

STRATFORD MINING COMPLEX

**Monthly Compliance Noise Monitoring
August 2020**

Prepared for:

Stratford Coal Pty Ltd
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SLR 

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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 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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DOCUMENT CONTROL

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CONTENTS

1	INTRODUCTION	5
2	SMC NOISE CRITERIA	6
2.1	Project Approval Schedule 3 Environmental Performance Conditions	6
2.2	Project Approval Appendix 6: Noise Compliance Assessment	8
2.3	EPL Noise Limits – SMC Operations	9
2.4	Noise Limits at the Nominated Attended Noise Monitoring Locations.....	9
2.5	Rail Noise Goals	9
3	OPERATIONAL NOISE MONITORING METHODOLOGY	10
3.1	NMP Monitoring Requirements	10
3.2	Monitoring Equipment Requirements.....	10
3.3	Operator-attended Noise Monitoring Locations.....	10
3.4	Extrapolation Methodology for Intermediate Monitoring Locations.....	11
3.5	Compliance Assessment Protocol.....	13
4	RESULTS	13
4.1	Operator-attended Noise Monitoring – SMC Operational Activity.....	13
4.1.1	Operator-attended Noise Survey Results – ‘Atkins’	14
4.1.2	Operator-attended Noise Survey Results - ‘Clarke’ and ‘Wadland’	15
4.1.3	Operator-attended Noise Survey Results – ‘Hall’	18
4.1.4	Operator-attended Noise Survey Results – ‘Lowrey’	19
4.1.5	Operator-attended Noise Survey Results – ‘Pryce-Jones’	20
4.1.6	Operator-attended Noise Survey Results – ‘Van der Drift’	21
4.1.7	Operator-attended Noise Survey Results – ‘Greenwood’	22
4.2	Rail Noise Monitoring	23
5	PERFORMANCE ASSESSMENT	23
6	SLEEP DISTURBANCE.....	24
7	CONCLUSION.....	25

DOCUMENT REFERENCES

TABLES

Table 1	Noise Limits for the Nominated Noise Monitoring Locations.....	9
Table 2	ARTC EPL 3142 Noise Objectives.....	9
Table 3	SMC Operational Noise Monitoring Locations.....	11
Table 4	Operator-attended Noise Survey Results - ‘Atkins’	14

CONTENTS

Table 5	Operator-attended Noise Survey Results - ‘Clarke’ and ‘Wadland’	15
Table 6	Predicted Noise Levels – Bagnall.....	17
Table 7	Operator-attended Noise Survey Results – ‘Hall’.....	18
Table 8	Attended Noise Survey Results – ‘Lowrey’.....	19
Table 9	Attended Noise Survey Results – ‘Pryce Jones’.....	20
Table 10	Attended Noise Survey Results – ‘Van der Drift’.....	21
Table 11	Attended Noise Survey Results – ‘Greenwood’	22
Table 12	Operator-attended Rail Noise Monitoring Results	23
Table 13	Performance Assessment – Operations.....	23
Table 14	Performance Assessment – Sleep Disturbance.....	24

FIGURES

Figure 1	Stratford Mining Complex Attended Noise Monitoring Locations	12
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APPENDICES

Appendix A	Acoustic Terminology
Appendix B	Operator Attended Noise Survey Charts

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 on Thursday 13 August 2020 and Friday 14 August 2020.

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, representative of receivers in the area surrounding the SMC. The eight nominated 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	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 Monitoring Equipment Requirements

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2004 *Electroacoustics—Sound level meters – Specifications*, AS IEC 61672.2-2004, AS IEC 61672.3-2004 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 3003389) and Brüel & Kjær Type 2270 (s/n 2697354) 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 seven NMP nominated residential noise monitoring locations. An additional noise monitoring location (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:

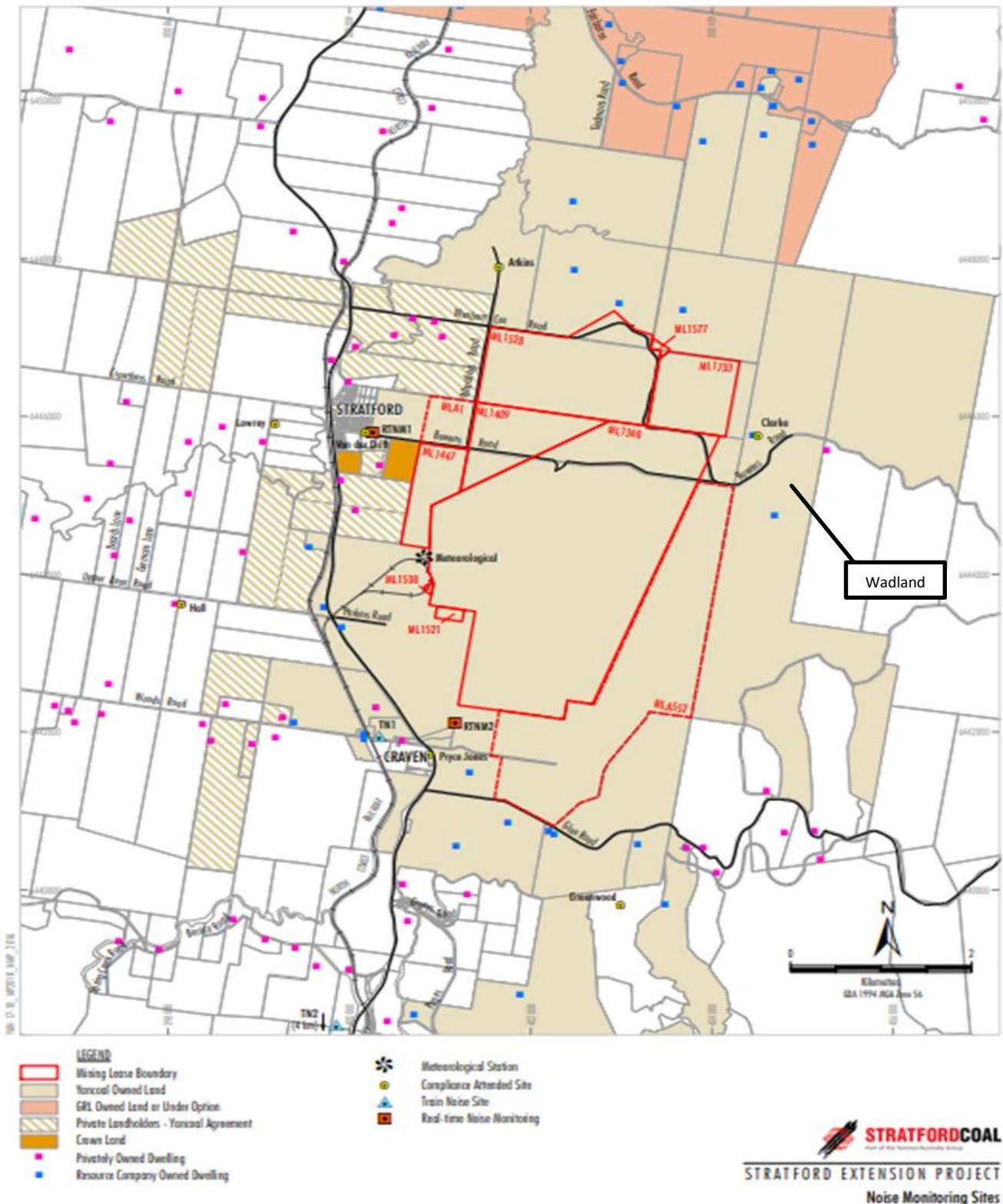
Direct measurement at alternative or intermediate location/s

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 the Bagnall residence using an ENM model for all monitoring periods. The noise model is calibrated using the operator attended noise monitoring results and weather conditions at the time of the Clarke and Wadland noise monitoring.

Figure 1 Stratford Mining Complex Attended Noise Monitoring Locations



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 during a day, evening and night period on Thursday 13 August 2020 and Friday 14 August 2020. 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}	LA1	LA10	LA90	L _{Aeq}	L _{Aeq} (≤1.25kHz)		
Day	13/08/2020 13:52 23°C 1.6 m/s SSE	52	44	36	31	35	33	No	<i>Site related noise events:</i> SMC: Audible General mining operations 30-34 L_{Aeq(15minute)} contribution 32 dBA <i>Other noise events:</i> Frogs 29-34 Birds 33-40 Light wind 30-32 Farming operations 40 Jet 39-52
Evening	13/08/2020 19:57 15°C 0.5 m/s WNW	50	47	46	43	45	36	No	<i>Site related noise events:</i> SMC: Barely Audible in lulls Haul trucks 24-33 L_{Aeq(15minute)} contribution 30 dBA <i>Other noise events:</i> Frogs 45-47 Exhaust click 50
Night	13/08/2020 22:51 11°C 1.1 m/s NNW Lapse Rate 4.8°C/100m	49	47	46	43	45	37	N/A	<i>Site related noise events:</i> SMC: Audible General mining operations 32-41 L_{Aeq(15minute)} contribution 36 dBA L_{Amax} contribution 41 dBA <i>Other noise events:</i> Frogs 45-48 Exhaust click 49

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

SMC operations were audible during all operator attended surveys at this location. SMC operations generated an LAeq(15minute) noise contribution of 32 dBA during the day, 30 dBA during the evening and 36 dBA during the night-time respectively. During the night-time period the operation of the pit generated LAm_{ax} noise levels of up to 41 dBA at the monitoring location.

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

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

Results of the operator-attended noise surveys at 'Clarke' and Wadland are provided in **Table 5**. These monitoring locations represent residential receptors located to the east of the site and is a SMC owned property. 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 5 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}	LA1	LA10	LA90	LAeq	LAeq (≤1.25kHz)		
Day – Clarke	13/08/2020 14:18 22°C 1.1 m/s SE	67	39	35	26	34	33	No	<i>Site related noise events:</i> SMC: Audible Dozers and haul trucks 28-34 Haul truck 40 LAeq(15minute) contribution 32 dBA <i>Other noise events:</i> Helicopter 33-36 Birdsong 35-67 Livestock 36-41
Day - Wadland	13/08/2020 14:42 23°C 1.8 m/s E	61	49	39	27	37	36	N/A	<i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Livestock 36-61 Birdsong 33-41 Insects/frogs 23-41 Aeroplane 30-40
Evening – Clarke	13/08/2020 19:10 16°C 1.9 m/s NNE	53	38	34	30	32	28	No	<i>Site related noise events:</i> SMC: Audible Haul trucks 26-38 LAeq(15minute) contribution 30 dBA <i>Other noise events:</i> Frogs/insects 29-32 Exhaust click 53 Dog barking 38-43

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}	LA1	LA10	LA90	L _{Aeq}	L _{Aeq} (≤1.25kHz)		
Evening - Wadland	13/08/2020 19:32 16°C 1 m/s NW	50	46	45	40	43	28	N/A	<i>Site related noise events:</i> SMC: Barely Audible General mining operations 27-30 L_{Aeq}(15minute) contribution 28 dBA <i>Other noise events:</i> Frogs 40-50 Birds 40-45
Night - Clarke	13/08/2020 22:03 12°C 0.7 m/s N Lapse rate 4.4°C/100m	55	48	43	36	41	40	N/A	<i>Site related noise events:</i> SMC: Audible General pit operations 34-43 Reverse signal 47-51 L_{Aeq}(15minute) contribution 40 dBA L_{Amax} contribution 51 dBA Frogs 30-34 Exhaust click 55
Night - Wadland	13/08/2020 22:25 11°C 0.3 m/s WNW Lapse Rate 5.1°C/100m	52	46	44	40	42	33	N/A	<i>Site related noise events:</i> SMC: Audible General mining operations 30-47 L_{Aeq}(15minute) contribution 33 dBA L_{Amax} contribution 47 dBA <i>Other noise events:</i> Frogs/birds 40-48 Pen click 52

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

At Clarke SMC operations were audible during the day and audible during the evening and night-time operator attended surveys. SMC operations generated an L_{Aeq}(15minute) noise contribution of 32 dBA during the day, 30 dBA during the evening and 40 dBA during the night-time respectively. During the night-time period the operation of the pit generated L_{Amax} noise levels of up to 51 dBA at Clarke.

At Wadland SMC operations were inaudible during the day, barely audible during the evening and audible during the night-time operator attended surveys. SMC operations generated an L_{Aeq}(15minute) noise contribution of 28 dBA during the evening and 33 dBA during the night-time. During the night-time period the operation of the pit generated L_{Amax} noise levels of up to 47 dBA at Wadland.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion in excess of 3°C/100 m during the night-time period of the operator attended measurements. As such, the night-time criteria are not applicable 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 in **Table 6**.

Table 6 Predicted Noise Levels – Bagnall

Period and Location	Meteorological Parameters	Noise Level at Monitoring Location	Predicted Noise Level at Bagnall	Propagation Attenuation – Monitoring Location to Bagnall (dB)
Day – Clarke	Temp 22.1°C Humidity 45.6% Wind Speed 1.1 m/s Wind Direction 129° Lapse Rate -1.6°C/100m	32 dBA LAeq(15minute)	19 dBA LAeq(15minute)	-13.1
Evening – Clarke	Temp 15.9°C Humidity 76.3% Wind Speed 1.9 m/s Wind Direction 14° Lapse Rate -0.8°C/100m	30 dBA LAeq(15minute)	16 dBA LAeq(15minute)	-14.5
Evening - Wadland	Temp 15.7°C Humidity 77.2% Wind Speed 1.0 m/s Wind Direction 312° Lapse Rate 0°C/100m	28 dBA LAeq(15minute)	25 dBA LAeq(15minute)	-2.7
Night – Clarke	Temp 12.0°C Humidity 91.7% Wind Speed 0.7 m/s Wind Direction 350° Lapse Rate 4.4°C/100m	40 dBA LAeq(15minute)	28 dBA LAeq(15minute)	-12.3
		51 dBA LAmax	39 dBA LAmax	-12.3
Night - Wadland	Temp 11.3°C Humidity 94.2% Wind Speed 0.3 m/s Wind Direction 289° Lapse Rate 5.1°C/100m	33 dBA LAeq(15minute)	29 dBA LAeq(15minute)	-3.6
		47 dBA LAmax	43 dBA LAmax	-3.6

LAeq(15minute) noise levels are predicted to be up to 29 dBA over the noise monitoring period. The night-time LAmax noise level is predicted to be up to 43 dBA. As such SMC operations are considered to be compliant at the Bagnall location.

