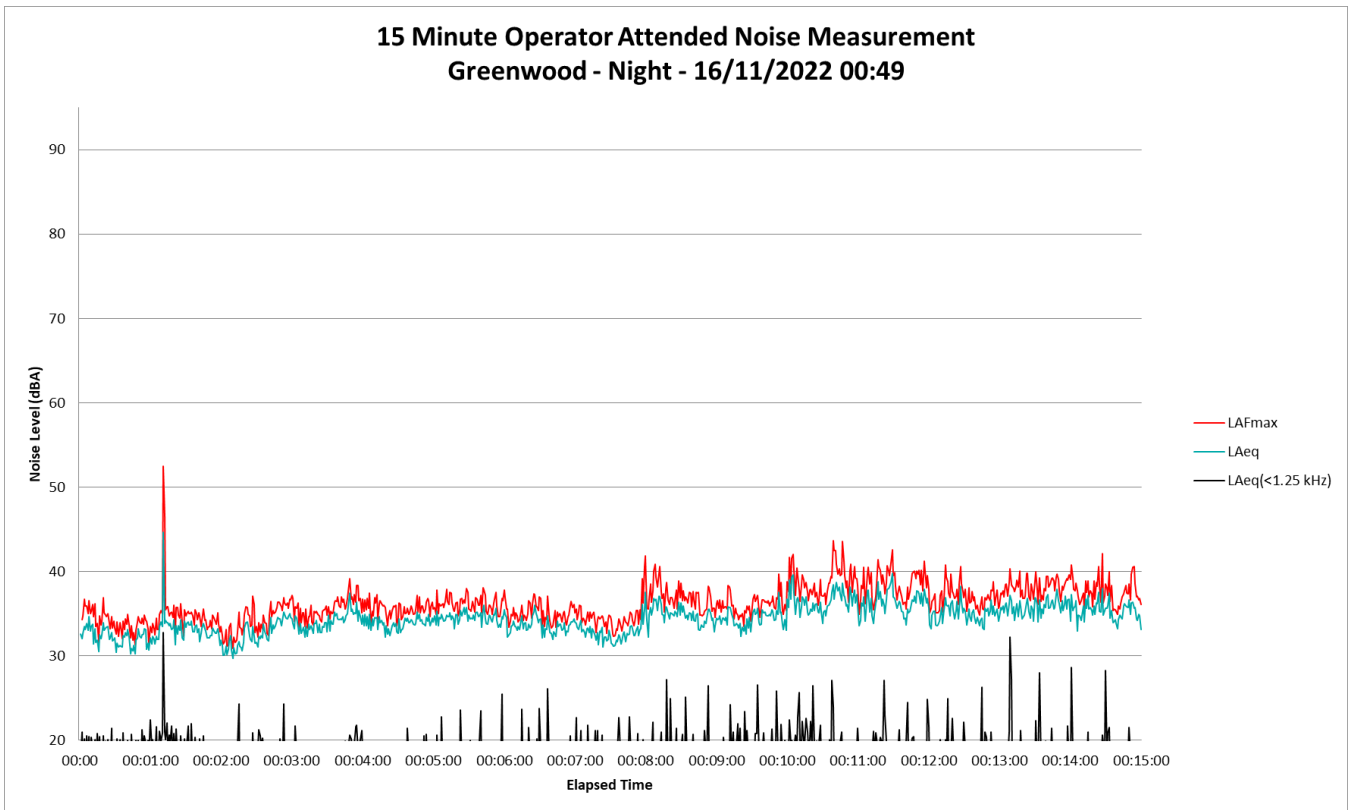


Figure B22 – Day Period – ‘Wadland’ Operator Attended Noise Survey Results

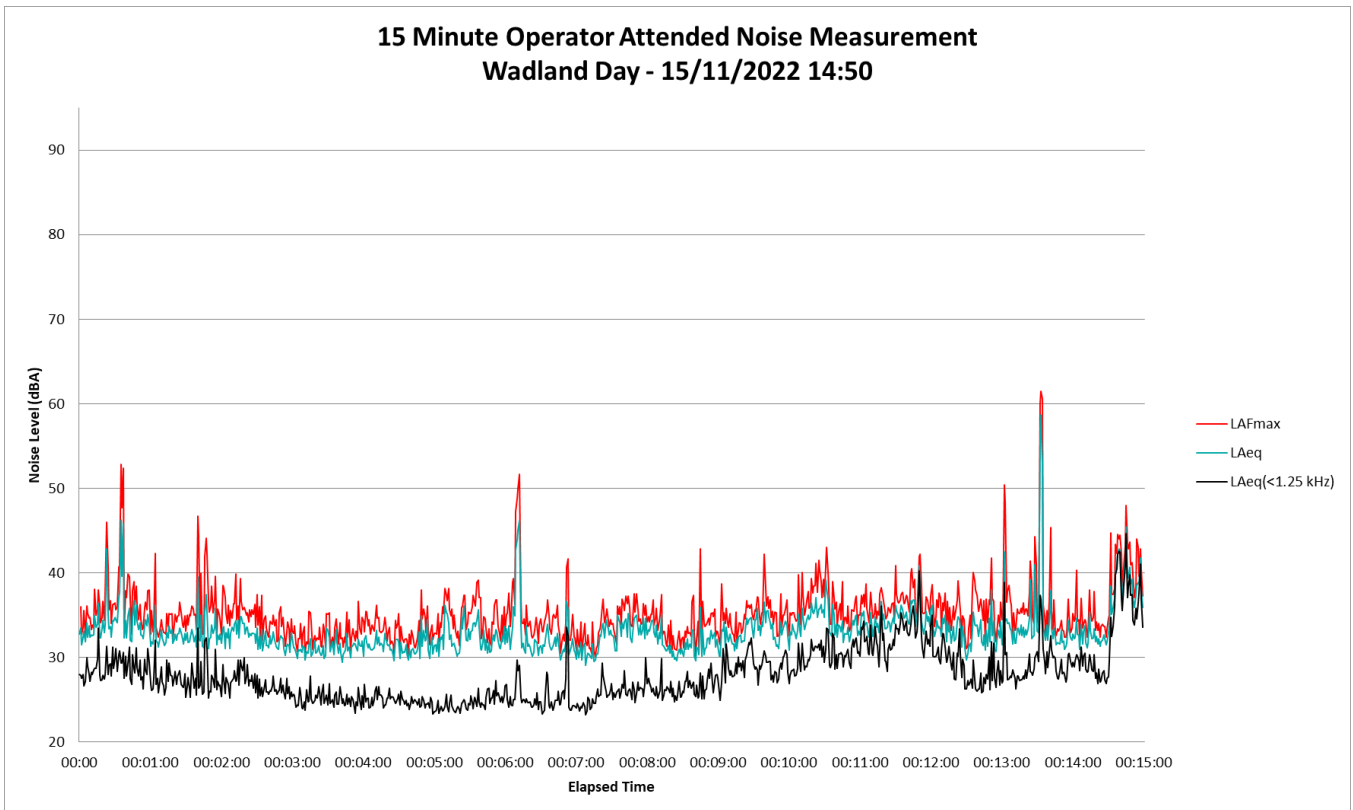


Figure B23 – Evening Period – ‘Wadland’ Operator Attended Noise Survey Results

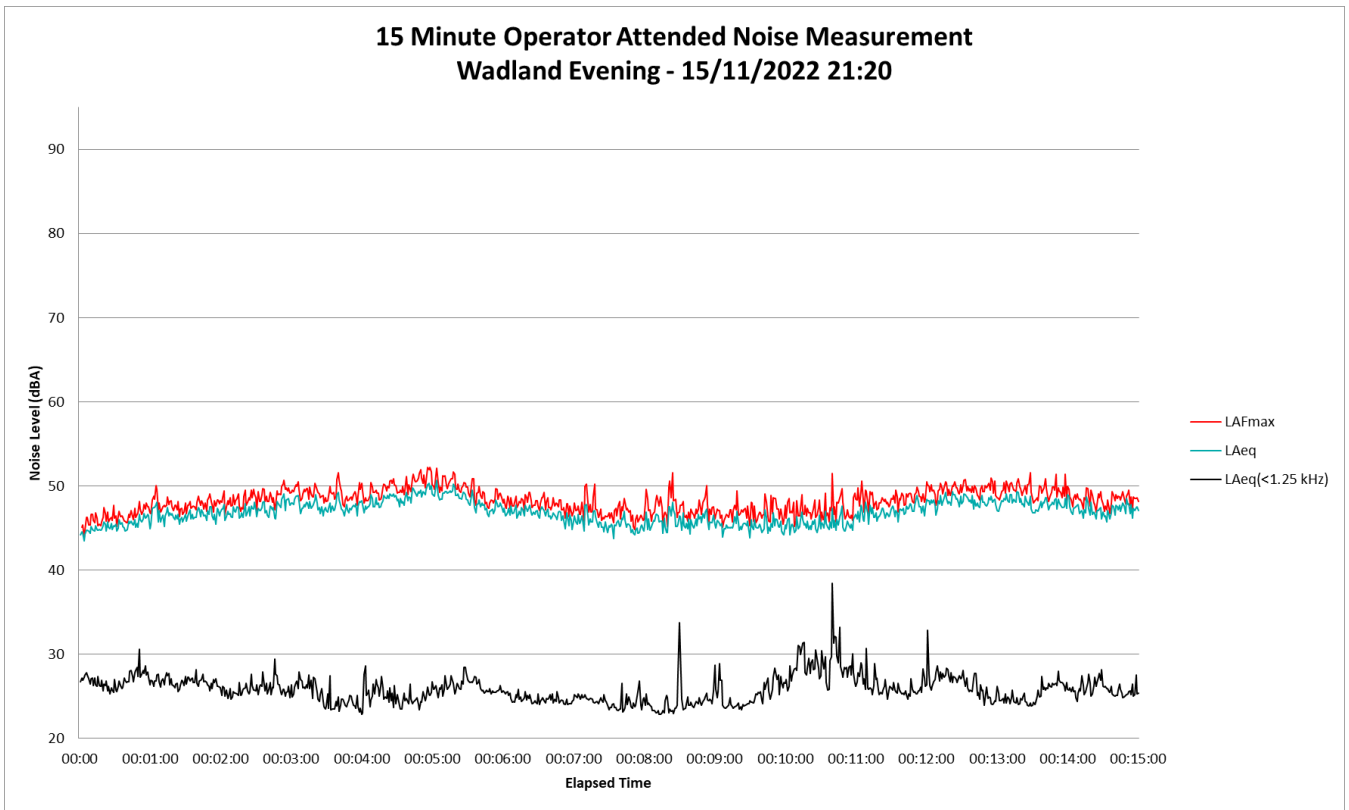


Figure B24 – Night Period – ‘Wadland’ Operator Attended Noise Survey Results

