Appendix G

Noise Impact Assessment

ZEPHYR ENERGY

PARRON WIND FARM

BADGINGARRA

NOISE IMPACT ASSESSMENT

NOVEMBER 2024

OUR REFERENCE: 33167-5-24117-06

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NOISE IMPACT ASSESSMENT

PARRON WIND FARM, BADGINGARRA

Job No: 24117-06

Document Reference : 33167-5-24117-06

FOR

ZEPHYR ENERGY

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REVISION HISTORY

Revision	Description	Date	Author	Checked
1	Revision to include new background noise monitoring	25/9/2024	GW	
2	Revision for typographical error	27/9/2024	GW	
3	Revision of report following client feedback	7/10/2024	GW	
4	Revision following DWER Noise Branch Advice note	18/11/2024	GW	TR

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CONTENTS

APPENDICIES

1. INTRODUCTION

Herring Storer Acoustics were commissioned to carry out a noise impact assessment for the proposed Parron Wind Farm development, located in the vicinity of Badgingarra, to address the development approval conditions for the project.

The proposed development site is located 5km to the north of the existing Emu Downs Wind Farm.

The proposed wind farm consists of 79 wind turbines, in cleared farming country.

See Appendix A for locations of turbines and noise sensitive premises and Appendix B for a table of wind turbine locations and types.

The noise impact assessment has been carried out in accordance with the EPA of South Australia *"Wind Farms – Environmental noise guidelines– July 2009, Updated November 2021"* (Guidelines) which is the guidelines recognised by the Department of Water and Environment Regulation (DWER) for the assessment of wind farms.

2. SUMMARY

Noise levels were assessed at 25 identified receiver points, with these locations shown in Appendix A.

Noise emissions have been calculated to comply with the noise criteria based upon background noise monitoring at all locations, with the exception of R4, R5, R7 and R24. All premises where an exceedance to the noise criteria based upon background noise monitoring are "Stake Holder" premises, at which the criteria based upon background noise monitoring is not applicable.

The noise levels at the "Stake Holder" premises comply with the criteria recommended by the SA Guidelines for such premises.

3. CRITERIA

According to the Western Australian Planning Position Statement : Renewable Energy Facilities - March 2020, the noise impact of proposed wind farms in Western Australia should be assessed in accordance with the criteria and approach of assessing wind farms described in the EPA of South Australia *"Wind Farms – Environmental noise guidelines– July 2009, Updated November 2021"* (Guidelines).

Whilst the Western Australian Planning Position Statement additionally refers to the requirement of wind farms to meet the standards prescribed under the Environmental Protection (Noise) Regulations 1997, which relates to "unreasonable noise". The Environmental Protection Act 1986 under Part 1, Section 3, Clause 3 defines "unreasonable noise" as follows :

For the purposes of the Act, noise is to be unreasonable if –

a) It is emitted, or the equipment emitting it is used, in contravention of –
   i) this Act;
   ii) any subsidiary legislation made under this Act; or
   iii) any requirement or permission (by whatever name called) made or given by or under this Act;

b) having regard to the nature and duration of the noise emissions, the frequency of similar noise emissions from the same sources (or a source under the control of the same person or persons) and the time of day at which the noise is emitted, the noise unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person; or

c) it is prescribed to be unreasonable for the purposes of the Act.

Given that the Regulations, and associated guidelines associated with the Regulations, were established prior to wind farms being a realistic consideration in Western Australia, and the meteorological conditions dictated within the DWER guidance on environmental noise for the modelling and assessment of proposed noise sources does not align with the maximum noise generated by wind turbines, the SA Guidelines is considered to provide an appropriate criteria to utilise for assessment purposes of noise emissions associated with wind farms, based upon part b) of Clause 3 of the Act above. Hence, the Guidelines has been utilised in this assessment.

The Guidelines recommend the following criteria for the assessment of noise levels associated with proposed wind farms.

The predicted equivalent noise level ($L_{Aeq,10\ minutes}$), adjusted for tonality in accordance with the Guidelines, should not exceed :

- 35 dB(A), or
- 40 dB(A) in a primary production / rural industry zone, or
- the "Alternative Minimum Criteria" (Varying with Wind Speed); or
- the background noise ($L_{A90,10\ minutes}$) by more than 5 dB(A).

The criteria for background noise levels will vary with wind speed, as will wind turbine generated noise.

The alternative minimum criterion, varying with wind speed, are listed below in Table 3.1. This conservative minimum criterion has been determined based on a comparison of background noise levels at a number of existing and proposed wind farm sites around Australia.

TABLE 3.1 – ALTERNATIVE MINIMUM CRITERIA (VARYING WITH WIND SPEED)

	Wind Speed at 10m above ground level					
	≤ 5	**6**	**7**	**8**	**9**	**≥ 10**
Minimum Criteria L_{Aeq} [dB(A)]	35	37	38	40	41	43

Based on the results of background noise monitoring undertaken between March and May 2007 (presented in the Sonus report, included in Appendix F), the criteria for wind turbine noise are as presented in Table 3.2.

TABLE 3.2 – NOISE CRITERIA BASED ON BACKGROUND NOISE LEVELS, dB(A)

Background Monitoring Location	WIND SPEED AT 10m ABOVE GROUND LEVEL (m/s)								
	4	5	6	7	8	9	10	11	12
A	35	36	38	40	43	46	48	51	52
B	35	35	36	38	40	42	45	48	52
C	35	35	35	36	38	40	42	44	45
D	35	35	36	39	43	47	51	54	56
E	35	38	43	46	49	52	55	58	61
F	35	35	38	42	45	47	49	51	52
G	35	35	35	39	42	46	49	52	54
H	35	35	38	40	42	43	45	48	51
I	35	36	40	43	45	47	49	52	55
J	35	35	37	38	39	41	42	44	46
K	35	35	36	38	41	43	46	48	51
L	35	35	35	38	40	42	44	45	46
M	35	36	38	40	42	44	47	49	51

Further to the background noise monitoring undertaken in 2007, background noise monitoring was undertaken by Herring Storer Acoustics during July and August 2024. This monitoring was undertaken to the north of the wind farm with the report included in Appendix G. The criteria for wind turbine noise at the monitored locations are as presented in Table 3.3. it is noted that as per the results of the background noise monitoring, Location 3 background noise criteria has been used in place of Location 2 due to the presence of frog noise impact noise levels at Location 2.

TABLE 3.3 – NOISE CRITERIA BASED ON BACKGROUND NOISE LEVELS, dB(A)

Background Monitoring Location	WIND SPEED AT 150m ABOVE GROUND LEVEL (m/s)									
	4	5	6	7	8	9	10	11	12	13
1	35	35	35	35	35	35	35	35	37	42
2	39	39	39	40	41	42	42	43	43	44
3	39	39	39	40	41	42	42	43	43	45
4	35	35	35	35	35	35	36	37	39	42

As the 2007 background noise monitoring was correlated to wind speeds at a height of 10m above ground level, the 2024 monitoring criteria needs to be rationalised to this height, noting that 4m/s at 10m AGL relates to a wind speed of 7 m/s at 150m AGL.

Hence, Table 3.4 summarises the 2024 background noise monitoring criteria, rationalised to 10m AGL.

TABLE 3.3 – NOISE CRITERIA BASED ON BACKGROUND NOISE LEVELS, dB(A)

Background Monitoring Location	WIND SPEED AT 10m ABOVE GROUND LEVEL (m/s)			
	4	5	6	7
1	35	35	35	42
2	40	42	43	45
3	40	42	43	45
4	35	35	37	42

Utilising the nearest background noise monitoring location to each receiver point considered, results in the following background noise monitoring locations being utilised as shown in Table 3.3 below.

TABLE 3.3 – BACKGROUND NOISE MONITORING LOCATION UTILISED TO DETERMINE NOISE CRITERIA FOR EACH RECEIVER LOCATION

ID#	Background Noise Monitoring Location Utilised
R1	M
R2	B
R3	D
R4	C
R5	I
R6	E
R7	F
R8	L
R9	H
R10	4
R11	4
R12	4
R13	3
R14	3
R15	3
R16	3
R17	2
R18	2
R19	2
R20	2
R21	2
R22	1
R23	1
R24	1
R25	1

This assessment has been based on the noise criteria based on monitored background noise levels. It is noted that the Guidelines have been developed to minimise the impact on the amenity of premises that do not have an agreement with wind farm developers. Our assessment includes all identified residential premises in the surrounding area, some of which may have such an agreement.

The Guidelines recommends that a noise level criteria of not greater than 30 dB(A) indoors and 45 dB(A) outdoor is considered acceptable for “Stake-Holder” premises.

4. MODELLING

Noise immissions at residential premises, due to the proposed wind farm, were determined by noise modelling, using the computer program "SoundPlan" version 9.0.

SoundPlan uses the theoretical sound power levels determined from measured sound pressure levels to calculate the noise level at any location.

The following input data was used in the SoundPlan model:

a) Topographical Information – Ground contours of the development area;

b) Residential and Wind Turbine Locations – See Appendix A; and

c) Sound Power Levels, varying with wind speed, of the wind turbines intended to be utilised. The turbine proposed to be utilised is as follows:

   Vestas V162-6.2 MW, 150m hub height, Blades with serrated trailing edges in normal operating mode (Noise Mode 0).

See Appendix B for locations and Appendix C for turbine specifications.

The Guidelines indicate that noise immissions should be modelled to reflect typical, (but not extreme) "worst case" meteorological conditions for sound propagation towards the receiver.

After a review of the literature available on the subject, noise level emissions were modelled using the ISO 9613-2:2024 algorithm, with the conditions listed in Table 4.1. These conditions, and calculating noise levels utilising a "G=0" ground absorption, and a receiver height of 1.4m, have been found to provide a generally realistic and conservative assessment of noise levels associated with wind turbines. This is also listed in Annex D of ISO 9613-2:2024 "Calculation of sound pressure levels caused by wind turbines" – hence is considered appropriate.