4.1.3 Operator-attended Noise Survey Results – ‘Hall’

Results of the operator-attended noise surveys at ‘Hall’ are provided in **Table 7**. Monitoring location ‘Hall’ represents residential receptors located to the southwest of the site.

Table 7 Operator-attended Noise Survey Results – ‘Hall’

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	14/08/2020 07:48 11°C 2.3 m/s NNE	78	62	48	38	51	50	No	<i>Site related noise events:</i> SMC: Audible in lulls Haul trucks 30-39 Alarm 39 L_{Aeq}(15minute) contribution 34 dBA <i>Other noise events:</i> Road traffic 30-41 Vehicle pass-by 49-78 Train pass-by 39-57 Birdsong 35-63
Evening	13/08/2020 21:00 12°C 0.5 m/s S Lapse Rate 5.8°C /100m	54	42	41	37	39	28	N/A	<i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Frogs 42 Road traffic 37-41
Night	13/08/2020 22:34 11°C 0.3 m/s WNW Lapse Rate 5.1°C /100m	47	44	42	38	41	32	N/A	<i>Site related noise events:</i> SMC: Barely Audible General mining operations 27-30 L_{Aeq}(15minute) contribution 27 dBA L_{Amax} contribution 30 dBA <i>Other noise events:</i> Road traffic 36-39 Insects/frogs 40-45 Horse 41

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

SMC operations were audible during the day and inaudible during the evening and barely audible during the night-time operator-attended noise surveys at this location. SMC operations generated L_{Aeq}(15minute) contributions of 34 dBA during the day and 27 dBA during the night-time. SMC operations generated an L_{Amax} level of 30 dBA during the night-time attended noise survey.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion in excess of 3°C/100 m during the evening and night-time periods of the operator attended measurements. As such, the evening and night-time criteria are not applicable during the attended noise surveys.

4.1.4 Operator-attended Noise Survey Results – ‘Lowrey’

Results of the operator-attended noise surveys at ‘Lowrey’ are provided in **Table 8**. Monitoring location ‘Lowrey’ represents residential receptors located to the west of the site and west of Bucketts Way.

Table 8 Attended Noise Survey Results – ‘Lowrey’

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	14/08/2020 07:23 11°C 2.5 /s NNE	55	48	45	38	43	42	N/A	<i>Site related noise events:</i> SMC: Not Measurable <i>Other noise events:</i> Road traffic 36-49 Birds 35-55
Evening	13/08/2020 21:25 13°C 0.5 /s NNE Lapse Rate 6.2°C /100m	48	45	42	39	41	35	N/A	<i>Site related noise events:</i> SMC: Not Measurable <i>Other noise events:</i> Road traffic 35-46 Frogs/birds 32-41 Bats 40-48 Dog barking 33-45
Night	13/08/2020 23:15 11°C 0.7 m/s NNW Lapse Rate 3.2°C /100m	55	50	43	38	41	38	N/A	<i>Site related noise events:</i> SMC: Audible General mining operations 35-38 Rock dump 41 L_{Aeq}(15minute) contribution 35 dBA L_{Amax} contribution 41 dBA <i>Other noise events:</i> Road traffic 35-51 Frogs 38-41 Bats 42-55 Dog barking 39-46

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

SMC operations were not measurable during the day and evening and audible during the night-time operator attended noise surveys at this location. SMC operations generated L_{Aeq}(15minute) contributions of 35 dBA and an L_{Amax} level of 41 dBA during the night-time attended noise survey.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion in excess of 3°C/100 m during the evening and night-time periods of the operator attended measurements. As such, the evening and night-time criteria are not applicable during the attended noise surveys.

4.1.5 Operator-attended Noise Survey Results – ‘Pryce-Jones’

Results of the operator-attended noise surveys at ‘Pryce Jones’ are provided in **Table 9**. Monitoring location ‘Pryce Jones’ represents residential receptors located in Craven to the south of the site.

Table 9 Attended Noise Survey Results – ‘Pryce Jones’

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	13/08/2020 12:21 22°C 1.4 m/s SE	82	69	61	35	58	57	N/A	<i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Road traffic 40-82 Birds 33-38 Residential noise 32-35
Evening	13/08/2020 20:04 15°C 0.5 m/s WNW	70	67	58	39	54	53	No	<i>Site related noise events:</i> SMC: Audible General mining operations 38-43 Dozers 40 L_{Aeq}(15minute) contribution 39 dBA <i>Other noise events:</i> Road traffic 49-70 Insects/frogs 40-48 Wind in trees 33-36
Night	13/08/2020 22:57 11°C 1.1 /s NNW Lapse Rate 4.8°C /100m	69	61	49	39	49	47	N/A	<i>Site related noise events:</i> SMC: Audible General mining operations 34-37 L_{Aeq}(15minute) contribution 36 dBA L_{Amax} contribution 37 dBA <i>Other noise events:</i> Road traffic 44-69 Creek flow 36 Frogs/insects 40-52

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

SMC operations were inaudible during the day and audible during the evening and night-time operator-attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) contribution of 39 dBA during the evening and 36 dBA during the night-time. During the night-time period, SMC generated an L_{Amax} level of up to 37 dBA.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion up to and in excess of 3°C/100 m during the night-time period of the operator attended measurements. As such, the night-time criteria are not applicable during the attended noise surveys.

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 10**.

Table 10 Attended Noise Survey Results – ‘Van der Drift’

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	14/08/2020 07:00 9°C 2.9 m/s NE	74	62	48	34	49	47	No	<i>Site related noise events:</i> SMC: Audible General mining operations 31-37 L_{Aeq}(15minute) contribution 34 dBA <i>Other noise events:</i> Road traffic 33-39 Train passby 36-52 Train horn 53 Birds 30-74
Evening	13/08/2020 21:03 12°C 0.5 /s S Lapse Rate 5.8°C /100m	46	41	35	32	34	29	N/A	<i>Site related noise events:</i> SMC: Barely Audible General pit operations 24-29 L_{Aeq}(15minute) contribution 26 dBA <i>Other noise events:</i> Road traffic 36-46 Frogs 32-35
Night	13/08/2020 23:39 10°C 0.7 m/s N Lapse Rate 4.6°C /100m	51	39	36	31	34	32	N/A	<i>Site related noise events:</i> SMC: Audible General mining operations 29-34 Rock dump 40 L_{Aeq}(15minute) contribution 31 dBA L_{Amax} contribution 40 dBA <i>Other noise events:</i> Road traffic 35-40 Frogs 29-32 Exhaust clicks 38-51

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

SMC operations were audible during the day, barely audible during the evening and audible during the night-time operator attended noise surveys at this location. SMC operations generated an L_{Aeq}(15minute) contribution of 34 dBA during the day, 26 dBA during the evening and 31 dBA during the night-time. During the night-time period, the operation of the pit generated an L_{Amax} level of up to 40 dBA.

Meteorological data from the onsite SMC automatic weather stations showed a temperature inversion in excess of 3°C/100 m during the evening and night-time periods of the operator attended measurements. As such, the evening and night-time criteria are not applicable during the attended noise surveys.

4.1.7 Operator-attended Noise Survey Results – ‘Greenwood’

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

Table 11 Attended Noise Survey Results – ‘Greenwood’

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	13/08/2020 15:03 23°C 1.8 m/s ESE	59	53	44	28	41	37	N/A	<i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Distant road traffic 34-36 Birdsong 33-38 Frogs 36
Evening	13/08/2020 19:41 15°C 0.8 m/s W	52	44	42	37	40	28	N/A	<i>Site related noise events:</i> SMC: Inaudible <i>Other noise events:</i> Distant road traffic 35-38 Frogs 39-43 Exhaust click 52
Night	13/08/2020 23:22 10°C 1.2 m/s NE Lapse Rate 5.1°C/100m	45	41	40	37	38	29	N/A	<i>Site related noise events:</i> SMC: Barely Audible General mining operations 26-28 L_{Aeq}(15minute) contribution 26 dBA L_{Amax} contribution 28 dBA <i>Other noise events:</i> Distant road traffic 36 Frogs/insects 40-45

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

SMC operations were inaudible during the day and evening and barely audible during the night-time operator-attended noise surveys at this location. SMC operations generated L_{Aeq}(15minute) noise levels of 26 dBA and an L_{Amax} noise level of 28 dBA during the night-time attended noise survey.

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

4.2 Rail Noise Monitoring

SMC rail pass-by noise levels are presented in **Table 12**.

Table 12 Operator-attended Rail Noise Monitoring Results

Monitoring Location	Date and Time	L _{Amax} (dBA)	
		Horn Included	Horn Excluded
TN1	13/08/2020 12:58 PM	95	74
TN2	13/08/2020 13:05 PM	83	76

Maximum SMC rail pass-by were compliant with the 85 dBA L_{Amax} limit at both locations, excluding the sounding of the horn on the approach to the level crossing at location TN1.

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 13**.

Table 13 Performance Assessment – Operations

Location	Estimated SMC L _{Aeq} (15minute) Noise Level dBA ¹			Noise Criteria L _{Aeq} (15minute) dBA			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Atkins	32	30	36 ⁷	35	35	35	Yes	Yes	Yes
Clarke ²	32	30	40 ⁷	37	37	37	N/A ⁵	N/A ⁵	N/A ⁵
Wadland ²	I/A	28	33 ⁷	37	37	37	N/A ⁵	N/A ⁵	N/A ⁵
Bagnall	19	25 ⁶	29 ^{6,7}	37	37	37	Yes	Yes	Yes
Hall	34	I/A	27 ⁷	35	35	35	Yes	Yes	Yes
Lowrey	NM ⁴	NM ⁴	27 ⁷	35	35	35	Yes	Yes	Yes
Pryce Jones	I/A	39	36 ⁷	43	43	43	Yes	Yes	Yes
Van der Drift	34	26 ⁷	31 ⁷	35	35	35	Yes	Yes	Yes
Greenwood	I/A	I/A	26 ⁷	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: Highest predicted noise level.

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 14**.

Table 14 Performance Assessment – Sleep Disturbance

Location	SMC LA1(1minute) Contribution	Noise Criteria LA1(1minute)	Compliance
Atkins	41 ⁵	45	Yes
Clarke ²	51 ^{4,5}	45	N/A ⁴
Wadland	47 ^{4,5}	45	N/A ⁴
Bagnall ³	43 ⁵	45	Yes
Hall	30 ⁵	45	Yes
Lowrey	41 ⁵	45	Yes
Pryce Jones	37 ⁵	49	Yes
Van der Drift	40 ⁵	45	Yes
Greenwood	28 ⁵	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 and the rail noise monitoring conducted at two locations. Monitoring commenced Thursday 13 August 2020 and concluded Friday 14 August 2020 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.

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

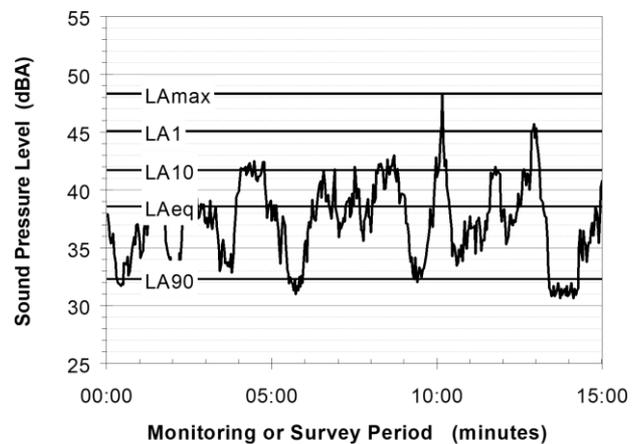
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The 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

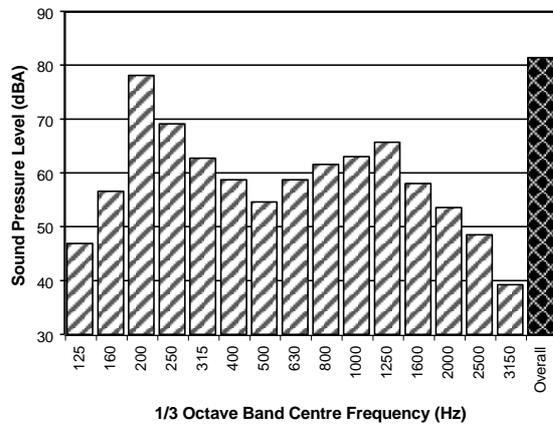
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

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.