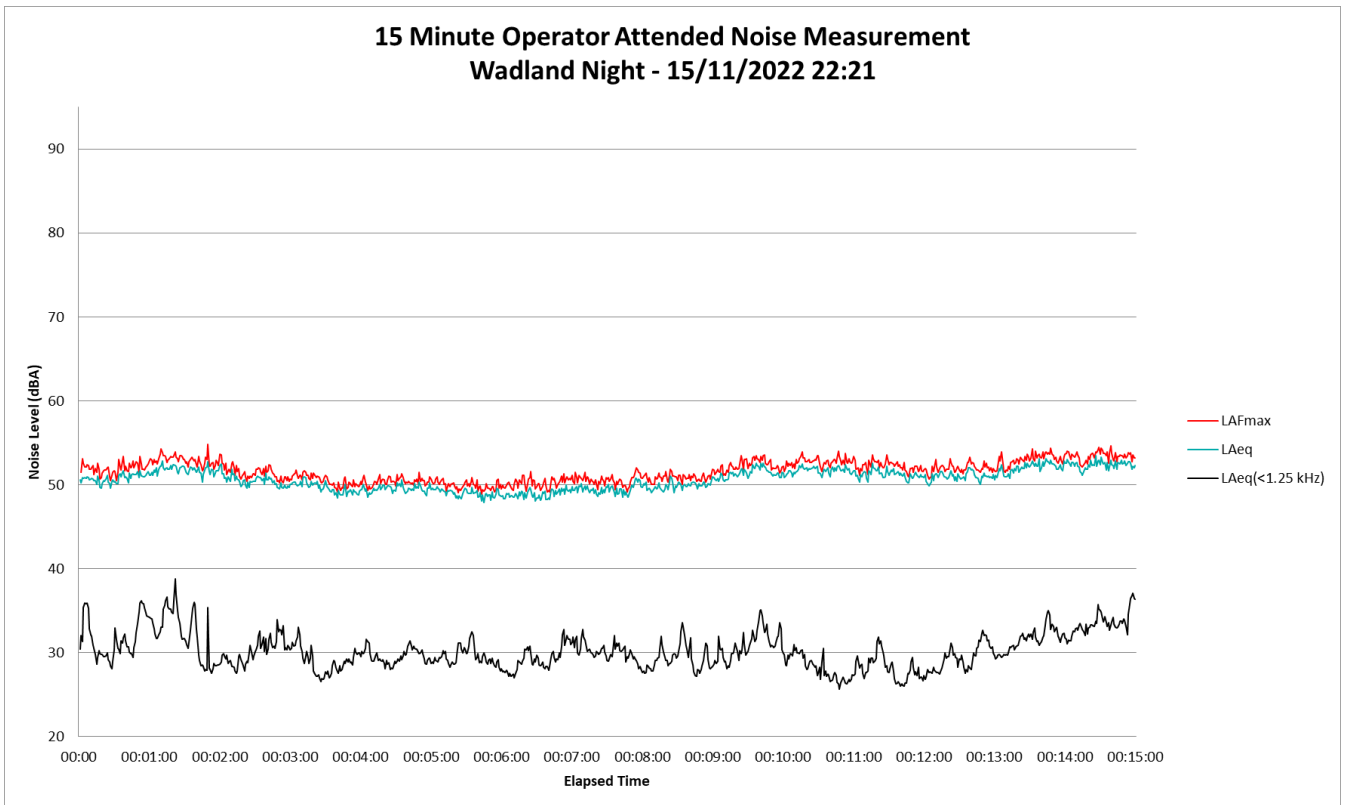


Figure B25 – RTNM1 – Operator Attended Noise Survey Results

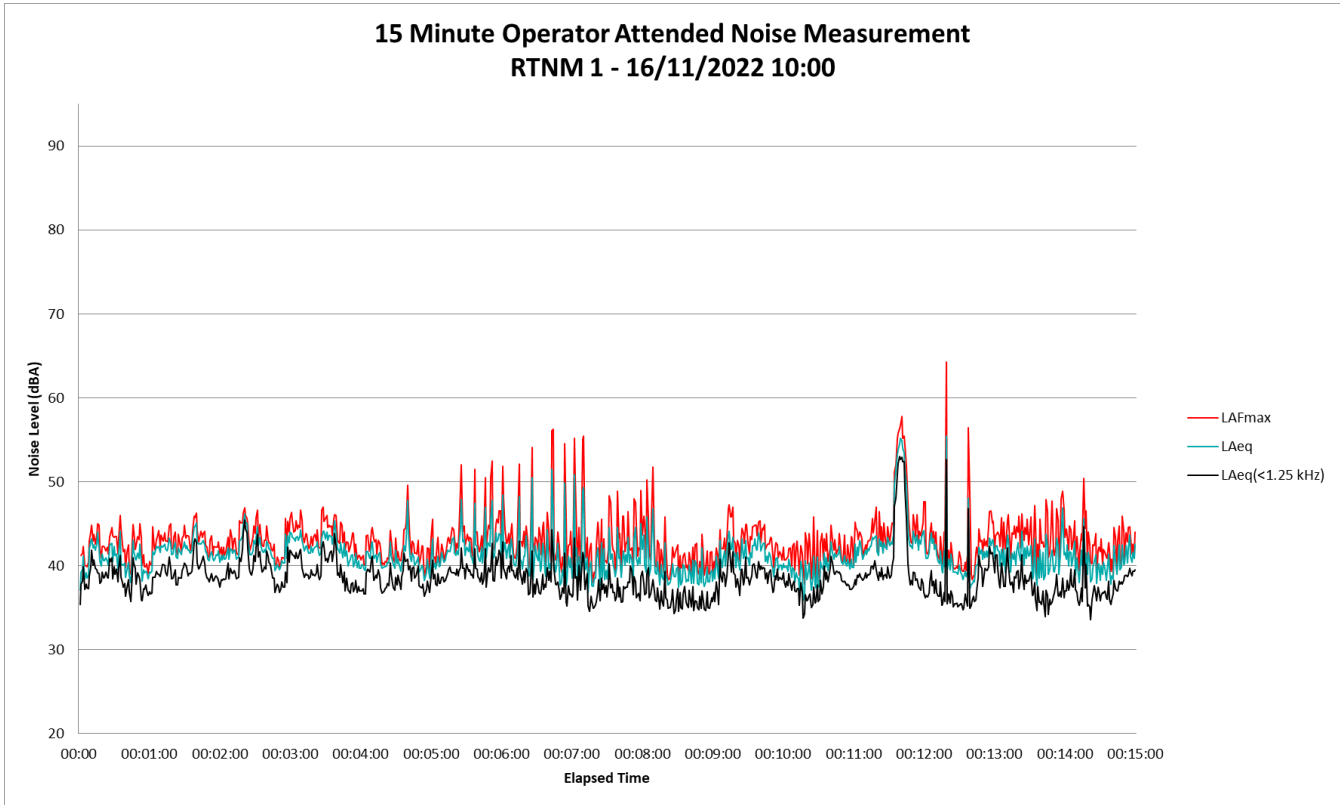
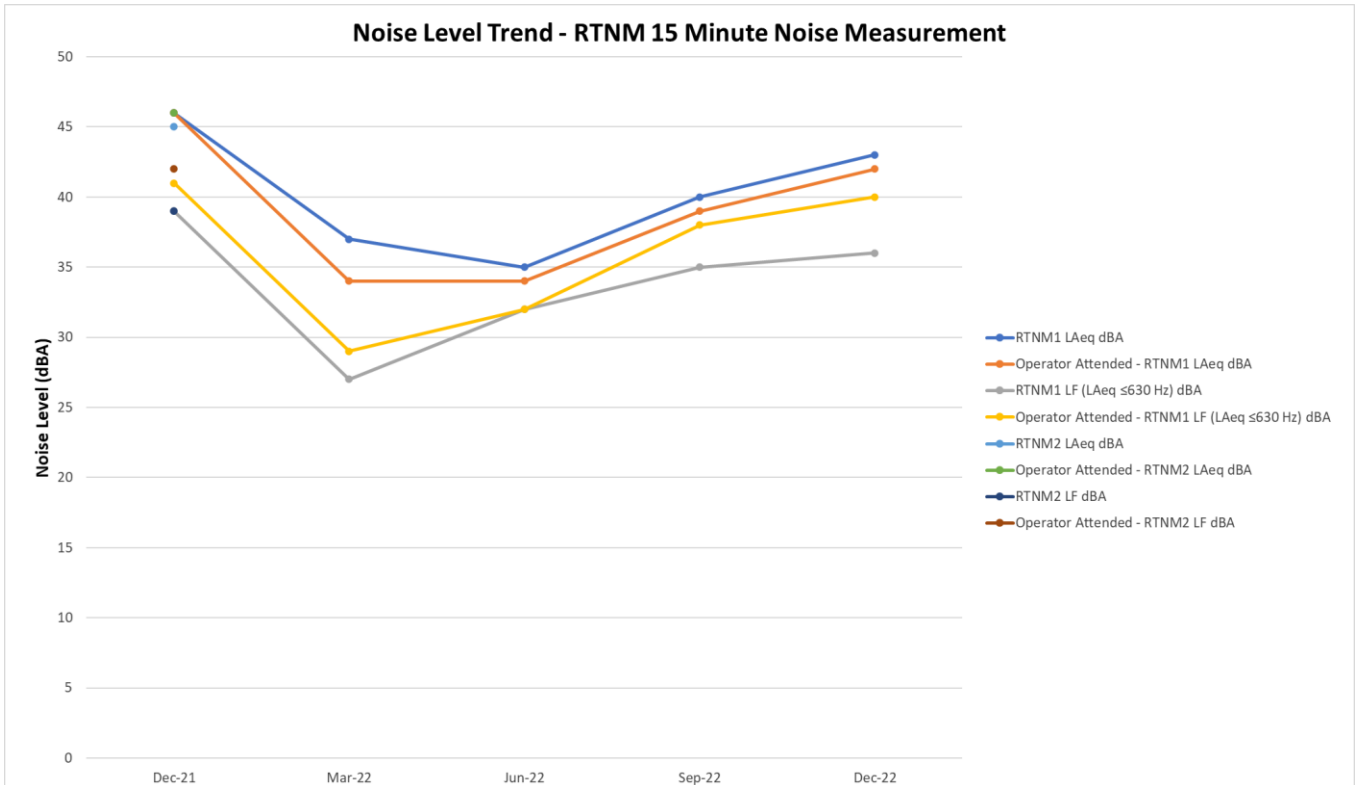


Figure B26 – RTNM1 – Noise Level Trend – Q4 2022 RTNM 15 Minute Noise Measurement



ASIA PACIFIC OFFICES

ADELAIDE

60 Halifax Street
Adelaide SA 5000
Australia
T: +61 431 516 449

BRISBANE

Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA

GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN

Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST

Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY

21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE

Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE CBD

Suite 2B, 125 Bull Street
Newcastle West NSW 2302
Australia
T: +61 2 4940 0442

NEWCASTLE

10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH

Grd Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY

Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE

12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG

Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND

Level 4, 12 O'Connell Street
Auckland 1010
New Zealand
T: 0800 757 695

NELSON

6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628

WELLINGTON

12A & B Waterloo Quay
Wellington 6011
New Zealand
T: +64 2181 7186

SINGAPORE

39b Craig Road
Singapore 089677
T: +65 6822 2203