TABLE 4.1 – METEOROLOGICAL CONDITIONS

Condition	Value
Temperature	15 °C
Relative humidity	70%
Atmospheric Pressure	101.325 kPa

Noise levels attributable to the proposed wind farm were calculated for integer wind speeds 4 – 6m/s at a height of 10m above ground level. A wind speed of 6m/s at a height of 10m above ground level corresponds to a hub height wind speed of almost 11m/s. At 11m/s hub height wind speed, the selected wind turbine has reached maximum noise level output according to the technical specifications, and therefore increases in wind speed beyond this level does not need to be considered.

The wind shear rate that has been assumed for this calculation is 0.22/s, which was provided based upon extensive ongoing wind monitoring in the area.

The sound power level of the turbines were varied for each integer wind speed, however the other weather conditions within the model remained constant at the conditions stipulated in Table 4.1 above.

5. RESULTS

Noise contour plots are attached in Appendix D.

The predicted noise level at each identified residential premises are listed in Table 5.1 below for each of the hub height wind speeds considered, relative to the wind speed at 10m above ground level.

TABLE 5.1 – PREDICTED NOISE LEVELS AT IDENTIFIED RECEIVER LOCATIONS

Receiver ID#	Predicted Noise Level, L_{Aeq} [dB(A)]		
	4m/s @10 AGL	5m/s @10 AGL	6m/s @10 AGL
R1	23	27	28
R2	19	23	24
R3	30	35	35
R4	32	37	37
R5	34	39	39
R6	33	38	38
R7	34	38	39
R8	30	35	35
R9	21	25	26
R10	28	33	33
R11	27	32	32
R12	26	31	31
R13	24	29	29
R14	23	27	28
R15	23	28	28
R16	23	28	28
R17	22	27	27
R18	23	27	28
R19	24	28	29
R20	22	26	26
R21	23	27	28
R22	25	30	30
R23	30	34	35
R24	31	35	36
R25	19	24	24

6. ASSESSMENT

Table 6.1 below summarises the level of exceedance to the noise criteria based on background noise monitoring, with the predicted levels exceeding the criteria highlighted in red and the level of exceedance listed in brackets adjacent.

TABLE 6.1 – ASSESSMENT OF NOISE LEVELS AT IDENTIFIED RECEIVER LOCATIONS

ID#	Predicted Noise Level, L_{Aeq} [dB(A)]			Noise Criteria Based on Background Noise Level, L_{Aeq} [dB(A)]		
	4m/s @10 AGL	5m/s @10 AGL	6m/s @10 AGL	4m/s @10 AGL	5m/s @10 AGL	6m/s @10 AGL
R1	23	27	28	35	36	38
R2	19	23	24	35	35	36
R3	30	35	35	35	35	36
R4	32	37 (+2)	37 (+2)	35	35	35
R5	34	39 (+3)	39	35	36	40
R6	33	38	38	35	38	43
R7	34	38 (+3)	39 (+1)	35	35	38
R8	30	35	35	35	35	35
R9	21	25	26	35	35	38
R10	28	33	33	35	35	37
R11	27	32	32	35	35	37
R12	26	31	31	35	35	37
R13	24	29	29	40	42	43
R14	23	27	28	40	42	43
R15	23	28	28	40	42	43
R16	23	28	28	40	42	43
R17	22	27	27	40	42	43
R18	23	27	28	40	42	43
R19	24	28	29	40	42	43
R20	22	26	26	40	42	43
R21	23	27	28	40	42	43
R22	25	30	30	35	35	35
R23	30	34	35	35	35	35
R24	31	35	36 (+1)	35	35	35
R25	19	24	24	35	35	35

As can be seen from the above tables, calculated noise levels generally comply with the noise criteria based upon background noise monitoring, with the exception of R4, R5, R7 and R24. R5 and R7 are “Stake Holder” premises, at which the criteria based upon background noise monitoring is not applicable. The project has secured neighbour agreements with the landowners of sensitive receptors at R4 and R24 such that these residents would be considered “Stake Holder” premises.

The SA Guidelines suggests a level of 45 dB(A) is considered acceptable for “Stake-Holder” premises – which is met for all wind speeds at these locations.

If approved, it is anticipated the development will be subject to a Noise Management Plan that demonstrates noise emissions will achieve compliance with the requirements in the EPA of South Australia *“Wind Farms – Environmental noise guidelines– July 2009, Updated November 2021”*

7. WIND DIRECTION ANALYSIS

On the basis of the DWER Noise Branch opinion, the definition of R4 and R24 as "Stake Holder" premises has been questioned, on the basis they cannot be a "Stake holder" unless the premises host a turbine – rather than a neighbour agreement.

Despite disputing this opinion, an analysis of noise level emissions, varying with wind direction, has been undertaken.

The reason for this additional analysis is due to the predicted noise levels listed in Table 6.1 above determined on the basis of winds in "all directions" occurring at once. Typically, with a noise source that is located, or proposed to be located, in a relatively small area, this is a reasonable assessment method as the downwind propagation condition under consideration could occur.

Wind farms are located over a large, spread out, area where noise sources (wind turbines) can be located in multiple directions from the receiver points. Hence, the "all winds" modelling is considering a conservative scenario that cannot physically occur in reality – hence – over estimates the noise impact at locations – especially in scenarios where there are turbines proposed to be located at multiple locations around a receiver point.

Hence, an analysis of the predicted noise levels under the four cardinal wind directions and at 45 degree increments between, has been undertaken to further explore the noise impact at "R4" and "R24".

The noise modelling was undertaken utilising CONCAWE algorithms, as ISO 9613-2:2024 does not allow for specific wind directions, and undertaken at 6m/s @10m AGL as this is representative of both the highest noise level emission of the wind farm and the highest level of exceedance to the SA Guidelines criteria at both "R4" and "R24".

The absolute predicted noise levels under the above conditions and modelling method, are listed in Table 7.1 below, with the relative difference listed in Table 7.2. It is noted that the absolute levels listed below should not be relied upon, with more emphasis on the relative difference of different wind directions. For visualisation purposes, contour plots are included in Appendix E.

TABLE 7.1 – PREDICTED NOISE LEVELS AT IDENTIFIED RECEIVER LOCATIONS VARYING WITH WIND DIRECTION

Wind Direction	Predicted Noise Level, L_{Aeq} [dB(A)]	
	R4	R24
All Directions	43.9	40.6
45° (NE)	43.7	35.3
90° (E)	43.7	34.3
135° (SE)	42.8	36.4
180° (S)	41.9	39.6
225° (SW)	39.4	40.6
270° (W)	39.8	40.6
315° (NW)	40.9	40.4
0°/360° (N)	42.6	38.7

TABLE 7.2 – PREDICTED NOISE LEVELS AT IDENTIFIED RECEIVER LOCATIONS

RELATIVE DIFFERENCE VARYING WITH WIND DIRECTION

Wind Direction	Predicted Noise Level, L_{Aeq} [dB(A)]	
	R4	R24
45° (NE)	0.2	5.3
90° (E)	0.2	6.3
135° (SE)	1.1	4.2
180° (S)	2	1
225° (SW)	4.5	0
270° (W)	4.1	0
315° (NW)	3	0.2
0°/360° (N)	1.3	1.9

The average diurnal wind speed and direction trend of the wind farm area is shown below in Figure 7.1.

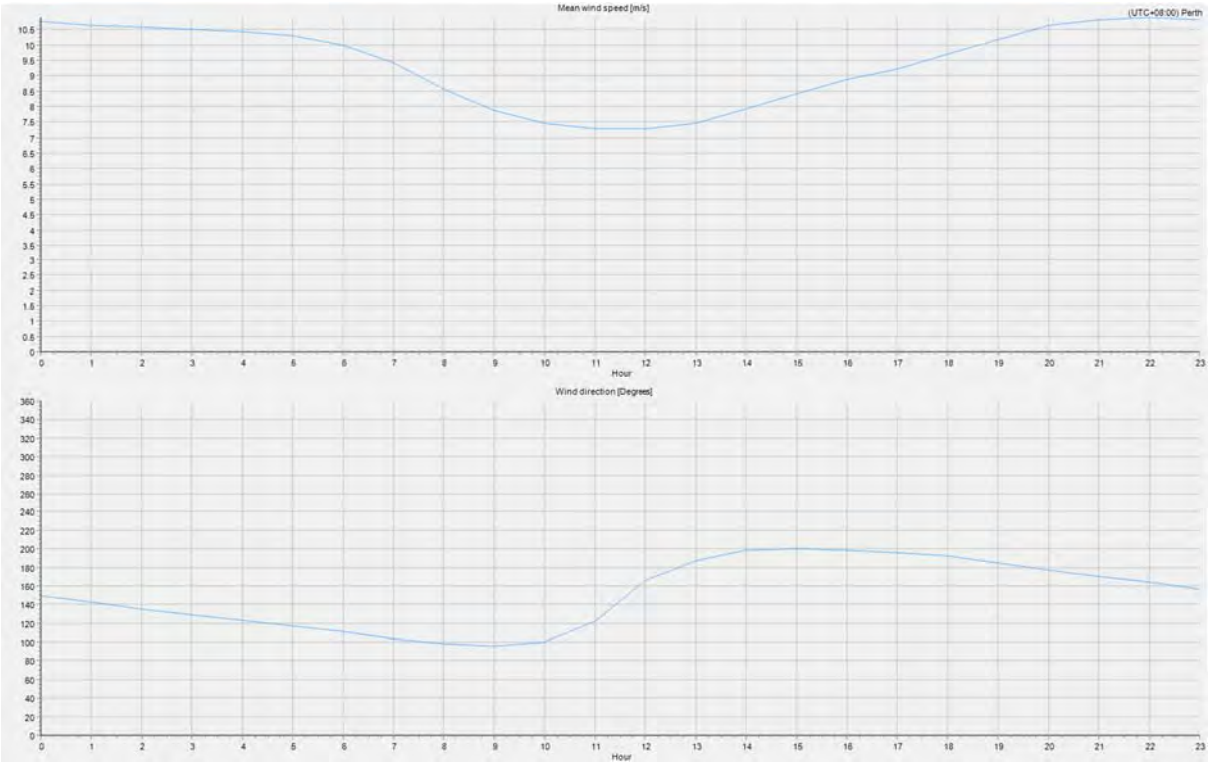


FIGURE 7.1 – AVERAGE DIRUNAL WIND DIRECTION AND SPEED

The night period, between 2200 and 0700 hours is the most stringent time for assessment purposes, with the direction of wind ranging between 100 and 160 degrees during this time period.