APPENDIX B

Operator Attended Noise Survey Charts

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

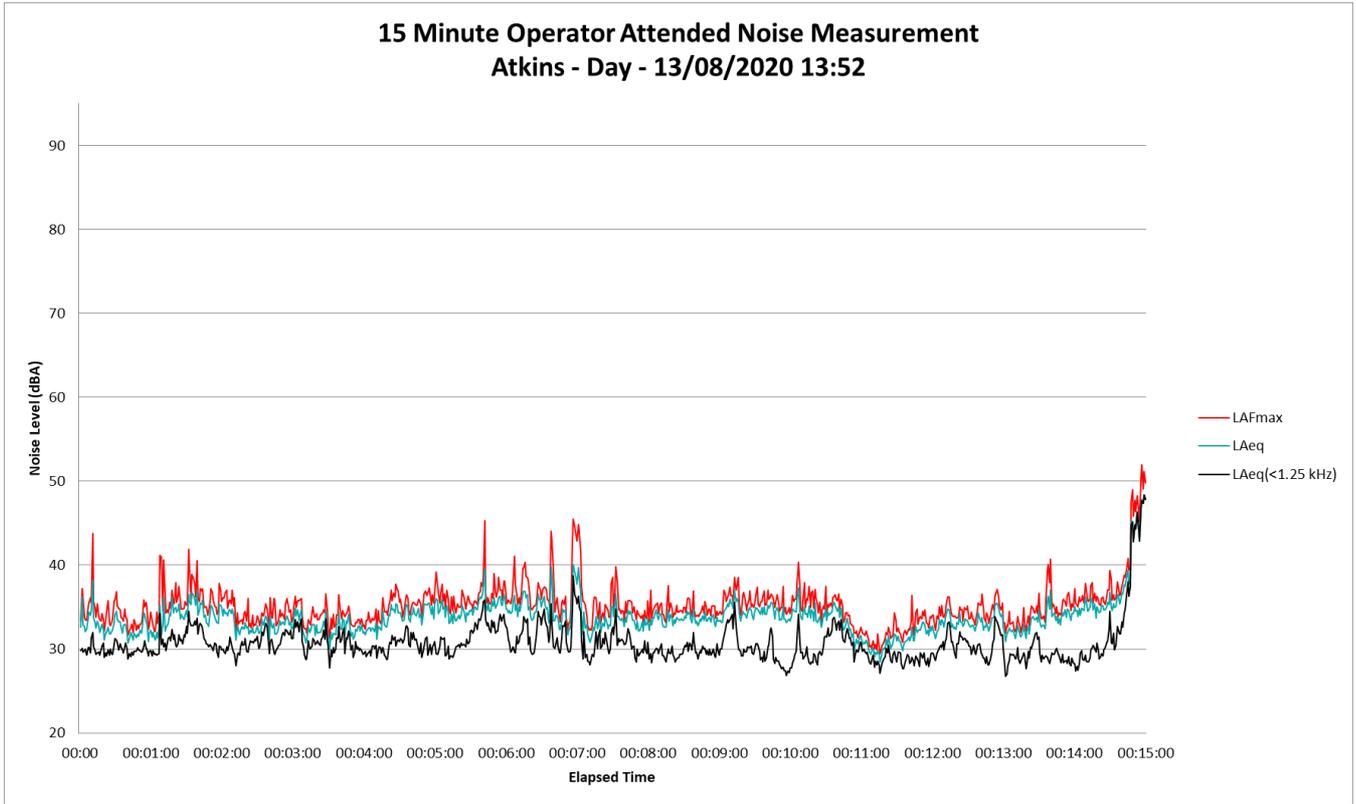


Figure B2 – Evening Period – ‘Atkins’ Operator Attended Noise Survey Results

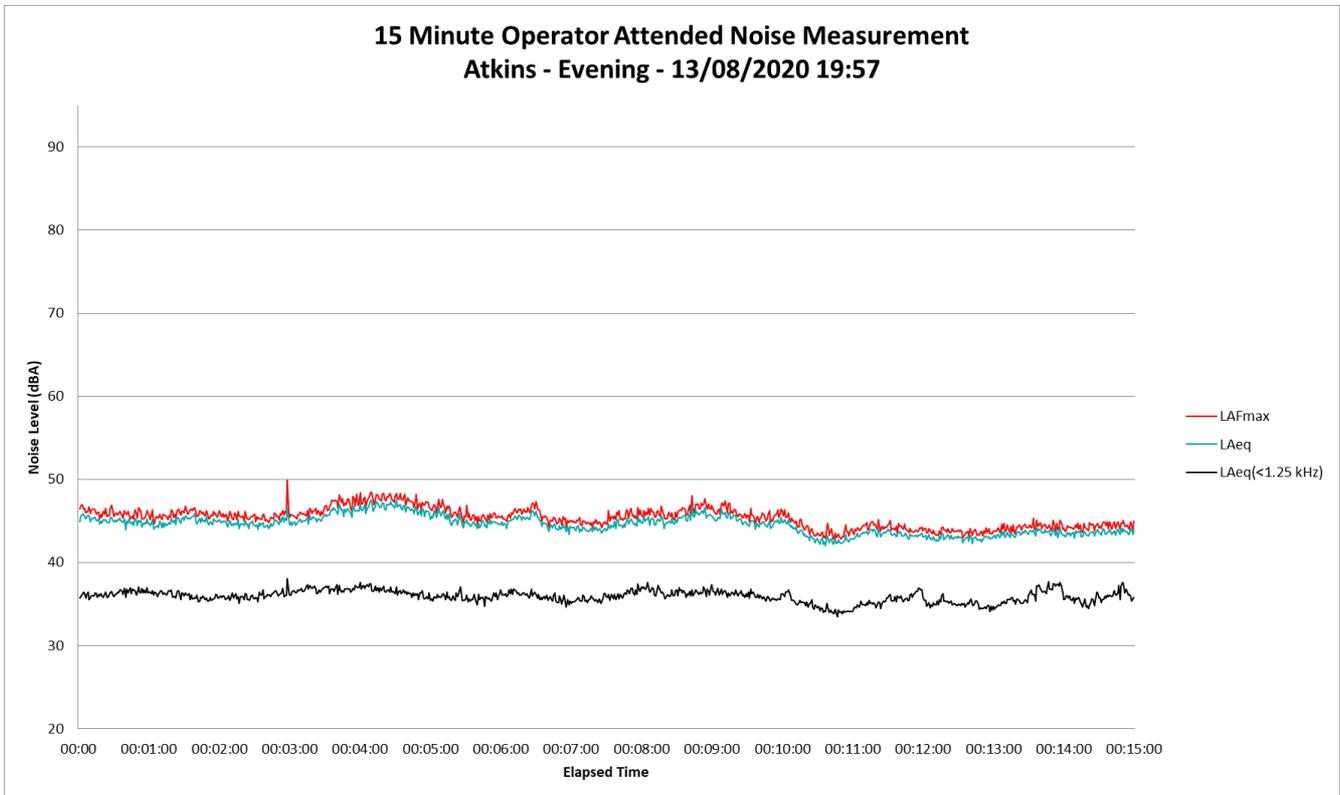


Figure B3 – Night Period – ‘Atkins’ Operator Attended Noise Survey Results

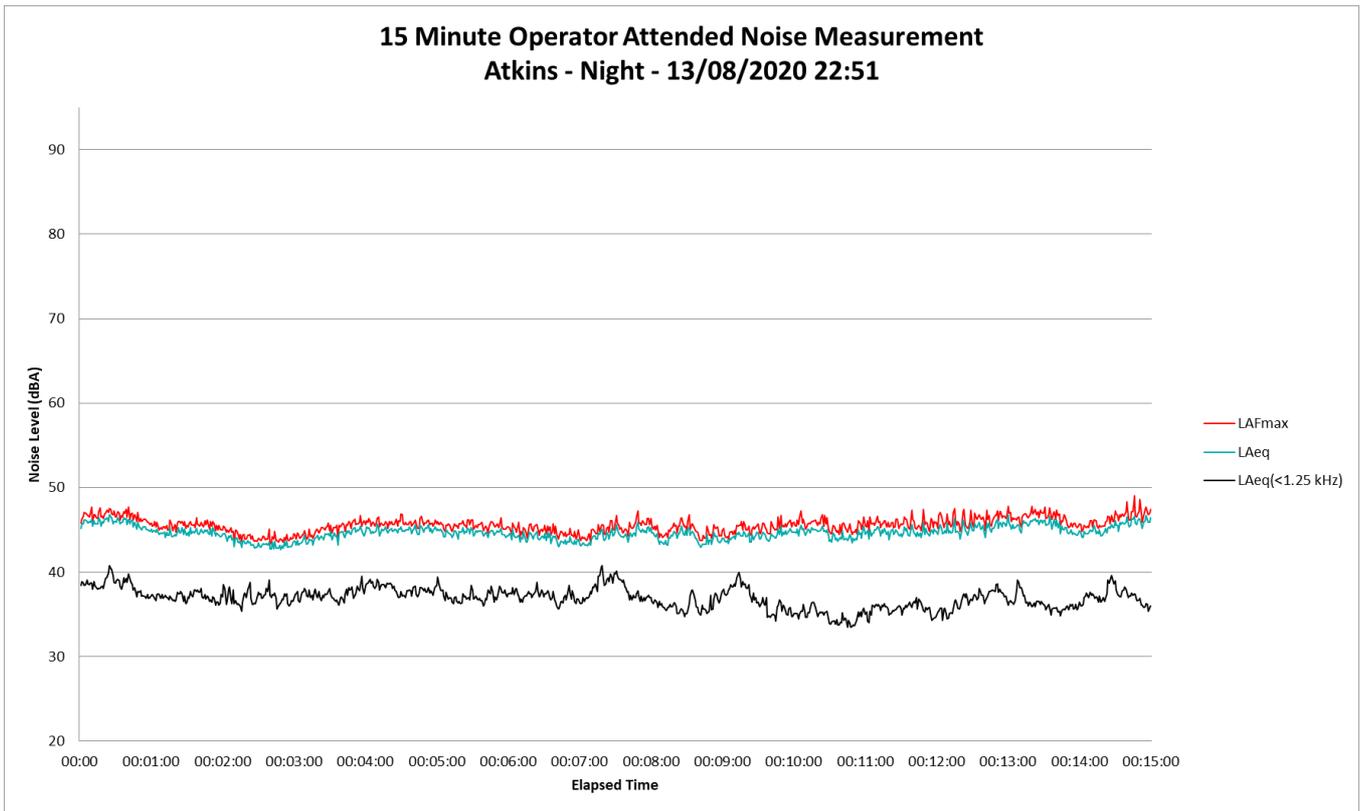


Figure B4 – Day Period – ‘Clarke’ Operator Attended Noise Survey Results

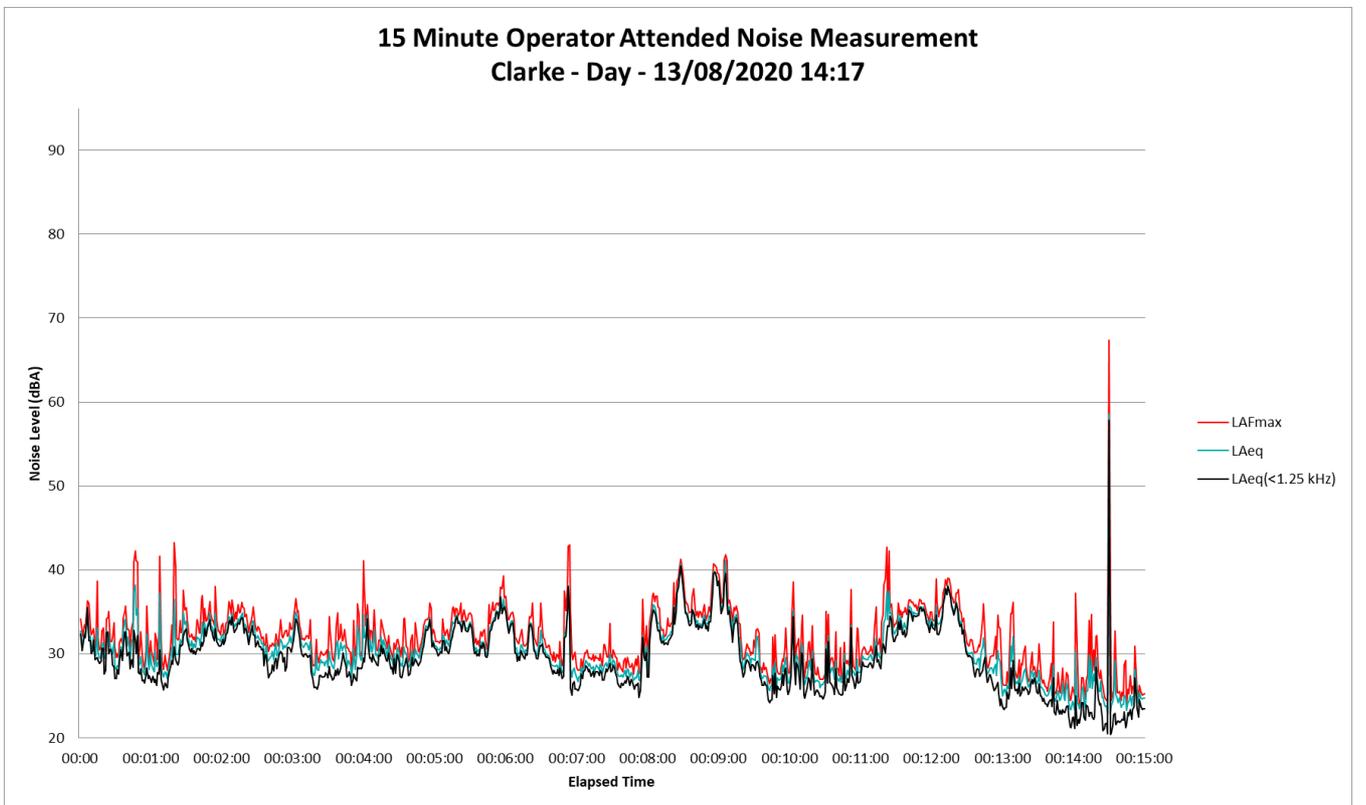