On this basis, a reduction of 0.5 – 2 dB could be expected for the predicted noise level at “R4” and 3.5 – 6 dB at “R24”.

Accounting for the above expected ‘actual’ noise levels for realistic wind conditions, noise levels during the night period at R24 would comply with the SA guidelines background noise criteria level.

Noise levels at R4 would either be compliant, or marginally (in the order of 0.5 dB) in excess of the background noise criteria level.

8. CONCLUSION

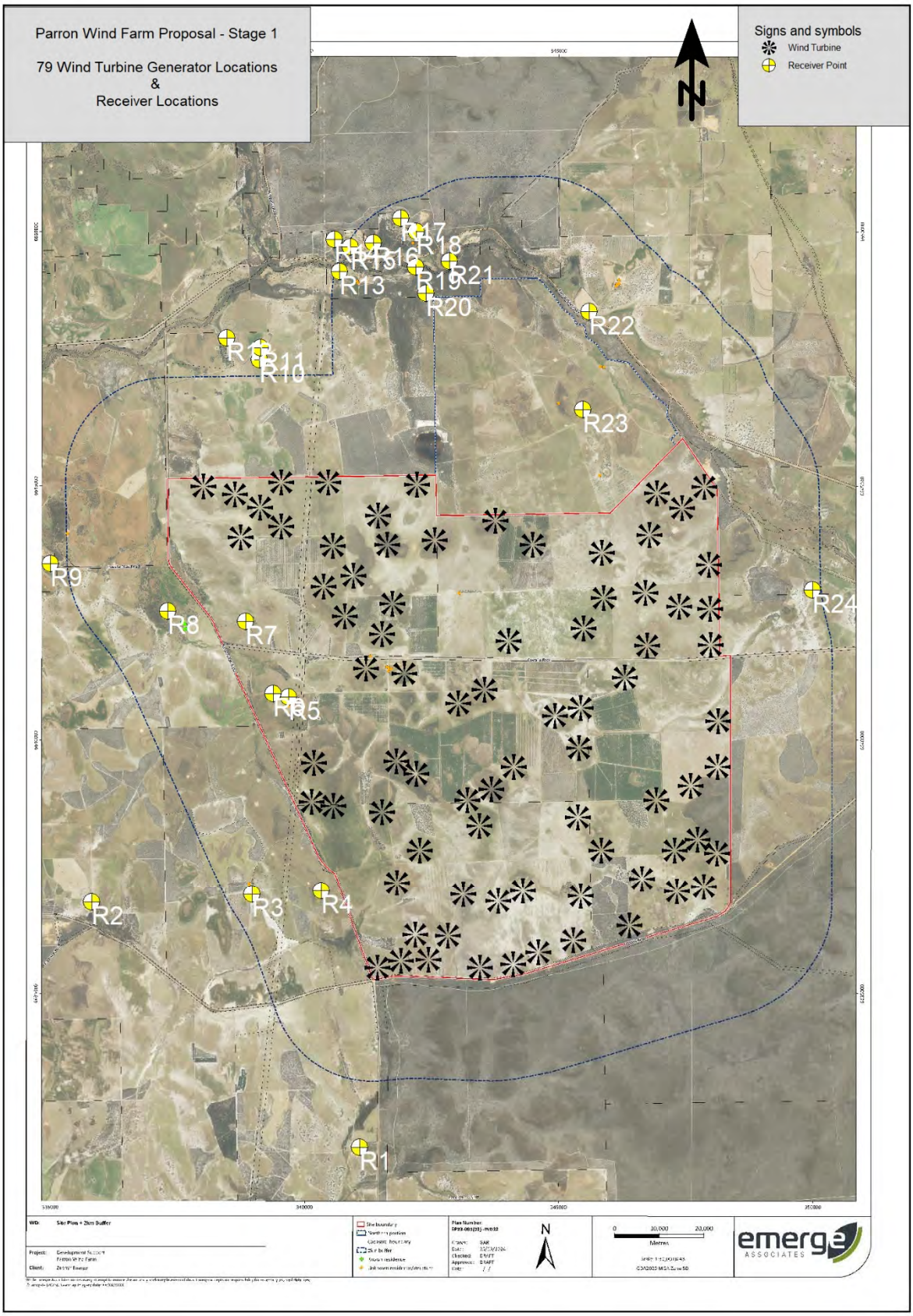
The proposed wind farm is able to comply with the requirement to meet the criteria based upon background noise monitoring, noting locations of exceedances are only predicted at “Stake Holder” premises, and at these locations the higher criteria recommended by the SA Guidelines is also met.

APPENDIX A

RESIDENTIAL LOCATIONS

RESIDENTIAL LOCATIONS

Name	Easting, m	Northing, m
R1	50341102	6631909
R2	50335817	6636762
R3	50338982	6636914
R4	50340346	6636986
R5	50339708	6640824
R6	50339404	6640886
R7	50338853	6642312
R8	50337321	6642518
R9	50335001	6643457
R10	50339123	6647478
R11	50339152	6647719
R12	50338484	6647910
R13	50340713	6649229
R14	50340614	6649853
R15	50340931	6649705
R16	50341375	6649787
R17	50341918	6650273
R18	50342231	6650021
R19	50342218	6649312
R20	50342416	6648798
R21	50342888	6649423
R22	50345640	6648428
R23	50345519	6646493
R24	50350054	6642931
R25	50352856	6640828


Parron Wind Farm Proposal - Stage 1
79 Wind Turbine Generator Locations
&
Receiver Locations
Signs and symbols
Wind Turbine
Receiver Point
N
R1
R2
R3
R4
R5
R7
R8
R9
R10
R11
R13
R16
R17
R18
R19
R20
R21
R22
R23
R24
emerge
ASSOCIATES

APPENDIX B

WIND TURBINE LOCATIONS

WIND TURBINE LOCATIONS AND TYPE

Name	Turbine Type	Easting, m	Northing, m
T1	V162-6.2 MW	50339557	6645060
T2	V162-6.2 MW	50342235	6645021
T5	V162-6.2 MW	50346830	6644016
T13	V162-6.2 MW	50341473	6644407
T17	V162-6.2 MW	50344046	6641930
T21	V162-6.2 MW	50338758	6643980
T24	V162-6.2 MW	50340978	6643219
T25	V162-6.2 MW	50340394	6643003
T32	V162-6.2 MW	50348029	6642567
T35	V162-6.2 MW	50341547	6642059
T36	V162-6.2 MW	50339556	6644191
T38	V162-6.2 MW	50341746	6642660
T40	V162-6.2 MW	50347918	6644976
T42	V162-6.2 MW	50342586	6643923
T45	V162-6.2 MW	50340572	6643808
T46	V162-6.2 MW	50340488	6645061
T51	V162-6.2 MW	50340809	6642411
T58	V162-6.2 MW	50348008	6643436
T65	V162-6.2 MW	50345885	6643666
T66	V162-6.2 MW	50339136	6644561
T67	V162-6.2 MW	50338018	6644986
T73	V162-6.2 MW	50346971	6644842
T74	V162-6.2 MW	50347471	6644553
T75	V162-6.2 MW	50344517	6643831
T76	V162-6.2 MW	50343788	6644304
T77	V162-6.2 MW	50338637	6644824
T79	V162-6.2 MW	50341644	6643828
T4	V162-6.2 MW	50343237	6638784
T6	V162-6.2 MW	50345419	6638442
T8	V162-6.2 MW	50345439	6639810
T10	V162-6.2 MW	50343480	6635455
T11	V162-6.2 MW	50347321	6637786
T12	V162-6.2 MW	50341986	6641285
T14	V162-6.2 MW	50345883	6637788
T15	V162-6.2 MW	50346434	6636295
T16	V162-6.2 MW	50342466	6635621
T18	V162-6.2 MW	50342224	6639303
T19	V162-6.2 MW	50343472	6638271
T20	V162-6.2 MW	50341917	6635590
T22	V162-6.2 MW	50345323	6635998
T23	V162-6.2 MW	50341547	6638545
T26	V162-6.2 MW	50340206	6639524
T27	V162-6.2 MW	50348161	6637731
T29	V162-6.2 MW	50347647	6639070
T30	V162-6.2 MW	50341836	6639554
T31	V162-6.2 MW	50342843	6636095

Name	Turbine Type	Easting, m	Northing, m
T33	V162-6.2 MW	50343838	6636780
T34	V162-6.2 MW	50343052	6640691
T37	V162-6.2 MW	50341453	6635457
T39	V162-6.2 MW	50346961	6638785
T43	V162-6.2 MW	50341847	6637147
T44	V162-6.2 MW	50344137	6635530
T47	V162-6.2 MW	50345471	6640610
T48	V162-6.2 MW	50345472	6636885
T49	V162-6.2 MW	50347782	6638000
T50	V162-6.2 MW	50347898	6637064
T52	V162-6.2 MW	50346678	6637220
T53	V162-6.2 MW	50342207	6636114
T54	V162-6.2 MW	50343573	6640973
T56	V162-6.2 MW	50343712	6638997
T57	V162-6.2 MW	50340153	6638752
T60	V162-6.2 MW	50344638	6635770
T61	V162-6.2 MW	50341228	6641390
T62	V162-6.2 MW	50348172	6639435
T63	V162-6.2 MW	50344328	6636991
T64	V162-6.2 MW	50342296	6637791
T68	V162-6.2 MW	50348185	6640346
T69	V162-6.2 MW	50344150	6639440
T70	V162-6.2 MW	50340586	6638670
T71	V162-6.2 MW	50346348	6641205
T72	V162-6.2 MW	50343151	6636924
T78	V162-6.2 MW	50347370	6636974
T80	V162-6.2 MW	50344960	6640449
T3	V162-6.2 MW	50348044	6641852
T59	V162-6.2 MW	50347412	6642602
T41	V162-6.2 MW	50346778	6641841
T28	V162-6.2 MW	50346754	6642875
T7	V162-6.2 MW	50345923	6642773
T9	V162-6.2 MW	50345523	6642174

APPENDIX C

TURBINE SPECIFICATIONS

Restricted
Document no 0105-5200_01

Third octave noise emission

EnVentus™ V162-6.2MW 50/60 Hz

Abstract

This document serves as a paper behind the General Specification.