Figure B5 – Evening Period – ‘Clarke’ Operator Attended Noise Survey Results

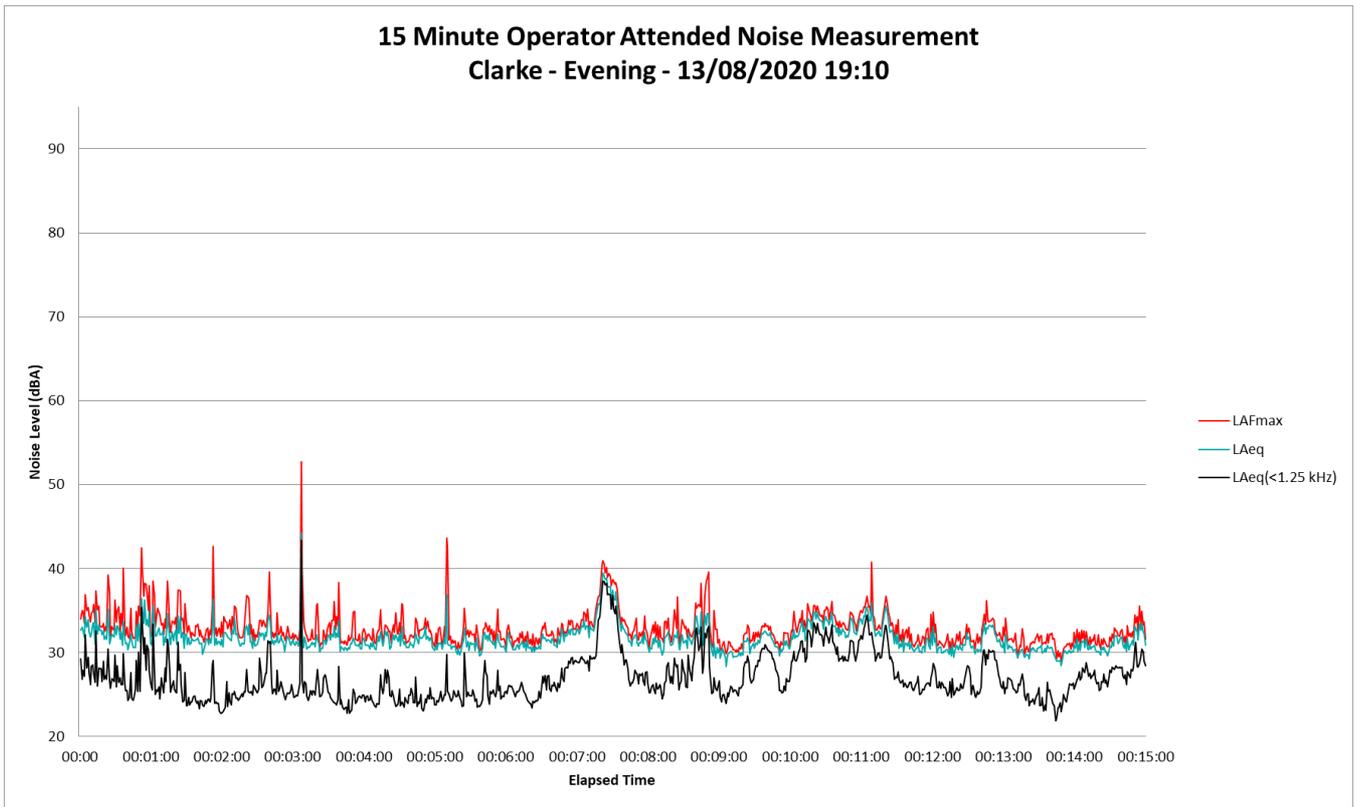


Figure B6 – Night Period – ‘Clarke’ Operator Attended Noise Survey Results

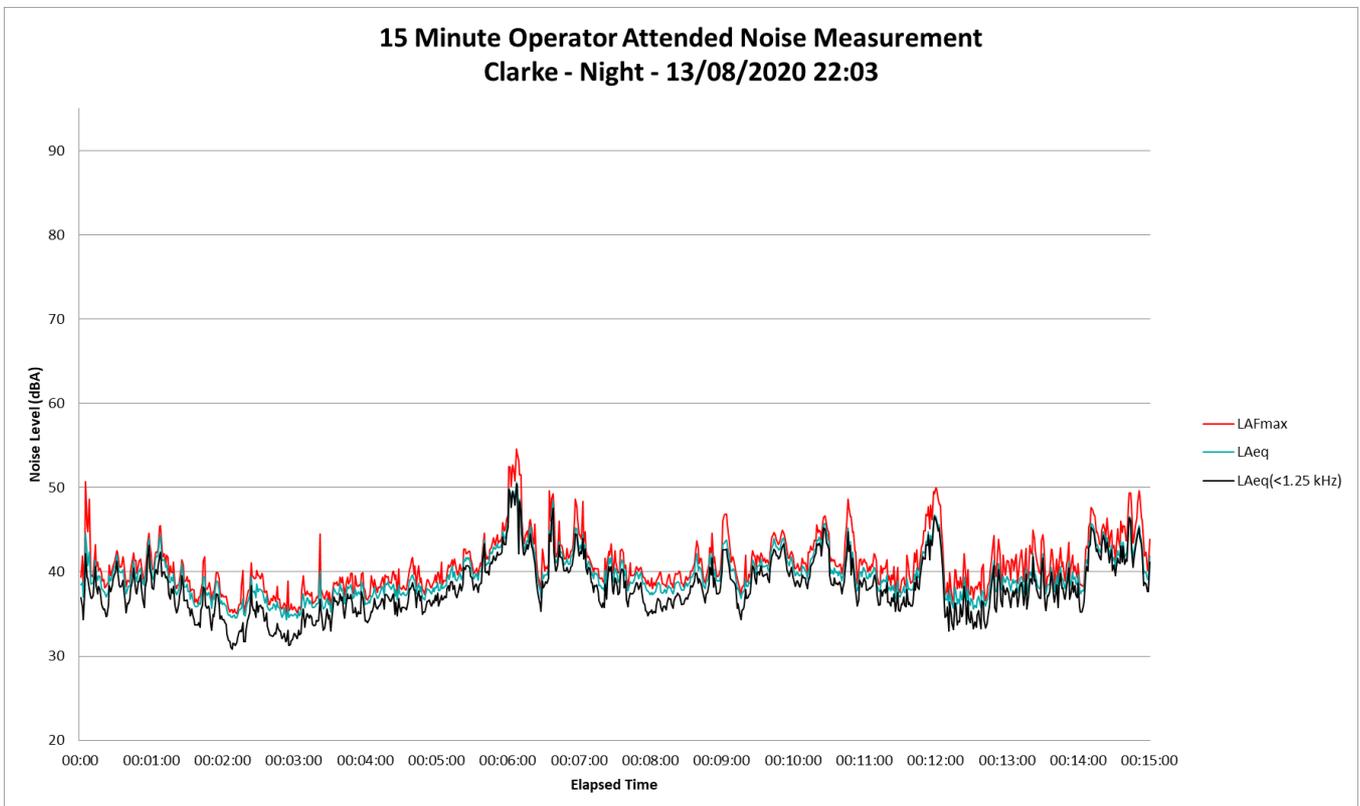


Figure B7 – Day Period – ‘Hall’ Operator Attended Noise Survey Results

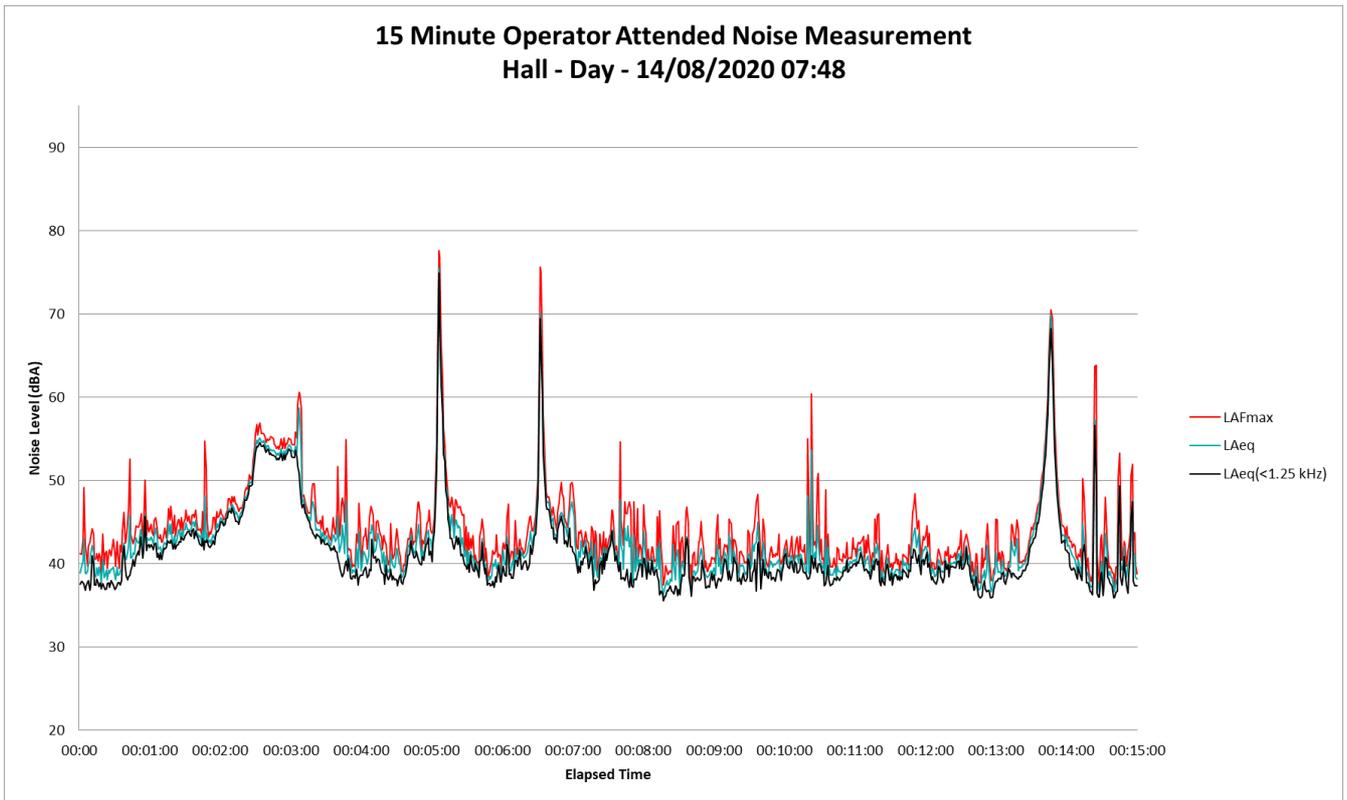


Figure B8 – Evening Period – ‘Hall’ Operator Attended Noise Survey Results

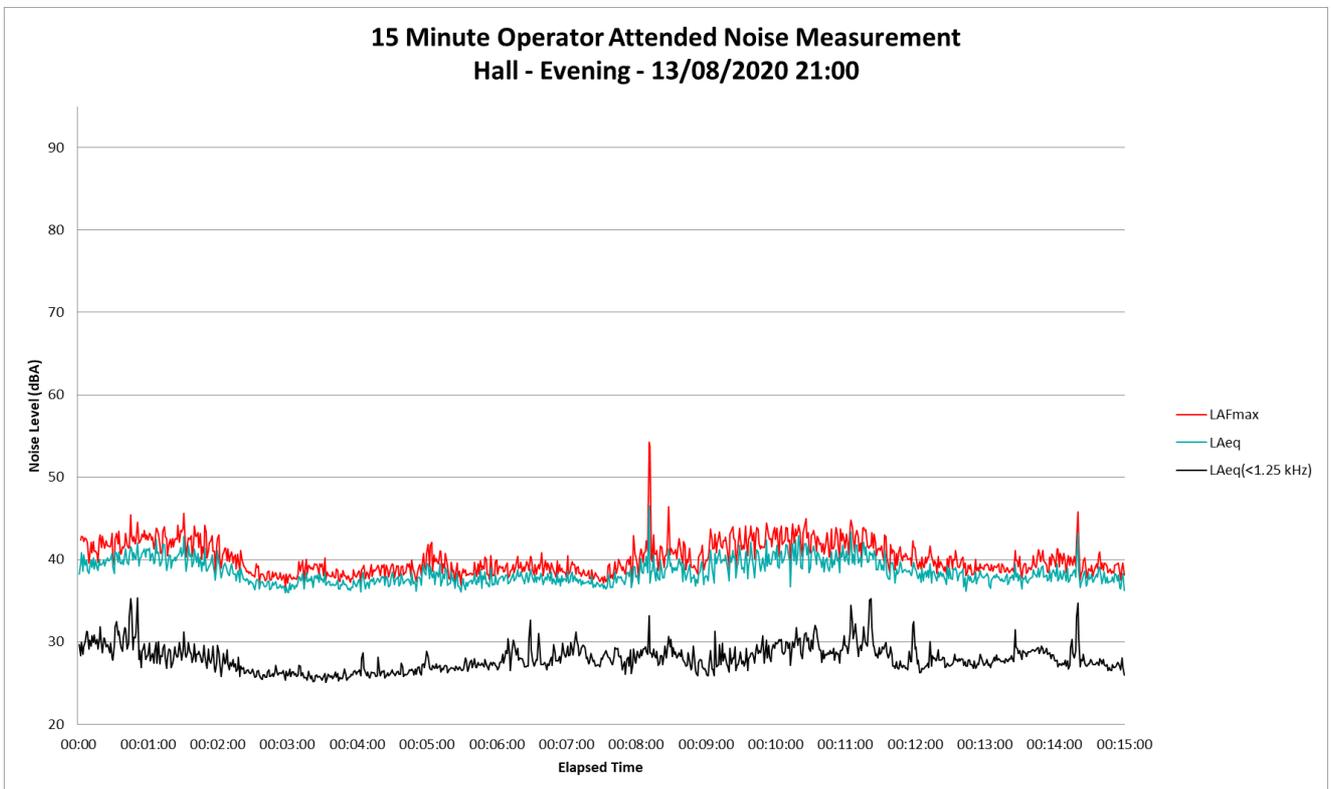