The document describes the measured/estimated third octave spectra for noise levels according to the General Specification.

The document is a living document and will be updated regularly.

When new measurements exist, the document might be updated.

Contents

1. Introduction

The purpose of this document is to present the expected third octave noise spectra for the V162 EnVentus™ turbine.

Test results from field measurements are available for turbines with serrated trailing edges. These have been used to compute median values to represent expected 3rd octave emission in field conditions.

Test results for blades with no STEs are not yet available, so data are based on test results from turbines with rotors that are as close as possible in size the V162.

2. Method

2.1 Procedure

During measurements, a very large number of correlated values for noise emission spectra and turbine operating parameters are identified.

From these a relation between noise emission within each 1/3 octave band, wind speed and operational conditions are extracted. By combination of these extracted values and the actual turbine operation and rotor size, an estimate of the 1/3 octave performance is obtained.

The frequency content is limited to the frequency range 6.3 Hz to 10 kHz to secure that measurement system limitations are not influencing the findings. The stated spectral values are thus representative for the expected noise emission from the turbine at each wind speed.

Results from 3 to 20m/s at hub height are reported here. If certain wind bins are not captured during the measurement process, interpolation/ extrapolation is applied as a fallback and checked with corresponding values from similar sized rotors.

Due to site-to-site variability however the stated values however do not enable issuing guarantees.

2.2 Physical environment

The results are valid for the downwind reference position as defined according to IEC 61400-11 Ed.3.

Applicable environmental conditions are thus corresponding to the standardized requirements as described directly and indirectly in IEC 61400-11.

These can be interpreted as air density 1.225 kg/m^3, yaw errors below +/- 15 deg. and vertical inflow angles below +/- 10 deg. Blade condition is clean and undamaged.

3. Results

3.1 Results V162 PO6200

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	16.7	15.4	17.0	16.6	22.0	23.5	26.8	26.7	28.0	27.9	29.4	30.2	30.9	32.0	32.1	31.6	31.9	29.7
8 Hz	23.2	22.0	23.6	23.4	28.6	30.3	33.5	33.5	34.6	34.6	35.8	36.5	37.1	38.0	38.1	37.7	38.0	36.0
10 Hz	29.3	28.3	29.8	29.9	35.0	36.8	39.9	39.8	40.9	40.8	41.9	42.5	43.0	43.7	43.8	43.5	43.7	41.9
12.5 Hz	35.2	34.3	35.6	36.0	40.9	42.9	45.9	45.9	46.8	46.8	47.7	48.1	48.6	49.1	49.2	48.9	49.2	47.5
16 Hz	41.1	40.3	41.5	41.7	46.5	48.6	51.5	51.6	52.4	52.3	53.1	53.5	53.8	54.2	54.3	54.0	54.3	52.8
20 Hz	46.6	46.0	47.1	47.5	52.2	54.0	56.8	56.9	57.6	57.5	58.2	58.5	58.7	59.0	59.1	58.9	59.1	57.8
25 Hz	52.2	51.7	52.7	52.9	57.5	59.4	62.1	62.2	62.9	62.8	63.4	63.5	63.7	63.8	64.0	63.8	64.0	62.8
31.5 Hz	57.7	57.3	58.2	58.3	62.8	64.4	67.1	67.2	67.8	67.7	68.2	68.2	68.4	68.4	68.5	68.4	68.5	67.6
40 Hz	62.4	62.0	62.9	63.6	68.0	69.4	72.0	72.2	72.7	72.6	72.9	73.0	73.0	72.9	73.1	73.0	73.1	72.3
50 Hz	66.2	66.0	66.7	68.1	72.3	74.3	76.9	77.1	77.5	77.4	77.7	77.6	77.7	77.5	77.7	77.5	77.7	77.0
63 Hz	69.7	69.6	70.3	71.7	75.8	78.4	80.9	81.1	81.5	81.4	81.6	81.5	81.5	81.2	81.4	81.3	81.4	80.8
80 Hz	72.9	72.8	73.4	75.0	79.0	81.6	84.0	84.3	84.6	84.5	84.6	84.5	84.4	84.1	84.3	84.2	84.3	83.9
100 Hz	75.7	75.7	76.3	77.9	81.8	84.4	86.8	87.1	87.3	87.2	87.3	87.2	87.1	86.8	86.9	86.9	87.0	86.6
125 Hz	78.2	78.3	78.8	80.5	84.2	86.8	89.2	89.5	89.7	89.6	89.7	89.5	89.4	89.1	89.2	89.2	89.3	89.0
160 Hz	80.4	80.5	80.9	82.7	86.3	88.9	91.3	91.6	91.8	91.7	91.7	91.5	91.4	91.1	91.2	91.2	91.2	91.1
200 Hz	82.3	82.4	82.8	84.6	88.0	90.7	93.0	93.4	93.5	93.4	93.4	93.2	93.1	92.8	92.9	92.9	92.9	92.8
250 Hz	83.3	83.5	83.8	86.1	89.4	92.0	94.3	94.8	94.8	94.7	94.7	94.5	94.5	94.2	94.3	94.3	94.3	94.2
315 Hz	83.4	83.7	83.9	86.7	89.9	93.0	95.3	95.8	95.8	95.8	95.7	95.6	95.5	95.2	95.3	95.3	95.3	95.3
400 Hz	83.6	83.8	84.0	86.5	89.6	93.2	95.4	95.9	95.9	95.9	95.8	95.7	95.7	95.5	95.5	95.5	95.5	95.6
500 Hz	83.7	84.0	84.1	86.2	89.2	92.4	94.7	95.2	95.2	95.2	95.1	95.1	95.0	94.9	95.0	95.0	95.0	95.0
630 Hz	83.5	83.8	83.9	86.0	88.8	91.6	93.9	94.5	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.5
800 Hz	83.4	83.6	83.7	85.3	88.0	90.8	93.1	93.7	93.6	93.6	93.6	93.7	93.7	93.9	93.8	93.8	93.8	93.9
1 kHz	82.9	83.1	83.2	84.7	87.3	89.6	91.9	92.5	92.4	92.5	92.5	92.7	92.8	93.0	92.9	92.9	92.9	93.0
1.25 kHz	82.1	82.3	82.4	83.7	86.2	88.4	90.8	91.4	91.3	91.4	91.5	91.7	91.9	92.2	92.1	92.1	92.1	92.2
1.6 kHz	80.9	81.1	81.2	82.4	84.8	86.9	89.2	89.9	89.8	89.9	90.1	90.4	90.6	91.2	91.0	91.0	90.9	91.0
2 kHz	79.5	79.6	79.6	80.8	83.0	85.0	87.4	88.1	88.0	88.1	88.3	88.8	89.1	89.8	89.6	89.5	89.5	89.6
2.5 kHz	77.6	77.8	77.8	78.7	80.8	82.7	85.1	85.8	85.8	86.0	86.3	86.8	87.2	88.1	87.8	87.8	87.7	87.8
3.15 kHz	75.5	75.6	75.6	76.4	78.3	80.1	82.6	83.3	83.3	83.5	83.9	84.5	84.9	86.1	85.8	85.7	85.7	85.6
4 kHz	73.0	73.1	73.0	73.7	75.5	77.1	79.6	80.4	80.4	80.6	81.1	81.9	82.4	83.8	83.4	83.3	83.3	83.2
5 kHz	70.2	70.2	70.2	70.6	72.3	73.7	76.3	77.1	77.1	77.4	78.0	78.9	79.6	81.1	80.7	80.6	80.6	80.4
6.3 kHz	67.1	67.0	67.0	67.1	68.7	70.0	72.7	73.5	73.5	73.8	74.5	75.7	76.4	78.2	77.7	77.6	77.6	77.4
8 kHz	63.6	63.4	63.4	63.4	64.8	65.9	68.6	69.5	69.6	69.9	70.8	72.0	72.9	75.0	74.4	74.3	74.2	73.9
10 kHz	59.8	59.6	59.5	59.2	60.6	61.5	64.3	65.1	65.3	65.7	66.6	68.1	69.0	71.4	70.8	70.6	70.6	70.2
A-wgt	93.9	94.1	94.3	96.2	99.2	102.0	104.3	104.8	104.8	104.8	104.8	104.8	104.8	104.8	104.8	104.8	104.8	104.8

Table 1: V162-PO6200, expected 1/3 octave band performance

(Blades with serrated trailing edges)