Figure B9 – Night Period – ‘Hall’ Operator Attended Noise Survey Results

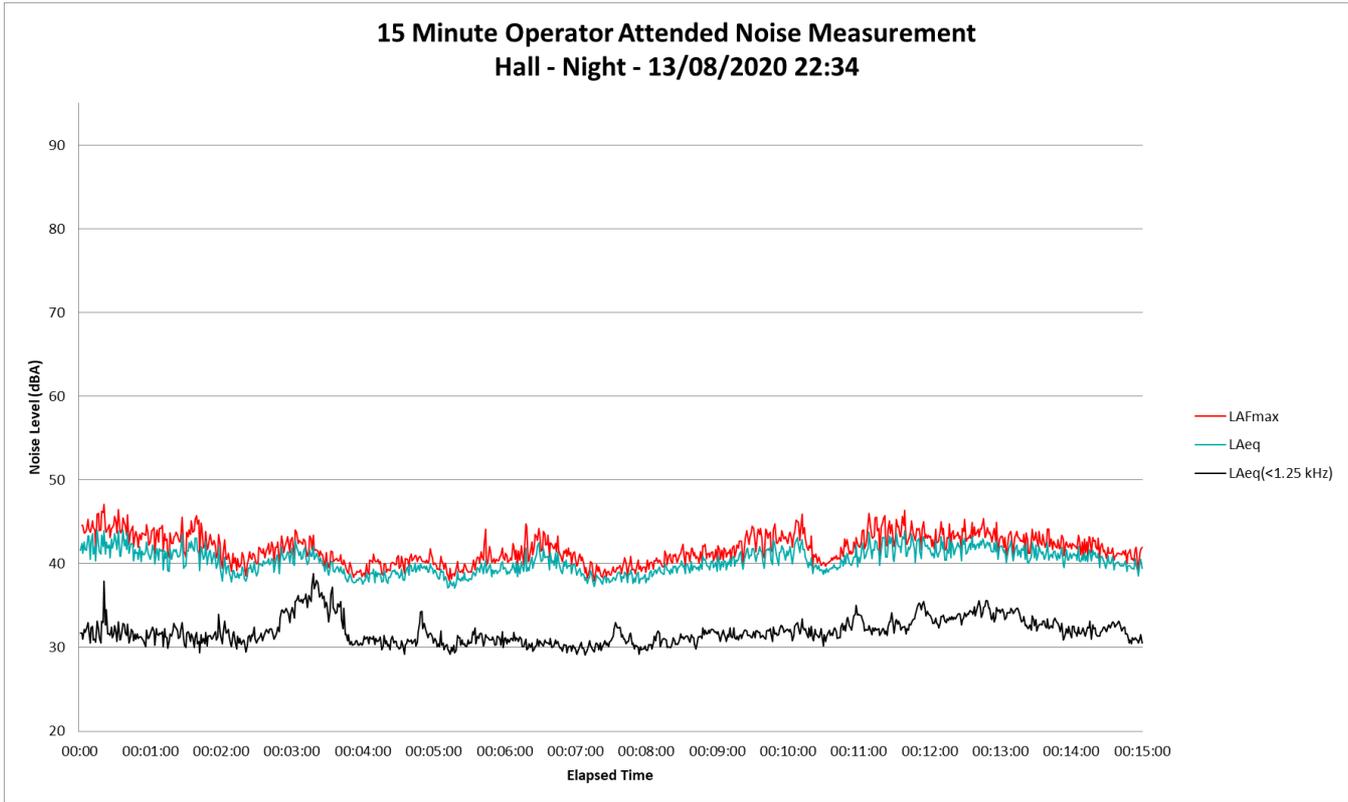


Figure B10 – Day Period – ‘Lowrey’ Operator Attended Noise Survey Results

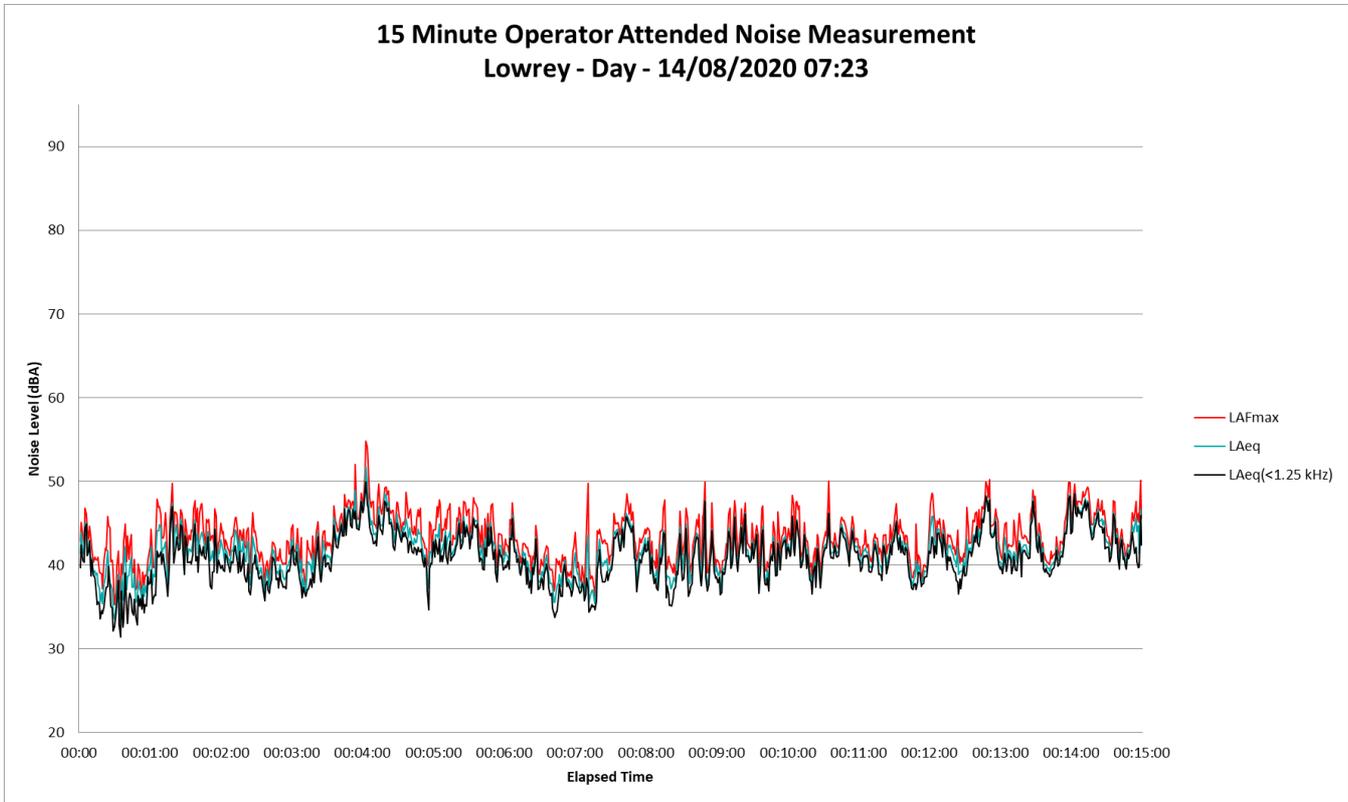


Figure B11 – Evening Period – ‘Lowrey’ Operator Attended Noise Survey Results

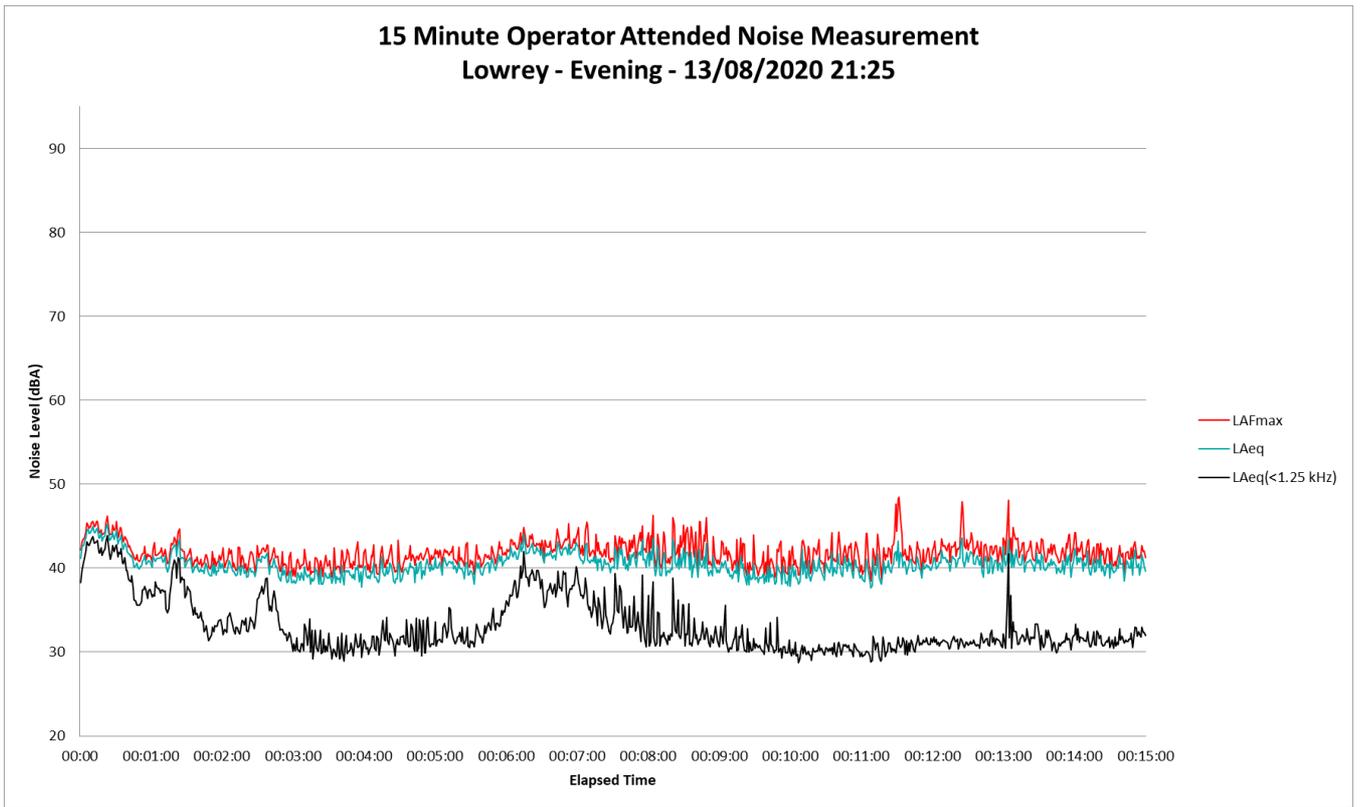


Figure B12 – Night Period – ‘Lowrey’ Operator Attended Noise Survey Results

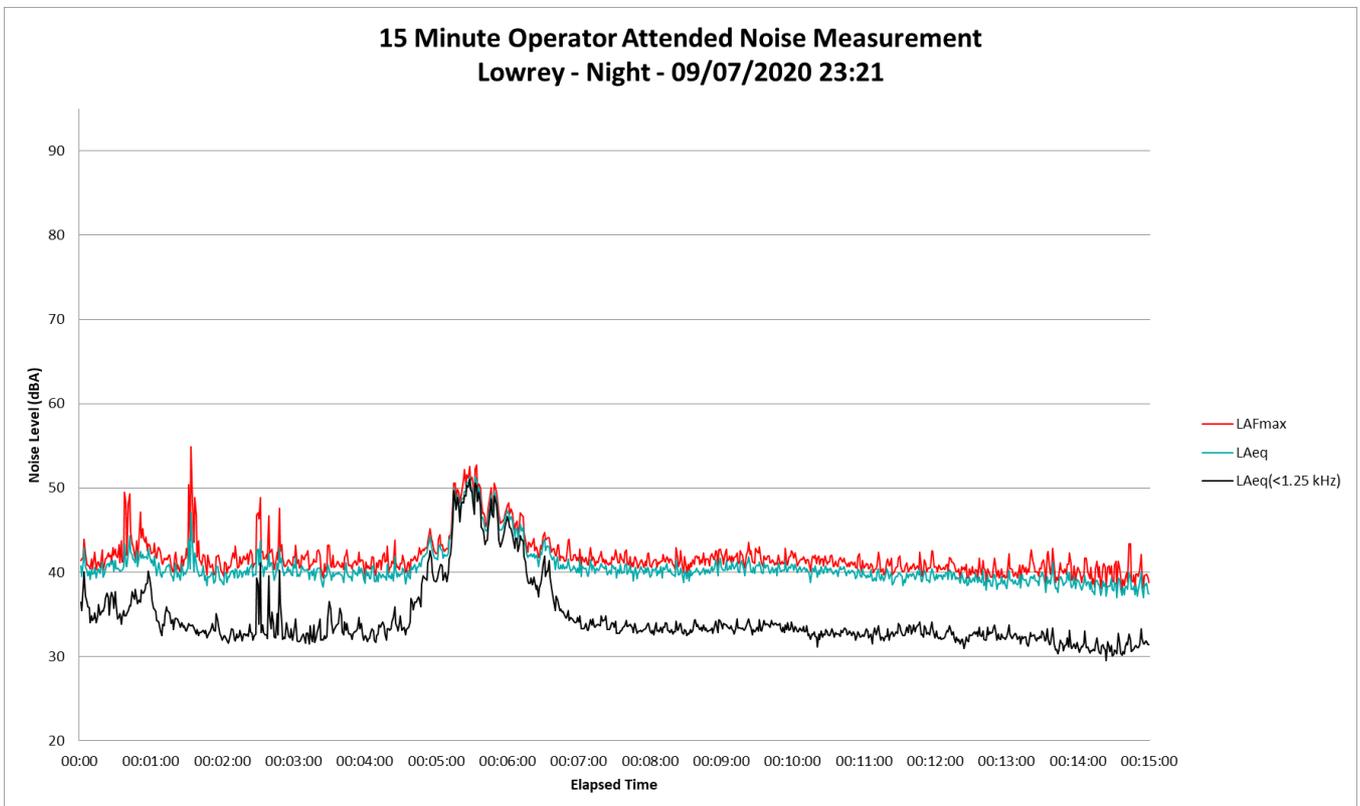


Figure B14 – Day Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

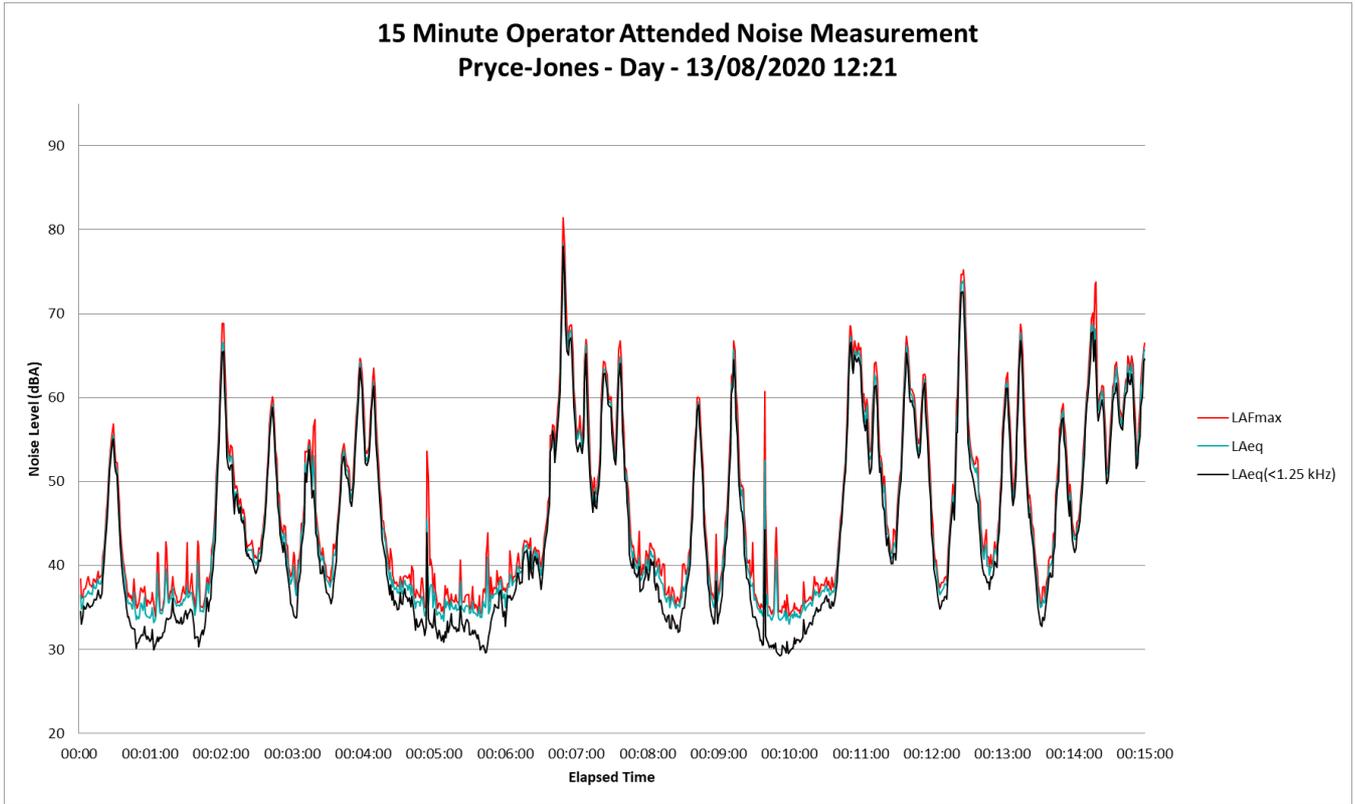


Figure B15 – Evening Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

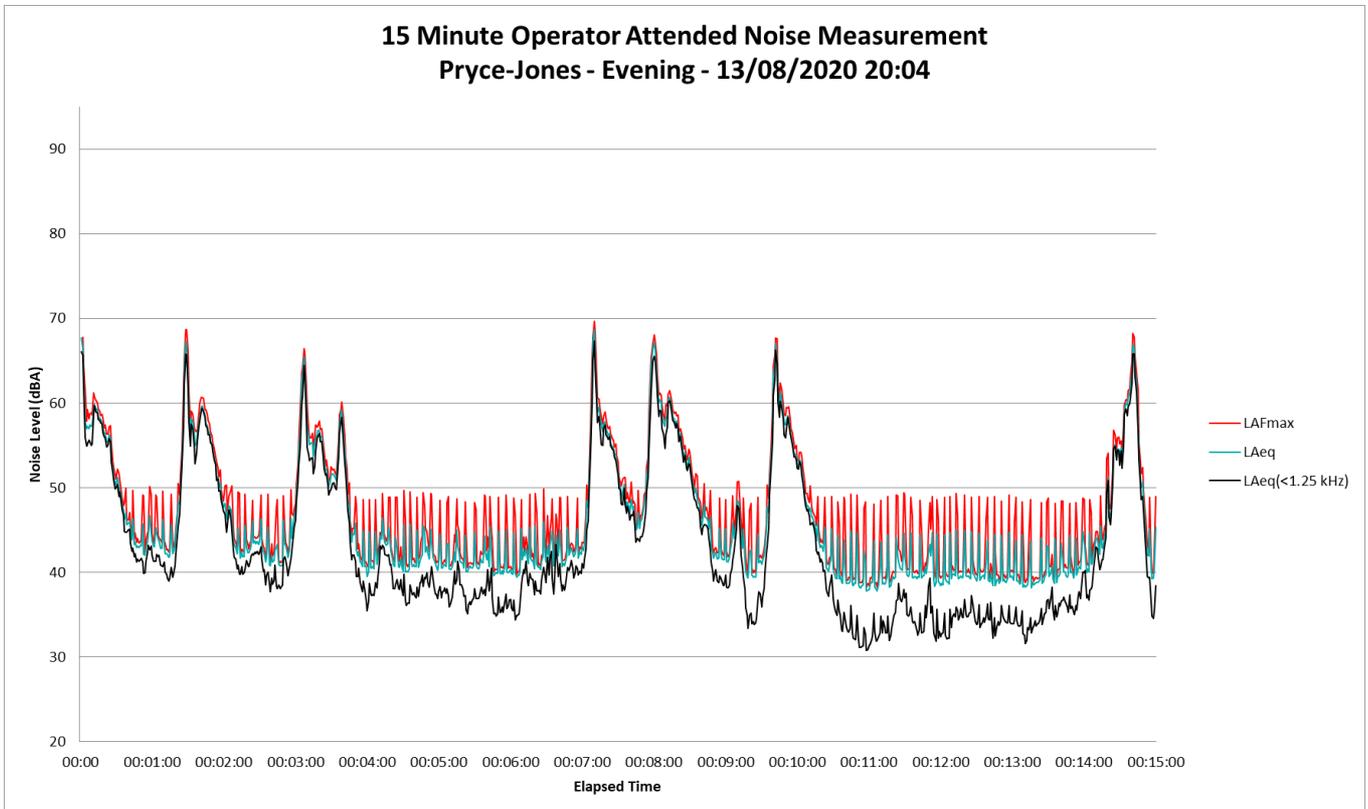


Figure B16 – Night Period – ‘Pryce Jones’ Operator Attended Noise Survey Results

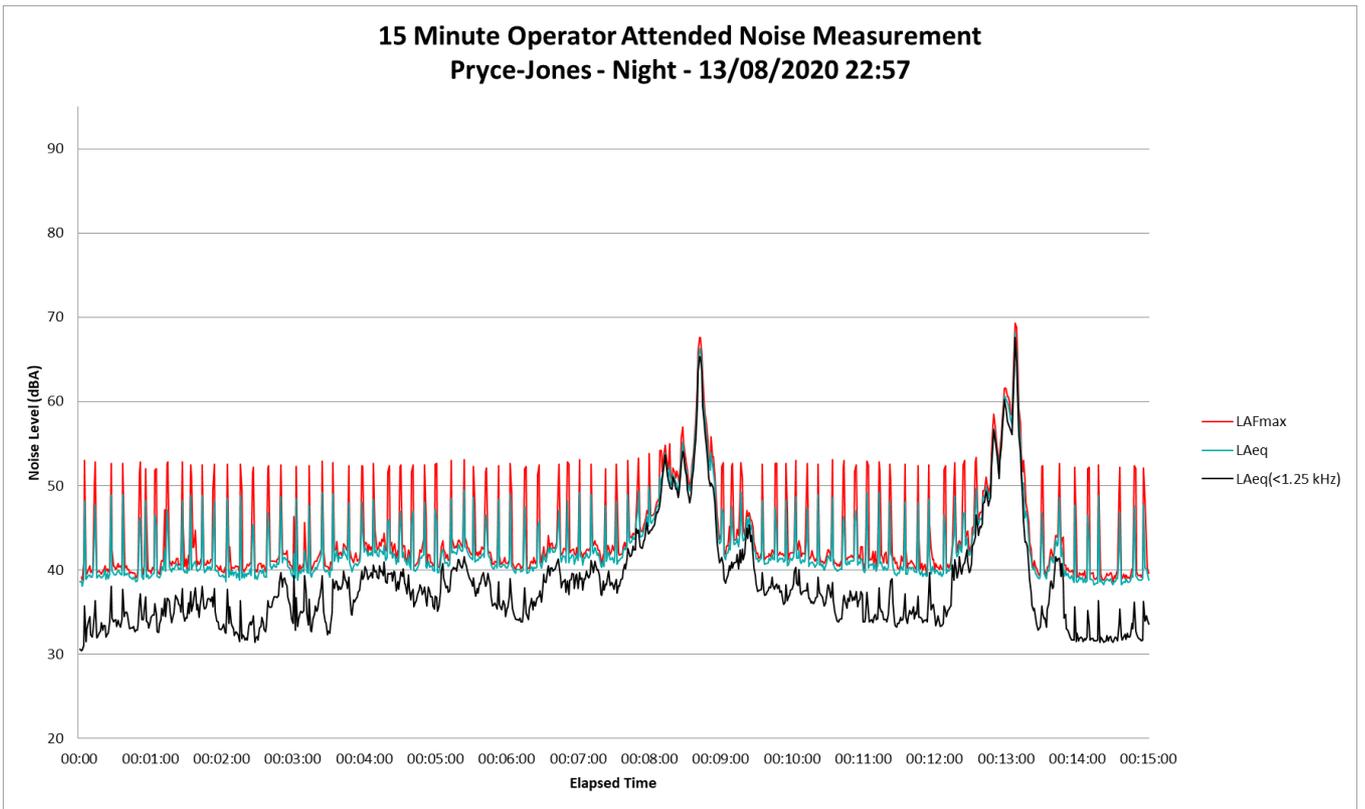


Figure B17 – Day Period – ‘Van der Drift’ Operator Attended Noise Survey Results

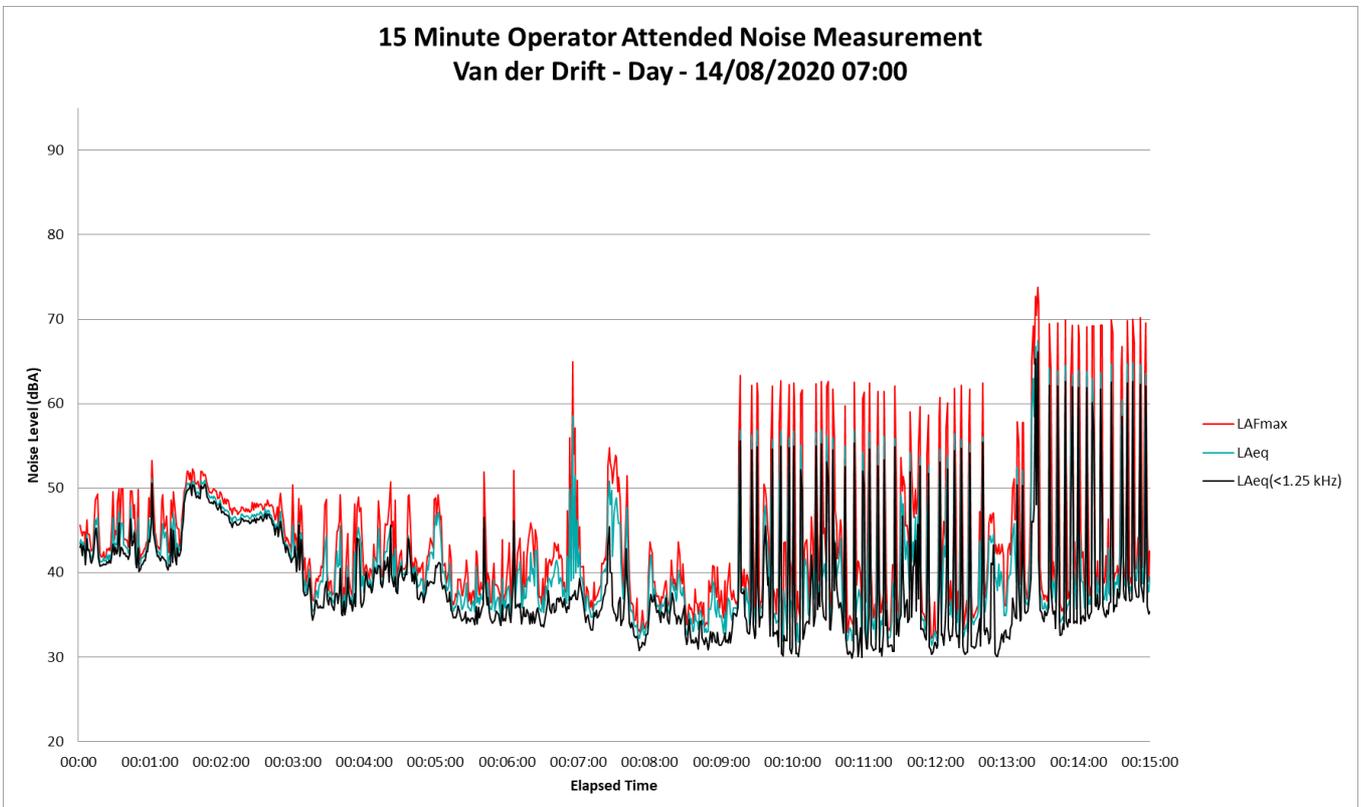


Figure B18 – Evening Period – ‘Van der Drift’ Operator Attended Noise Survey Results