3.2 Results V162 PO6200-0S

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	14.5	12.3	11.2	13.0	16.4	19.1	21.6	22.2	22.6	23.8	25.1	26.3	27.5	28.5	29.7	31.0	32.1	33.3
8 Hz	21.6	19.6	18.6	20.5	23.8	26.6	29.1	29.6	30.0	31.1	32.3	33.4	34.5	35.4	36.5	37.7	38.8	39.9
10 Hz	28.4	26.5	25.7	27.5	30.9	33.6	36.1	36.7	37.0	38.0	39.1	40.2	41.1	42.0	43.0	44.1	45.1	46.1
12.5 Hz	34.8	33.1	32.4	34.2	37.6	40.3	42.8	43.3	43.7	44.6	45.5	46.5	47.4	48.1	49.1	50.1	51.0	51.9
16 Hz	41.2	39.7	39.0	40.5	43.8	46.6	49.1	49.6	49.9	50.7	51.6	52.5	53.3	54.0	54.8	55.7	56.5	57.4
20 Hz	47.2	45.9	45.3	46.8	50.1	52.5	54.9	55.5	55.7	56.5	57.3	58.1	58.8	59.4	60.2	61.0	61.7	62.5
25 Hz	53.2	52.0	51.6	52.7	56.0	58.4	60.8	61.4	61.6	62.3	62.9	63.7	64.3	64.9	65.6	66.3	67.0	67.6
31.5 Hz	59.1	58.1	57.7	58.6	61.9	63.9	66.3	66.9	67.0	67.6	68.2	68.9	69.5	70.0	70.6	71.2	71.8	72.4
40 Hz	64.1	63.3	63.0	64.3	67.6	69.3	71.8	72.3	72.4	73.0	73.5	74.1	74.6	75.0	75.6	76.1	76.6	77.1
50 Hz	68.3	67.6	67.3	69.2	72.4	74.6	77.1	77.6	77.7	78.2	78.6	79.1	79.6	80.0	80.4	81.0	81.4	81.8
63 Hz	72.1	71.5	71.3	73.2	76.4	79.1	81.5	82.0	82.1	82.5	82.9	83.3	83.7	84.1	84.5	84.9	85.3	85.6
80 Hz	75.5	75.0	74.9	76.7	80.0	82.6	85.0	85.6	85.7	86.0	86.3	86.7	87.0	87.3	87.6	88.0	88.3	88.6
100 Hz	78.5	78.2	78.1	79.9	83.1	85.8	88.2	88.7	88.8	89.0	89.3	89.6	89.9	90.1	90.4	90.7	91.0	91.2
125 Hz	81.2	81.0	81.0	82.8	85.9	88.6	91.0	91.5	91.5	91.7	91.9	92.2	92.4	92.6	92.8	93.1	93.2	93.4
160 Hz	83.5	83.4	83.4	85.2	88.3	90.9	93.3	93.8	93.9	94.0	94.2	94.4	94.5	94.7	94.9	95.0	95.2	95.3
200 Hz	85.4	85.4	85.5	87.2	90.3	92.9	95.3	95.8	95.8	95.9	96.0	96.2	96.3	96.4	96.5	96.7	96.8	96.9
250 Hz	86.5	86.5	86.7	88.9	92.0	94.5	96.9	97.4	97.4	97.5	97.5	97.6	97.7	97.8	97.8	97.9	98.0	98.0
315 Hz	86.7	86.8	86.9	89.6	92.7	95.7	98.1	98.6	98.6	98.6	98.6	98.7	98.7	98.7	98.8	98.8	98.8	98.8
400 Hz	86.7	86.9	87.1	89.5	92.5	96.0	98.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.7
500 Hz	86.8	87.0	87.3	89.3	92.3	95.4	97.7	98.2	98.2	98.2	98.2	98.1	98.1	98.0	98.0	97.9	97.9	97.8
630 Hz	86.5	86.8	87.0	89.0	92.0	94.8	97.0	97.5	97.5	97.5	97.4	97.3	97.3	97.2	97.1	97.0	97.0	96.9
800 Hz	86.2	86.5	86.8	88.3	91.2	94.0	96.3	96.8	96.8	96.7	96.6	96.5	96.4	96.3	96.2	96.1	96.0	95.9
1 kHz	85.5	85.9	86.1	87.6	90.5	92.9	95.1	95.6	95.6	95.5	95.4	95.3	95.2	95.1	94.9	94.8	94.6	94.5
1.25 kHz	84.4	84.9	85.1	86.6	89.4	91.8	94.0	94.5	94.5	94.4	94.2	94.1	93.9	93.8	93.6	93.5	93.3	93.2
1.6 kHz	83.0	83.5	83.7	85.1	87.9	90.3	92.4	92.9	92.9	92.8	92.7	92.5	92.3	92.2	92.0	91.8	91.6	91.5
2 kHz	81.2	81.7	81.9	83.3	86.1	88.3	90.5	91.0	91.0	90.9	90.7	90.5	90.3	90.2	90.0	89.7	89.6	89.4
2.5 kHz	79.0	79.5	79.8	81.1	83.8	86.0	88.2	88.7	88.7	88.6	88.4	88.2	88.0	87.8	87.6	87.3	87.2	87.0
3.15 kHz	76.5	77.0	77.2	78.5	81.1	83.3	85.5	86.0	86.0	85.9	85.7	85.5	85.3	85.1	84.8	84.6	84.4	84.2
4 kHz	73.6	74.1	74.3	75.5	78.1	80.3	82.3	82.8	82.9	82.8	82.6	82.4	82.2	82.0	81.7	81.4	81.3	81.1
5 kHz	70.3	70.8	70.9	72.1	74.7	76.8	78.8	79.3	79.4	79.3	79.1	78.9	78.7	78.5	78.2	77.9	77.8	77.6
6.3 kHz	66.6	67.1	67.2	68.3	70.8	72.9	74.9	75.4	75.5	75.4	75.3	75.0	74.8	74.6	74.4	74.1	73.9	73.8
8 kHz	62.6	63.1	63.1	64.2	66.6	68.7	70.7	71.2	71.2	71.2	71.0	70.8	70.6	70.4	70.1	69.8	69.7	69.5
10 kHz	58.2	58.6	58.7	59.6	62.0	64.0	66.0	66.5	66.6	66.6	66.4	66.2	66.0	65.8	65.5	65.3	65.1	65.0
A-wgt	96.7	96.9	97.1	99.0	102.0	104.8	107.1	107.6	107.6	107.6	107.6	107.6	107.6	107.6	107.6	107.6	107.6	107.6

Table 2: V162-PO6200-0S, expected 1/3 octave band performance
(Blades without serrated trailing edges)

3.3 Results V162 SO2

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	15.0	16.4	15.2	19.3	22.4	24.3	24.3	23.7	25.7	26.4	27.5	27.1	28.8	30.0	31.6	30.3	28.0	26.2
8 Hz	21.7	22.9	21.9	25.9	29.0	31.0	31.0	30.4	32.3	32.8	33.8	33.3	34.8	35.9	37.3	36.2	34.2	32.7
10 Hz	28.0	29.1	28.2	32.2	35.3	37.3	37.4	36.8	38.4	38.9	39.7	39.3	40.5	41.4	42.7	41.7	40.1	38.8
12.5 Hz	34.0	35.0	34.2	38.1	41.3	43.2	43.4	42.8	44.3	44.6	45.3	44.9	46.0	46.7	47.8	47.0	45.7	44.6
16 Hz	40.0	40.9	40.3	44.1	46.9	48.9	49.0	48.5	49.8	50.0	50.6	50.2	51.1	51.6	52.6	51.9	50.9	50.1
20 Hz	45.6	46.5	46.0	49.7	52.5	54.1	54.3	53.8	54.9	55.1	55.6	55.2	55.9	56.3	57.1	56.6	55.8	55.2
25 Hz	51.3	52.0	51.7	55.4	57.8	59.4	59.6	59.1	60.1	60.3	60.6	60.2	60.8	61.0	61.7	61.3	60.8	60.4
31.5 Hz	56.9	57.6	57.4	60.9	63.1	64.4	64.5	64.1	65.0	65.0	65.3	65.0	65.3	65.5	66.1	65.8	65.5	65.2
40 Hz	61.7	62.3	62.2	65.7	68.3	69.3	69.5	69.1	69.8	69.8	70.0	69.7	69.9	70.0	70.5	70.3	70.2	70.0
50 Hz	65.6	66.1	66.1	69.6	72.7	74.2	74.3	74.0	74.6	74.6	74.6	74.4	74.5	74.5	74.9	74.8	74.8	74.7
63 Hz	69.2	69.6	69.7	73.1	76.2	78.2	78.4	78.0	78.5	78.5	78.5	78.2	78.2	78.1	78.5	78.4	78.6	78.6
80 Hz	72.4	72.8	73.0	76.3	79.4	81.3	81.5	81.2	81.6	81.5	81.5	81.3	81.2	81.0	81.3	81.3	81.6	81.7
100 Hz	75.3	75.6	75.9	79.2	82.3	84.1	84.3	84.0	84.3	84.2	84.2	84.0	83.8	83.6	83.8	83.9	84.3	84.4
125 Hz	77.9	78.1	78.5	81.7	84.7	86.6	86.7	86.5	86.7	86.6	86.5	86.3	86.2	85.9	86.0	86.2	86.6	86.8
160 Hz	80.1	80.3	80.7	83.9	86.9	88.7	88.8	88.6	88.8	88.7	88.5	88.4	88.2	87.9	88.0	88.1	88.6	88.8
200 Hz	81.9	82.2	82.6	85.8	88.7	90.4	90.6	90.4	90.5	90.4	90.2	90.1	89.9	89.7	89.7	89.8	90.3	90.5
250 Hz	83.0	83.2	83.7	86.8	90.1	91.8	91.9	91.8	91.9	91.7	91.6	91.5	91.3	91.1	91.0	91.2	91.6	91.9
315 Hz	83.1	83.3	83.9	87.0	90.7	92.9	93.0	92.9	92.9	92.8	92.7	92.6	92.4	92.2	92.1	92.3	92.7	92.9
400 Hz	83.3	83.4	84.0	87.1	90.5	93.0	93.1	93.1	93.0	93.0	92.9	92.8	92.7	92.5	92.4	92.6	92.9	93.0
500 Hz	83.4	83.5	84.2	87.2	90.2	92.4	92.4	92.4	92.3	92.3	92.3	92.3	92.1	92.0	92.0	92.1	92.2	92.3
630 Hz	83.2	83.3	84.0	86.9	89.9	91.7	91.6	91.7	91.6	91.6	91.6	91.7	91.6	91.6	91.5	91.6	91.6	91.6
800 Hz	83.0	83.1	83.8	86.7	89.2	90.9	90.9	91.0	90.9	90.9	91.0	91.1	91.1	91.1	91.1	91.1	91.0	90.9
1 kHz	82.5	82.6	83.3	86.2	88.6	89.9	89.7	89.9	89.8	89.9	90.0	90.1	90.3	90.4	90.4	90.3	90.0	89.8
1.25 kHz	81.6	81.8	82.5	85.3	87.6	88.8	88.6	88.8	88.7	88.9	89.1	89.3	89.5	89.8	89.8	89.6	89.1	88.8
1.6 kHz	80.4	80.6	81.3	84.1	86.3	87.4	87.2	87.4	87.4	87.6	87.9	88.1	88.4	88.8	88.9	88.6	87.8	87.4
2 kHz	78.8	79.1	79.8	82.6	84.7	85.6	85.3	85.7	85.6	85.9	86.4	86.5	87.1	87.6	87.7	87.3	86.3	85.7
2.5 kHz	77.0	77.2	77.9	80.7	82.6	83.5	83.2	83.5	83.5	84.0	84.5	84.7	85.4	86.1	86.2	85.7	84.4	83.6
3.15 kHz	74.7	75.0	75.7	78.5	80.3	81.0	80.6	81.1	81.1	81.6	82.3	82.5	83.4	84.2	84.5	83.8	82.2	81.2
4 kHz	72.2	72.5	73.1	75.9	77.6	78.2	77.8	78.2	78.3	79.0	79.7	80.0	81.1	82.1	82.4	81.7	79.7	78.5
5 kHz	69.2	69.7	70.2	73.0	74.6	75.1	74.5	75.1	75.2	75.9	76.9	77.2	78.5	79.7	80.1	79.2	76.8	75.4
6.3 kHz	66.0	66.5	67.0	69.7	71.2	71.5	70.9	71.5	71.8	72.6	73.7	74.1	75.6	77.0	77.5	76.4	73.6	71.9
8 kHz	62.4	62.9	63.4	66.1	67.4	67.7	67.0	67.6	67.9	68.9	70.2	70.6	72.4	74.0	74.6	73.3	70.1	68.2
10 kHz	58.5	59.1	59.4	62.2	63.4	63.4	62.7	63.4	63.8	64.9	66.4	66.8	68.8	70.7	71.4	70.0	66.3	64.1
A-wgt	93.5	93.7	94.3	97.3	100.2	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0

Table 3: V162-SO2, expected 1/3 octave band performance

(Blades with serrated trailing edges)

3.4 Results V162 SO3

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	12.0	16.3	16.2	17.6	21.4	20.7	22.5	22.3	23.1	24.1	24.9	26.9	28.7	28.8	30.5	28.7	26.0	27.4
8 Hz	18.9	22.9	22.8	24.3	28.2	27.6	29.3	29.1	29.8	30.6	31.4	33.1	34.6	34.6	36.1	34.6	32.2	33.7
10 Hz	25.5	29.2	29.1	30.8	34.6	34.2	35.7	35.5	36.2	36.9	37.5	39.0	40.2	40.2	41.4	40.2	38.1	39.6
12.5 Hz	31.7	35.1	35.0	36.8	40.6	40.4	41.7	41.6	42.2	42.8	43.3	44.5	45.5	45.4	46.5	45.5	43.7	45.2
16 Hz	37.9	41.1	41.0	43.0	46.3	46.2	47.4	47.3	47.8	48.3	48.8	49.7	50.5	50.3	51.3	50.5	49.0	50.5
20 Hz	43.8	46.7	46.7	48.7	52.0	51.7	52.7	52.7	53.1	53.5	53.9	54.7	55.3	55.0	55.8	55.6	54.3	55.8
25 Hz	49.7	52.3	52.3	54.5	57.4	57.2	58.1	58.1	58.4	58.8	59.0	59.6	60.0	59.7	60.4	60.4	59.3	60.8
31.5 Hz	55.5	57.9	57.9	60.2	62.7	62.3	63.1	63.1	63.4	63.6	63.9	64.3	64.5	64.2	64.7	65.2	64.4	65.8
40 Hz	60.4	62.6	62.6	65.0	68.0	67.4	68.0	68.1	68.4	68.5	68.7	68.9	69.1	68.7	69.1	70.0	69.4	70.7
50 Hz	64.5	66.5	66.5	69.0	72.5	72.4	73.0	73.0	73.2	73.3	73.4	73.6	73.6	73.1	73.5	74.0	73.6	74.9
63 Hz	68.2	70.0	70.1	72.7	76.0	76.6	77.0	77.1	77.3	77.3	77.4	77.4	77.3	76.8	77.1	77.3	76.9	78.2
80 Hz	71.6	73.2	73.3	76.0	79.3	79.9	80.2	80.3	80.4	80.4	80.4	80.4	80.2	79.7	79.9	80.2	80.0	81.1
100 Hz	74.7	76.0	76.2	78.9	82.1	82.8	83.0	83.1	83.2	83.2	83.2	83.0	82.8	82.4	82.5	82.8	82.7	83.8
125 Hz	77.3	78.5	78.7	81.5	84.7	85.3	85.5	85.6	85.7	85.6	85.6	85.4	85.1	84.7	84.7	85.1	85.1	86.1
160 Hz	79.7	80.6	80.9	83.8	86.8	87.5	87.6	87.7	87.8	87.7	87.6	87.4	87.1	86.7	86.7	87.2	87.2	88.1
200 Hz	81.7	82.4	82.7	85.7	88.7	89.4	89.4	89.5	89.5	89.4	89.4	89.1	88.8	88.5	88.4	88.9	89.0	89.7
250 Hz	82.8	83.4	83.8	86.7	90.1	90.8	90.8	90.9	90.9	90.8	90.7	90.5	90.2	89.9	89.8	90.3	90.5	91.1
315 Hz	83.0	83.5	83.9	86.9	90.8	91.9	91.9	91.9	91.9	91.9	91.8	91.6	91.3	91.1	91.0	91.0	91.1	91.5
400 Hz	83.2	83.6	84.1	87.1	90.5	92.1	92.1	92.1	92.1	92.0	92.0	91.8	91.6	91.4	91.3	90.8	91.0	91.2
500 Hz	83.4	83.6	84.2	87.2	90.2	91.5	91.4	91.4	91.4	91.4	91.3	91.2	91.1	91.0	90.9	90.6	90.8	90.9
630 Hz	83.3	83.3	83.9	87.0	89.9	90.8	90.7	90.7	90.7	90.7	90.6	90.6	90.6	90.6	90.5	90.5	90.6	90.5
800 Hz	83.1	83.0	83.8	86.8	89.3	90.0	90.0	89.9	89.9	89.9	90.0	90.0	90.1	90.2	90.1	90.1	90.1	89.8
1 kHz	82.7	82.4	83.2	86.3	88.6	88.9	88.9	88.8	88.8	88.9	88.9	89.1	89.3	89.5	89.5	89.7	89.7	89.2
1.25 kHz	81.8	81.5	82.4	85.4	87.6	87.8	87.8	87.7	87.7	87.8	87.9	88.3	88.6	88.9	89.0	89.1	89.0	88.2
1.6 kHz	80.6	80.2	81.2	84.2	86.3	86.4	86.4	86.2	86.2	86.4	86.6	87.1	87.6	88.1	88.1	88.1	87.9	86.9
2 kHz	79.1	78.6	79.6	82.7	84.6	84.6	84.6	84.4	84.4	84.7	84.9	85.6	86.3	86.9	87.0	86.9	86.5	85.3
2.5 kHz	77.2	76.6	77.8	80.7	82.6	82.4	82.4	82.2	82.2	82.6	82.9	83.8	84.7	85.4	85.7	85.4	84.8	83.4
3.15 kHz	75.0	74.3	75.5	78.5	80.2	79.8	80.0	79.7	79.7	80.2	80.6	81.7	82.8	83.7	84.0	83.6	82.8	81.1
4 kHz	72.4	71.6	73.0	75.9	77.5	76.9	77.1	76.8	76.8	77.4	77.9	79.2	80.6	81.7	82.1	81.4	80.5	78.5
5 kHz	69.4	68.6	70.1	72.9	74.4	73.6	73.9	73.5	73.6	74.3	74.9	76.5	78.1	79.3	79.8	79.0	77.8	75.6
6.3 kHz	66.1	65.3	66.8	69.6	70.9	70.0	70.3	69.9	70.0	70.8	71.5	73.4	75.3	76.7	77.3	76.3	74.9	72.3
8 kHz	62.5	61.6	63.3	66.0	67.1	66.0	66.4	65.9	66.1	67.0	67.8	70.0	72.2	73.8	74.6	73.3	71.6	68.7
10 kHz	58.5	57.5	59.3	62.0	63.0	61.6	62.1	61.6	61.8	62.9	63.8	66.3	68.8	70.6	71.5	70.0	68.0	64.8
A-wgt	93.5	93.7	94.3	97.3	100.2	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0

Table 4: V162-SO3, expected 1/3 octave band performance

(Blades with serrated trailing edges)