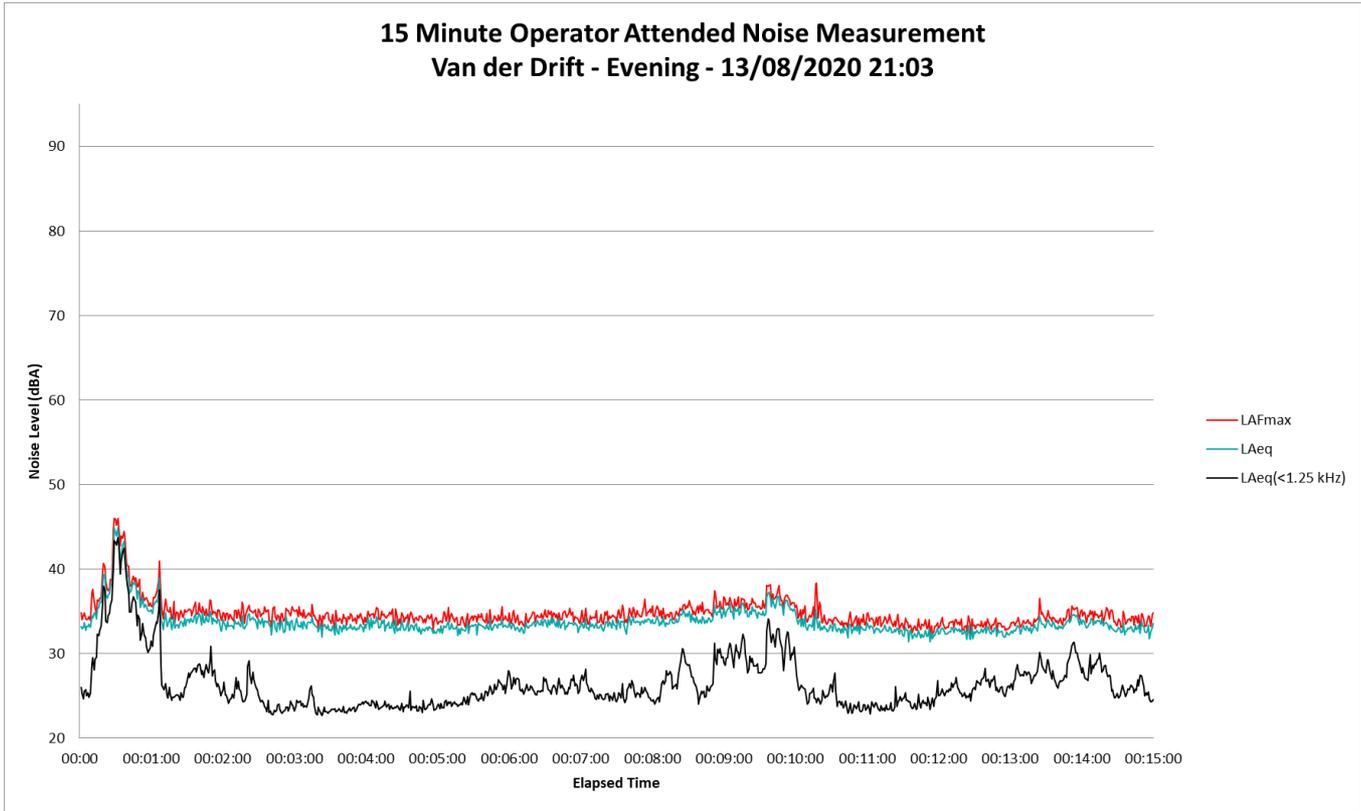


Figure B19 – Night Period – ‘Van der Drift’ Operator Attended Noise Survey Results