3.5 Results V162 SO4

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	13.1	12.5	15.5	18.4	20.5	21.0	20.7	22.1	22.8	24.4	26.1	26.9	28.1	30.1	28.6	29.8	34.8	31.7
8 Hz	19.9	19.4	22.2	25.1	27.3	27.9	27.6	28.8	29.5	30.9	32.3	33.0	34.0	35.7	34.6	35.7	40.0	37.2
10 Hz	26.4	25.9	28.5	31.5	33.7	34.4	34.1	35.2	35.8	37.0	38.2	38.8	39.6	41.0	40.2	41.3	44.9	42.5
12.5 Hz	32.6	32.1	34.4	37.5	39.8	40.5	40.3	41.2	41.8	42.8	43.8	44.3	44.9	46.1	45.6	46.6	49.6	47.4
16 Hz	38.7	38.4	40.4	43.6	45.6	46.2	46.1	46.9	47.4	48.3	49.1	49.4	49.9	50.8	50.6	51.5	54.0	52.1
20 Hz	44.6	44.3	46.1	49.3	51.3	52.0	51.9	52.6	53.0	53.8	54.4	54.7	55.0	55.7	55.7	56.6	58.5	56.9
25 Hz	50.4	50.1	51.8	55.0	56.7	57.4	57.3	57.9	58.3	58.9	59.4	59.6	59.8	60.3	60.5	61.3	62.8	61.4
31.5 Hz	56.1	55.9	57.4	60.6	62.1	62.8	62.7	63.3	63.6	64.1	64.4	64.5	64.7	64.9	65.3	66.0	67.1	66.0
40 Hz	61.0	60.8	62.1	65.4	67.4	68.2	68.1	68.5	68.8	69.2	69.4	69.4	69.5	69.6	70.1	70.8	71.5	70.5
50 Hz	65.0	64.9	66.1	69.3	71.9	72.6	72.6	72.9	73.1	73.4	73.5	73.5	73.5	73.4	74.1	74.7	75.0	74.3
63 Hz	68.7	68.6	69.7	72.9	75.5	76.2	76.2	76.4	76.6	76.9	76.8	76.8	76.7	76.5	77.3	77.8	77.9	77.3
80 Hz	72.1	72.0	72.9	76.2	78.7	79.4	79.4	79.6	79.8	79.9	79.8	79.7	79.6	79.3	80.2	80.6	80.4	80.0
100 Hz	75.0	75.0	75.8	79.1	81.6	82.3	82.3	82.4	82.6	82.6	82.5	82.4	82.2	81.9	82.7	83.1	82.7	82.5
125 Hz	77.7	77.7	78.4	81.7	84.2	84.8	84.8	84.9	85.0	85.0	84.8	84.7	84.5	84.1	85.0	85.3	84.8	84.7
160 Hz	79.9	80.0	80.6	83.9	86.4	87.0	87.0	87.0	87.1	87.1	86.9	86.7	86.5	86.1	86.9	87.2	86.6	86.5
200 Hz	81.9	82.0	82.5	85.8	88.2	88.7	88.8	88.8	88.8	88.8	88.6	88.4	88.2	87.8	88.5	88.7	88.1	88.1
250 Hz	82.9	83.1	83.6	86.8	89.7	90.2	90.2	90.2	90.2	90.1	89.9	89.8	89.6	89.2	89.9	90.0	89.4	89.5
315 Hz	83.2	83.3	83.8	87.0	90.3	90.7	90.8	90.7	90.7	90.6	90.5	90.3	90.1	89.8	90.4	90.4	89.8	90.0
400 Hz	83.3	83.5	84.0	87.1	90.0	90.4	90.5	90.4	90.4	90.3	90.2	90.1	89.9	89.6	90.1	90.1	89.6	89.7
500 Hz	83.4	83.7	84.1	87.2	89.7	90.1	90.1	90.0	90.0	89.9	89.8	89.8	89.7	89.5	89.7	89.7	89.3	89.5
630 Hz	83.2	83.5	84.0	87.0	89.4	89.7	89.7	89.6	89.6	89.6	89.5	89.5	89.5	89.4	89.4	89.4	89.2	89.3
800 Hz	83.0	83.3	83.8	86.8	88.7	88.9	88.9	88.9	88.8	88.8	88.9	88.9	89.0	89.0	88.8	88.7	88.8	88.9
1 kHz	82.5	82.8	83.4	86.2	88.1	88.2	88.2	88.1	88.1	88.1	88.3	88.4	88.6	88.7	88.3	88.1	88.4	88.5
1.25 kHz	81.6	81.9	82.6	85.4	87.1	87.1	87.0	87.1	87.0	87.1	87.4	87.6	87.8	88.2	87.4	87.2	87.9	87.9
1.6 kHz	80.4	80.7	81.4	84.1	85.7	85.6	85.6	85.6	85.6	85.7	86.2	86.5	86.8	87.4	86.3	86.0	87.1	87.0
2 kHz	78.8	79.1	79.9	82.6	84.0	83.8	83.7	83.8	83.8	84.0	84.6	85.0	85.5	86.2	84.8	84.5	86.0	85.8
2.5 kHz	76.9	77.2	78.1	80.6	82.0	81.6	81.5	81.7	81.7	82.0	82.7	83.3	83.8	84.9	83.1	82.7	84.6	84.3
3.15 kHz	74.6	74.9	75.9	78.4	79.5	79.1	79.0	79.2	79.2	79.6	80.5	81.2	81.9	83.2	81.0	80.6	83.0	82.5
4 kHz	71.9	72.3	73.4	75.8	76.8	76.2	76.0	76.3	76.4	76.9	78.0	78.8	79.7	81.2	78.6	78.2	81.1	80.5
5 kHz	68.9	69.3	70.6	72.8	73.6	72.9	72.8	73.1	73.2	73.8	75.2	76.1	77.1	79.0	75.9	75.4	79.0	78.2
6.3 kHz	65.6	65.9	67.4	69.5	70.2	69.3	69.1	69.5	69.6	70.4	72.0	73.1	74.3	76.5	72.9	72.4	76.6	75.6
8 kHz	61.9	62.2	63.9	65.9	66.3	65.3	65.1	65.6	65.7	66.6	68.5	69.7	71.1	73.7	69.5	69.0	74.0	72.7
10 kHz	57.9	58.2	60.1	61.9	62.1	61.0	60.7	61.3	61.5	62.5	64.7	66.1	67.7	70.7	65.9	65.4	71.0	69.5
A-wgt	93.5	93.7	94.3	97.3	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5: V162-SO4, expected 1/3 octave band performance

(Blades with serrated trailing edges)

3.6 Results V162 SO5

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	12.9	14.0	17.1	18.4	19.7	20.7	21.4	22.3	23.8	24.6	26.7	27.2	28.3	29.1	28.6	21.5	34.7	34.5
8 Hz	19.8	20.8	23.6	25.1	26.5	27.4	28.1	28.8	30.2	30.9	32.7	33.1	34.0	34.7	34.3	28.1	39.6	39.4
10 Hz	26.3	27.2	29.7	31.5	33.0	33.8	34.4	35.1	36.3	36.9	38.4	38.7	39.5	40.0	39.6	34.4	44.2	44.1
12.5 Hz	32.5	33.3	35.6	37.5	39.0	39.8	40.3	40.9	42.0	42.5	43.8	44.0	44.6	45.0	44.7	40.4	48.6	48.6
16 Hz	38.7	39.4	41.4	43.5	44.8	45.5	46.0	46.5	47.4	47.9	48.9	49.0	49.5	49.7	49.5	45.9	52.7	52.8
20 Hz	44.5	45.2	47.0	49.2	50.5	51.2	51.6	52.1	52.9	53.3	54.0	54.1	54.5	54.5	54.4	51.6	57.0	57.1
25 Hz	50.3	51.0	52.5	54.9	55.9	56.6	56.9	57.3	58.0	58.3	58.9	58.9	59.1	59.1	59.0	56.9	61.1	61.2
31.5 Hz	56.1	56.7	58.0	60.6	61.3	61.9	62.2	62.5	63.1	63.4	63.8	63.7	63.9	63.7	63.7	62.1	65.3	65.5
40 Hz	61.0	61.5	62.7	65.4	66.6	67.2	67.4	67.7	68.2	68.4	68.6	68.5	68.6	68.3	68.3	67.3	69.5	69.7
50 Hz	65.0	65.5	66.5	69.3	71.1	71.6	71.8	72.0	72.4	72.5	72.6	72.5	72.5	72.2	72.2	71.7	73.0	73.2
63 Hz	68.7	69.2	70.0	72.9	74.7	75.1	75.3	75.5	75.8	75.9	75.8	75.7	75.6	75.2	75.3	75.2	75.8	76.0
80 Hz	72.0	72.5	73.2	76.1	77.9	78.3	78.5	78.6	78.8	78.9	78.8	78.6	78.5	78.0	78.1	78.4	78.3	78.5
100 Hz	75.0	75.4	76.0	79.0	80.8	81.2	81.3	81.4	81.6	81.6	81.4	81.2	81.0	80.6	80.7	81.2	80.6	80.8
125 Hz	77.7	78.0	78.6	81.6	83.4	83.7	83.8	83.8	83.9	83.9	83.7	83.5	83.3	82.8	83.0	83.7	82.6	82.9
160 Hz	79.9	80.3	80.7	83.8	85.6	85.8	85.9	85.9	86.0	86.0	85.7	85.5	85.3	84.8	85.0	85.8	84.5	84.7
200 Hz	81.9	82.2	82.6	85.7	87.4	87.6	87.7	87.7	87.7	87.7	87.3	87.2	86.9	86.5	86.7	87.6	86.1	86.3
250 Hz	82.9	83.2	83.6	86.7	88.9	89.1	89.1	89.1	89.1	89.0	88.7	88.6	88.3	88.0	88.1	89.0	87.4	87.6
315 Hz	83.2	83.4	83.8	86.9	89.5	89.6	89.6	89.6	89.6	89.5	89.3	89.1	88.9	88.6	88.7	89.6	88.0	88.2
400 Hz	83.3	83.5	83.9	87.0	89.3	89.4	89.4	89.3	89.3	89.2	89.0	88.9	88.8	88.5	88.6	89.3	87.9	88.1
500 Hz	83.5	83.6	84.1	87.1	89.0	89.0	89.0	89.0	88.9	88.9	88.7	88.7	88.6	88.4	88.5	89.0	87.9	88.0
630 Hz	83.2	83.4	83.9	86.9	88.7	88.7	88.6	88.6	88.6	88.5	88.5	88.5	88.4	88.3	88.4	88.7	87.9	88.0
800 Hz	83.1	83.2	83.8	86.7	88.1	88.0	87.9	87.9	87.9	87.9	87.9	88.0	88.0	88.0	88.0	88.0	87.8	87.8
1 kHz	82.5	82.7	83.3	86.1	87.5	87.3	87.2	87.2	87.2	87.2	87.5	87.6	87.7	87.8	87.8	87.3	87.7	87.7
1.25 kHz	81.6	81.8	82.5	85.2	86.5	86.2	86.2	86.2	86.2	86.3	86.7	86.8	87.0	87.3	87.3	86.3	87.5	87.4
1.6 kHz	80.4	80.5	81.4	84.0	85.1	84.9	84.8	84.9	84.9	85.0	85.6	85.8	86.1	86.6	86.4	85.0	87.0	86.8
2 kHz	78.8	78.9	80.0	82.4	83.4	83.1	83.1	83.2	83.3	83.4	84.2	84.5	84.9	85.6	85.3	83.3	86.3	86.0
2.5 kHz	76.8	77.0	78.2	80.5	81.4	81.0	81.0	81.2	81.3	81.5	82.5	82.8	83.4	84.3	84.0	81.3	85.3	85.0
3.15 kHz	74.5	74.7	76.1	78.2	79.0	78.6	78.6	78.8	79.0	79.2	80.4	80.9	81.6	82.7	82.3	78.9	84.1	83.7
4 kHz	71.9	72.0	73.6	75.6	76.3	75.8	75.8	76.0	76.3	76.6	78.1	78.7	79.6	80.8	80.4	76.2	82.7	82.2
5 kHz	68.9	69.0	70.9	72.6	73.2	72.6	72.6	73.0	73.3	73.6	75.5	76.1	77.2	78.7	78.2	73.2	81.0	80.4
6.3 kHz	65.5	65.7	67.8	69.3	69.7	69.1	69.2	69.5	70.0	70.4	72.5	73.3	74.6	76.3	75.7	69.7	79.2	78.5
8 kHz	61.8	62.0	64.3	65.7	65.9	65.2	65.3	65.8	66.3	66.8	69.3	70.2	71.6	73.6	72.9	66.0	77.0	76.2
10 kHz	57.8	58.0	60.6	61.7	61.8	61.0	61.1	61.7	62.3	62.9	65.7	66.7	68.4	70.7	69.9	61.9	74.7	73.8
A-wgt	93.5	93.7	94.3	97.2	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0