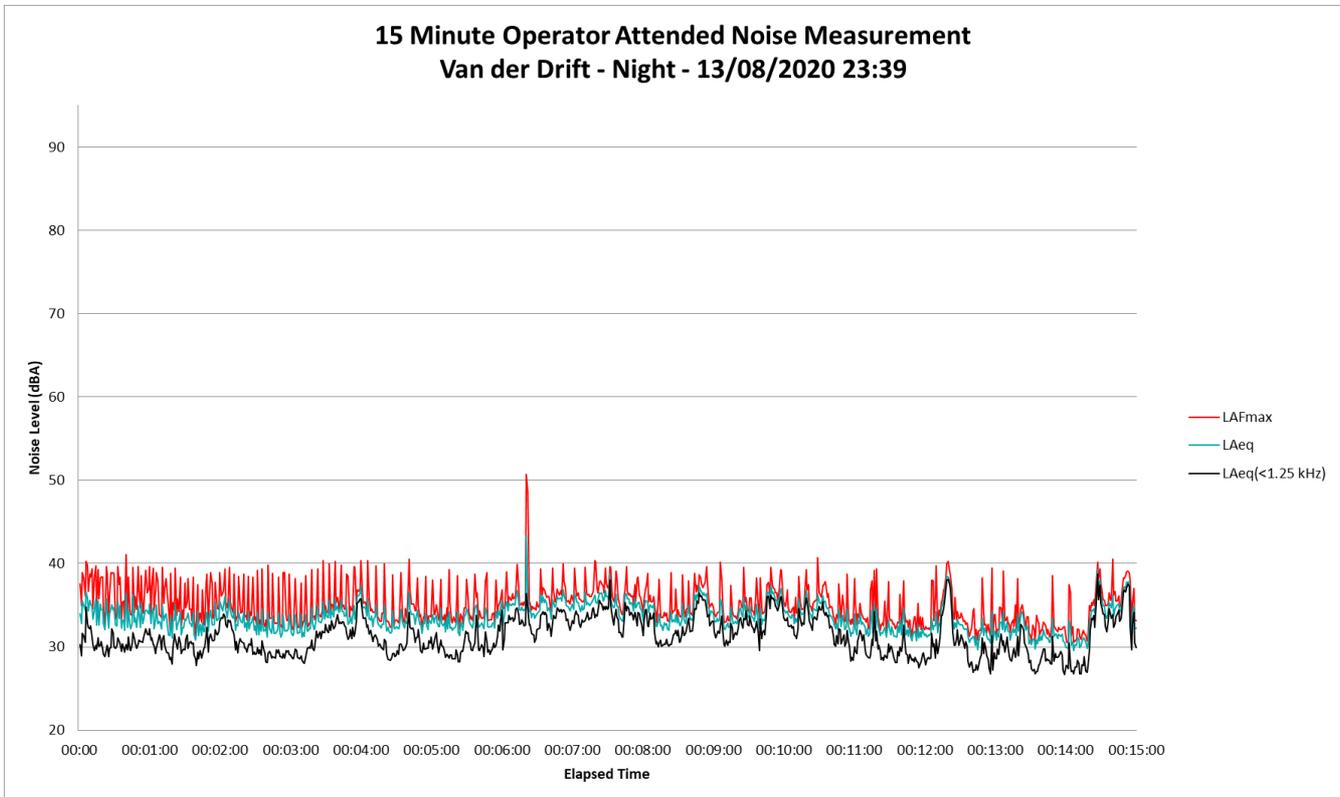


Figure B20 – Day Period – ‘Greenwood’ Operator Attended Noise Survey Results

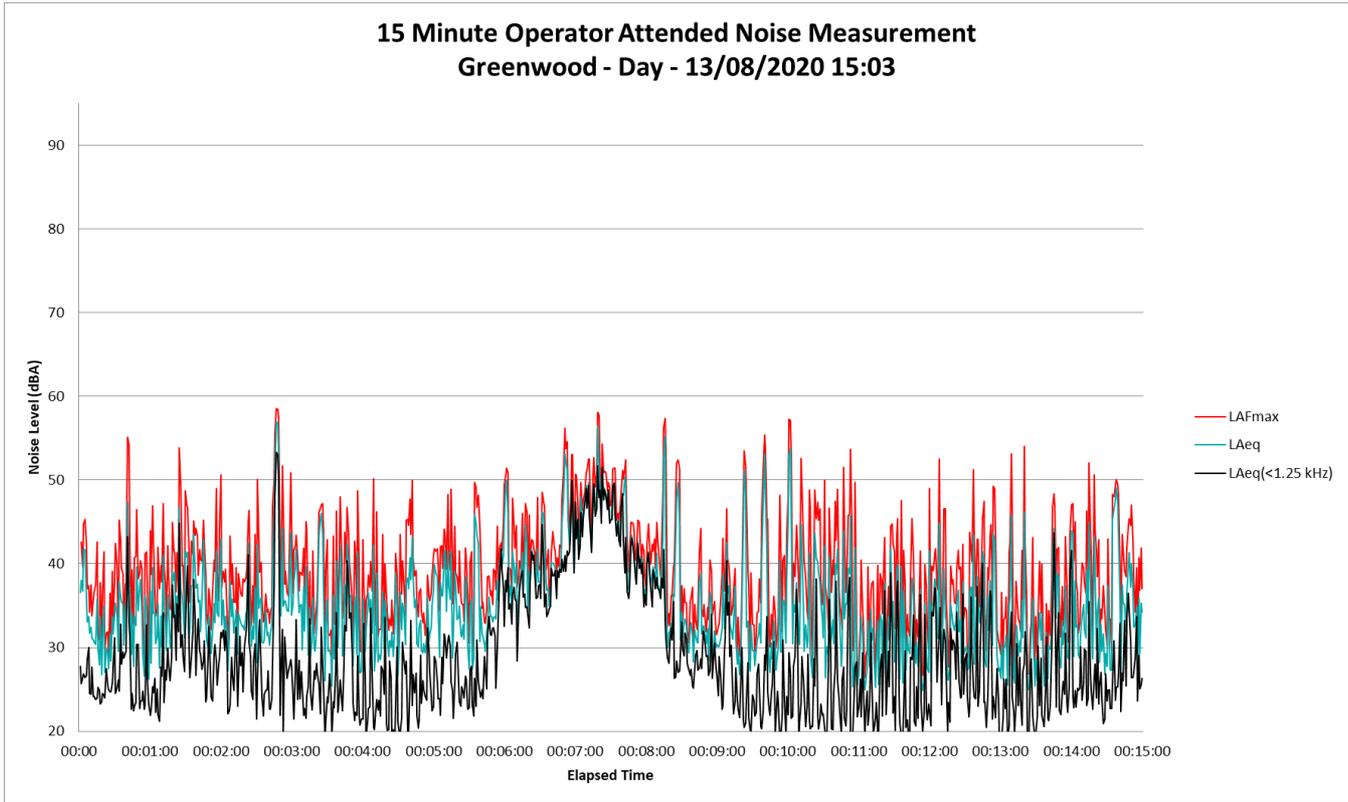


Figure B21 – Evening Period – ‘Greenwood’ Operator Attended Noise Survey Results

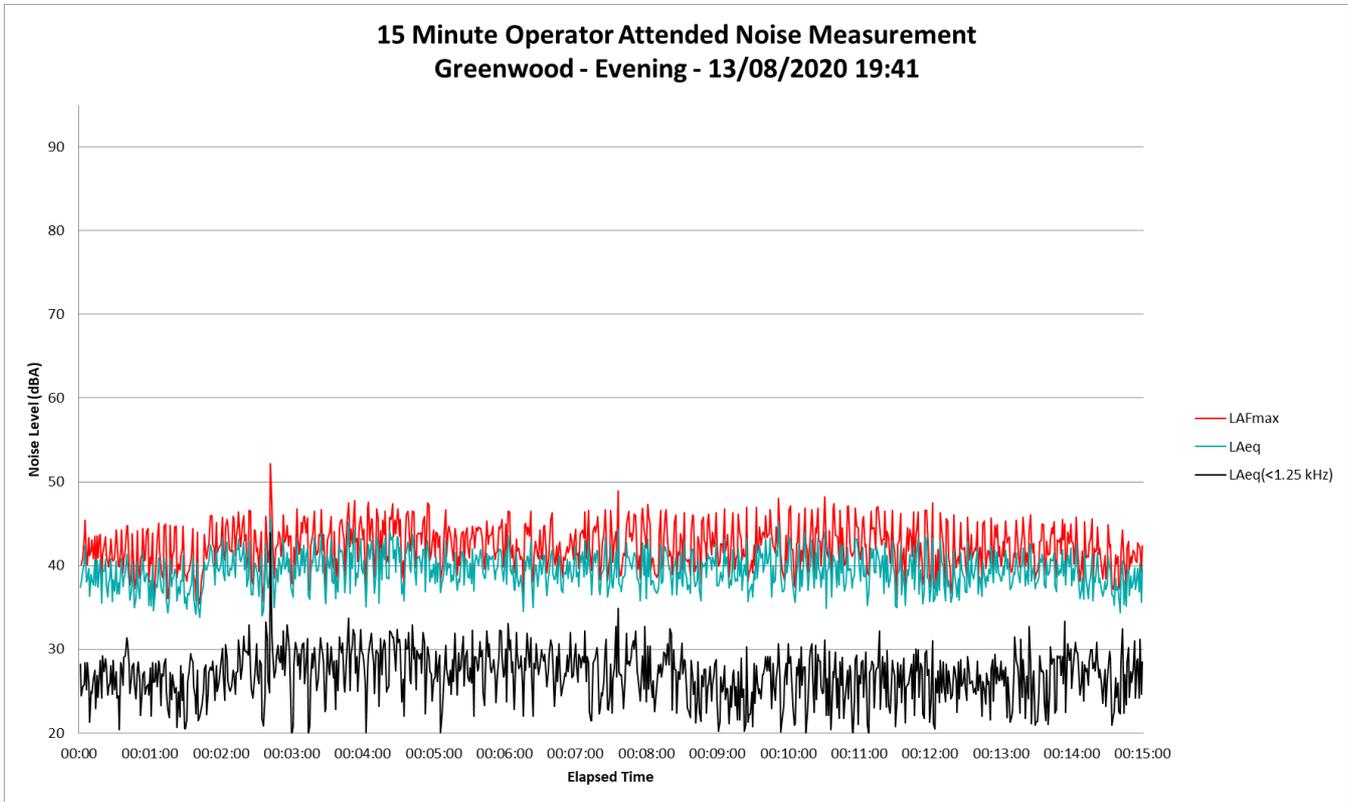


Figure B22 – Night Period – ‘Greenwood’ Operator Attended Noise Survey Results

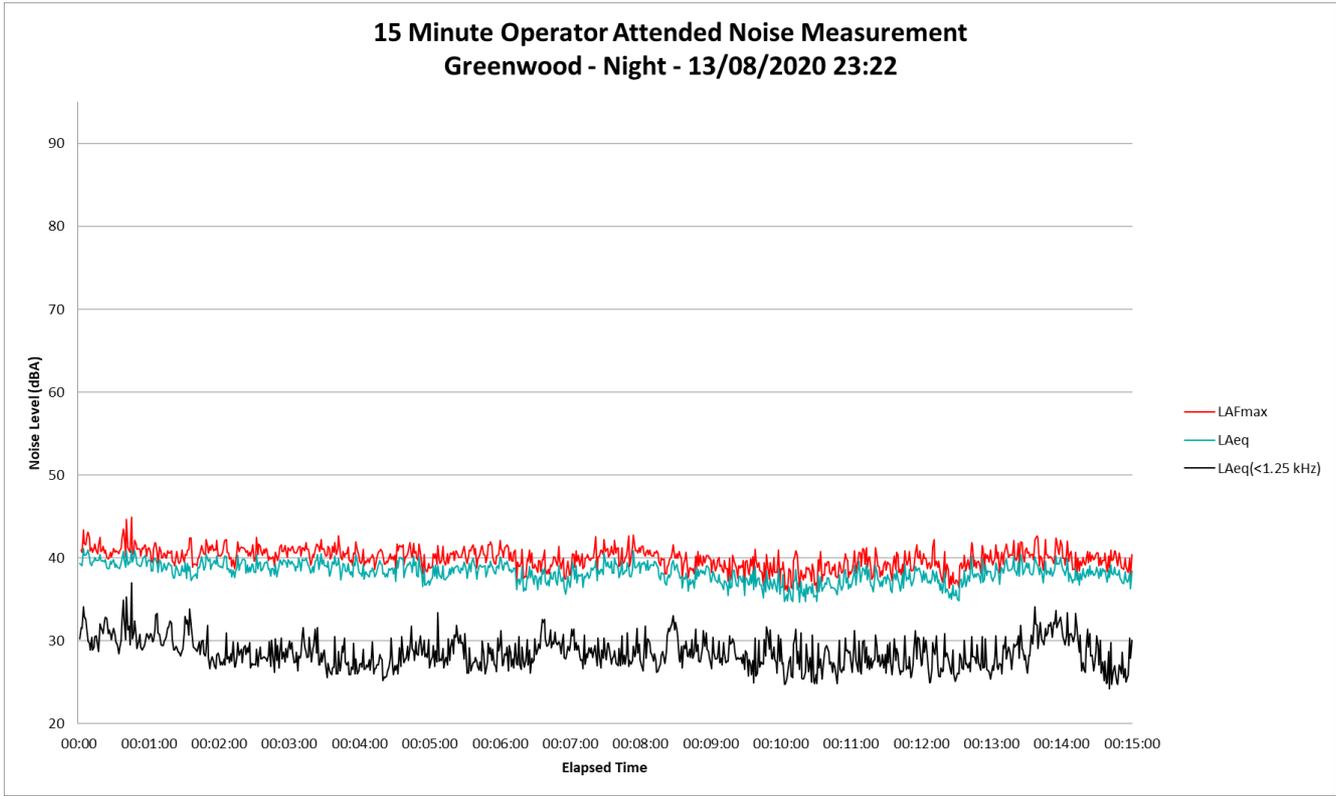


Figure B23 – Day Period – ‘Wadland’ Operator Attended Noise Survey Results

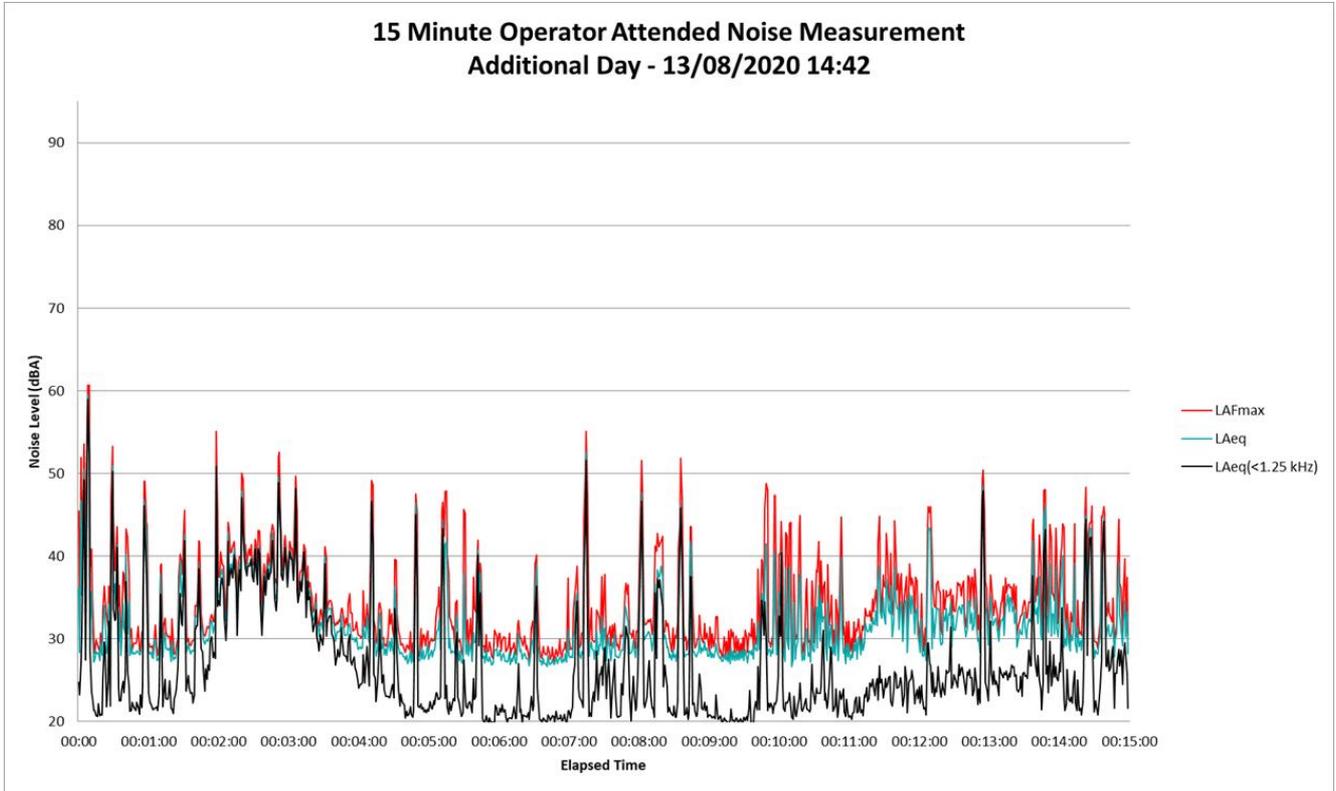


Figure B24 – Evening Period – ‘Wadland’ Operator Attended Noise Survey Results

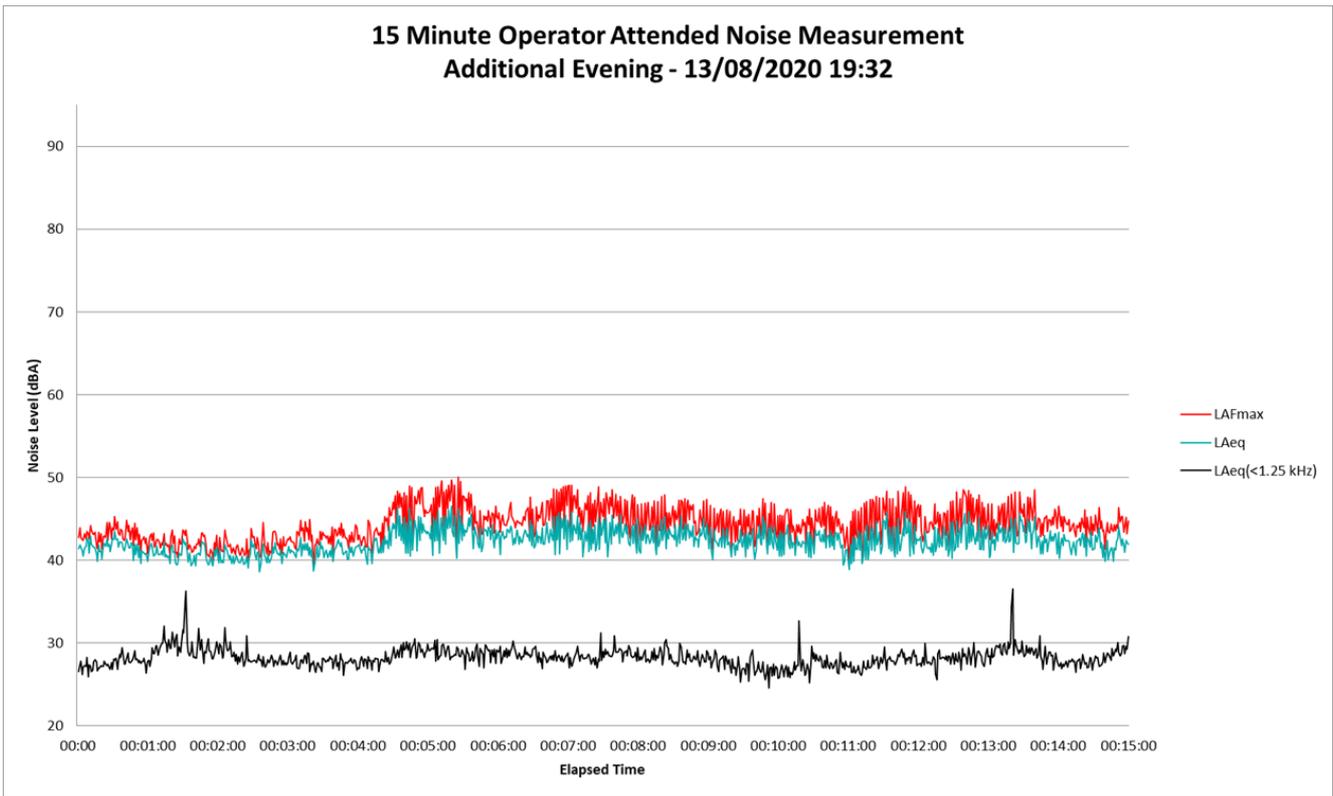
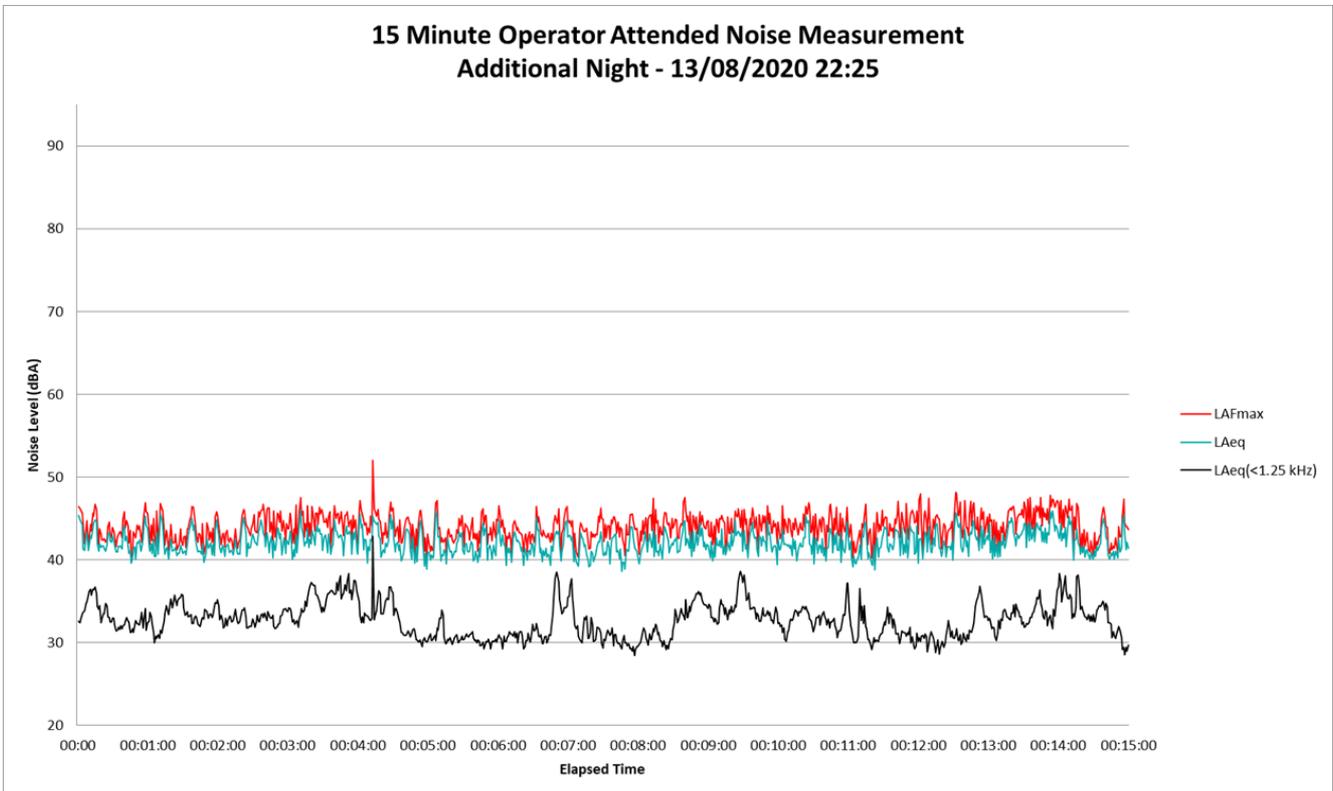


Figure B25 – Night Period – ‘Wadland’ Operator Attended Noise Survey Results



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