Table 6: V162-SO5, expected 1/3 octave band performance

(Blades with serrated trailing edges)

3.7 Results V162 SO6

Frequency	Hub height wind speeds [m/s]																	
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	12.0	16.3	16.2	17.4	19.2	18.0	19.8	19.6	20.4	21.4	22.2	24.2	26.0	26.1	27.7	25.7	23.0	24.4
8 Hz	18.9	22.9	22.8	24.1	26.0	25.0	26.6	26.4	27.1	28.0	28.7	30.4	31.9	31.9	33.4	31.6	29.2	30.7
10 Hz	25.5	29.2	29.1	30.6	32.4	31.5	33.0	32.9	33.5	34.2	34.8	36.3	37.5	37.4	38.7	37.2	35.1	36.6
12.5 Hz	31.7	35.1	35.0	36.6	38.4	37.7	39.0	38.9	39.5	40.1	40.6	41.8	42.8	42.7	43.8	42.5	40.7	42.2
16 Hz	37.9	41.1	41.0	42.8	44.1	43.6	44.7	44.7	45.1	45.6	46.1	47.0	47.8	47.6	48.5	47.5	46.0	47.5
20 Hz	43.8	46.7	46.7	48.5	49.8	49.4	50.4	50.4	50.8	51.2	51.6	52.3	52.9	52.6	53.4	52.6	51.3	52.8
25 Hz	49.7	52.3	52.3	54.3	55.2	54.9	55.8	55.8	56.1	56.5	56.7	57.3	57.7	57.4	58.1	57.4	56.3	57.8
31.5 Hz	55.5	57.9	57.9	60.0	60.5	60.4	61.1	61.1	61.4	61.7	61.9	62.3	62.6	62.2	62.7	62.2	61.4	62.8
40 Hz	60.4	62.6	62.6	64.8	65.8	65.8	66.4	66.4	66.7	66.8	67.0	67.2	67.4	67.0	67.4	67.0	66.4	67.7
50 Hz	64.5	66.5	66.5	68.8	70.3	70.3	70.8	70.8	71.1	71.2	71.2	71.4	71.4	70.9	71.3	71.0	70.6	71.9
63 Hz	68.2	70.0	70.1	72.5	73.8	73.9	74.3	74.4	74.6	74.6	74.7	74.7	74.6	74.1	74.4	74.3	73.9	75.2
80 Hz	71.6	73.2	73.3	75.8	77.1	77.2	77.5	77.6	77.7	77.7	77.7	77.7	77.5	77.0	77.2	77.2	77.0	78.1
100 Hz	74.7	76.0	76.2	78.7	79.9	80.1	80.4	80.4	80.5	80.5	80.5	80.3	80.1	79.6	79.7	79.8	79.7	80.8
125 Hz	77.3	78.5	78.7	81.3	82.5	82.7	82.8	82.9	83.0	82.9	82.9	82.7	82.4	82.0	82.0	82.1	82.1	83.1
160 Hz	79.7	80.6	80.9	83.6	84.6	84.9	85.0	85.0	85.1	85.0	84.9	84.7	84.4	84.0	84.0	84.2	84.2	85.1
200 Hz	81.7	82.4	82.7	85.5	86.5	86.7	86.7	86.8	86.8	86.7	86.7	86.4	86.1	85.7	85.7	85.9	86.0	86.7
250 Hz	82.8	83.4	83.8	86.5	87.9	88.1	88.2	88.2	88.2	88.1	88.1	87.8	87.5	87.2	87.1	87.3	87.5	88.1
315 Hz	83.0	83.5	83.9	86.7	88.6	88.7	88.7	88.8	88.7	88.7	88.6	88.4	88.1	87.8	87.7	88.0	88.1	88.5
400 Hz	83.2	83.6	84.1	86.9	88.3	88.4	88.4	88.4	88.4	88.3	88.3	88.1	87.9	87.7	87.6	87.8	88.0	88.2
500 Hz	83.4	83.6	84.2	87.0	88.0	88.1	88.0	88.0	88.0	88.0	87.9	87.8	87.7	87.6	87.5	87.6	87.8	87.9
630 Hz	83.3	83.3	83.9	86.8	87.7	87.7	87.6	87.6	87.6	87.6	87.6	87.5	87.5	87.5	87.4	87.5	87.6	87.5
800 Hz	83.1	83.0	83.8	86.6	87.1	87.0	86.9	86.9	86.8	86.9	86.9	87.0	87.0	87.1	87.0	87.1	87.1	86.8
1 kHz	82.7	82.4	83.2	86.1	86.4	86.2	86.2	86.1	86.1	86.2	86.2	86.4	86.6	86.8	86.8	86.7	86.7	86.2
1.25 kHz	81.8	81.5	82.4	85.2	85.4	85.2	85.1	85.0	85.0	85.1	85.2	85.6	85.9	86.2	86.2	86.1	86.0	85.2
1.6 kHz	80.6	80.2	81.2	84.0	84.1	83.7	83.7	83.5	83.5	83.7	83.9	84.4	84.9	85.3	85.4	85.1	84.9	83.9
2 kHz	79.1	78.6	79.6	82.5	82.4	81.9	81.9	81.7	81.7	82.0	82.3	82.9	83.6	84.2	84.3	83.9	83.5	82.3
2.5 kHz	77.2	76.6	77.8	80.5	80.4	79.7	79.8	79.5	79.6	79.9	80.2	81.1	82.0	82.7	82.9	82.4	81.8	80.4
3.15 kHz	75.0	74.3	75.5	78.3	78.0	77.1	77.3	77.0	77.0	77.5	77.9	79.0	80.1	81.0	81.3	80.6	79.8	78.1
4 kHz	72.4	71.6	73.0	75.7	75.3	74.2	74.4	74.1	74.2	74.7	75.2	76.5	77.9	78.9	79.3	78.4	77.5	75.5
5 kHz	69.4	68.6	70.1	72.7	72.2	70.9	71.2	70.8	70.9	71.6	72.2	73.8	75.4	76.6	77.1	76.0	74.8	72.6
6.3 kHz	66.1	65.3	66.8	69.4	68.7	67.3	67.6	67.2	67.3	68.1	68.8	70.7	72.6	74.0	74.6	73.3	71.9	69.3
8 kHz	62.5	61.6	63.3	65.8	64.9	63.3	63.7	63.2	63.4	64.3	65.1	67.3	69.5	71.1	71.8	70.3	68.6	65.7
10 kHz	58.5	57.5	59.3	61.8	60.8	58.9	59.5	58.9	59.1	60.2	61.1	63.6	66.1	67.9	68.8	67.0	65.0	61.8
A-wgt	93.5	93.7	94.3	97.1	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0

Table 7: V162-SO6, expected 1/3 octave band performance

(Blades with serrated trailing edges)

4. Limitations

The values as stated in the present document are to be regarded as “best estimates” for the octave band performance for the turbine. The values are to be regarded as informative and cannot in any way be used as guaranteed for any projects.

The complete document can be handed out as pdf and must always be referred to using the complete document DMS number.

5. Recalculation to 10 m wind speeds

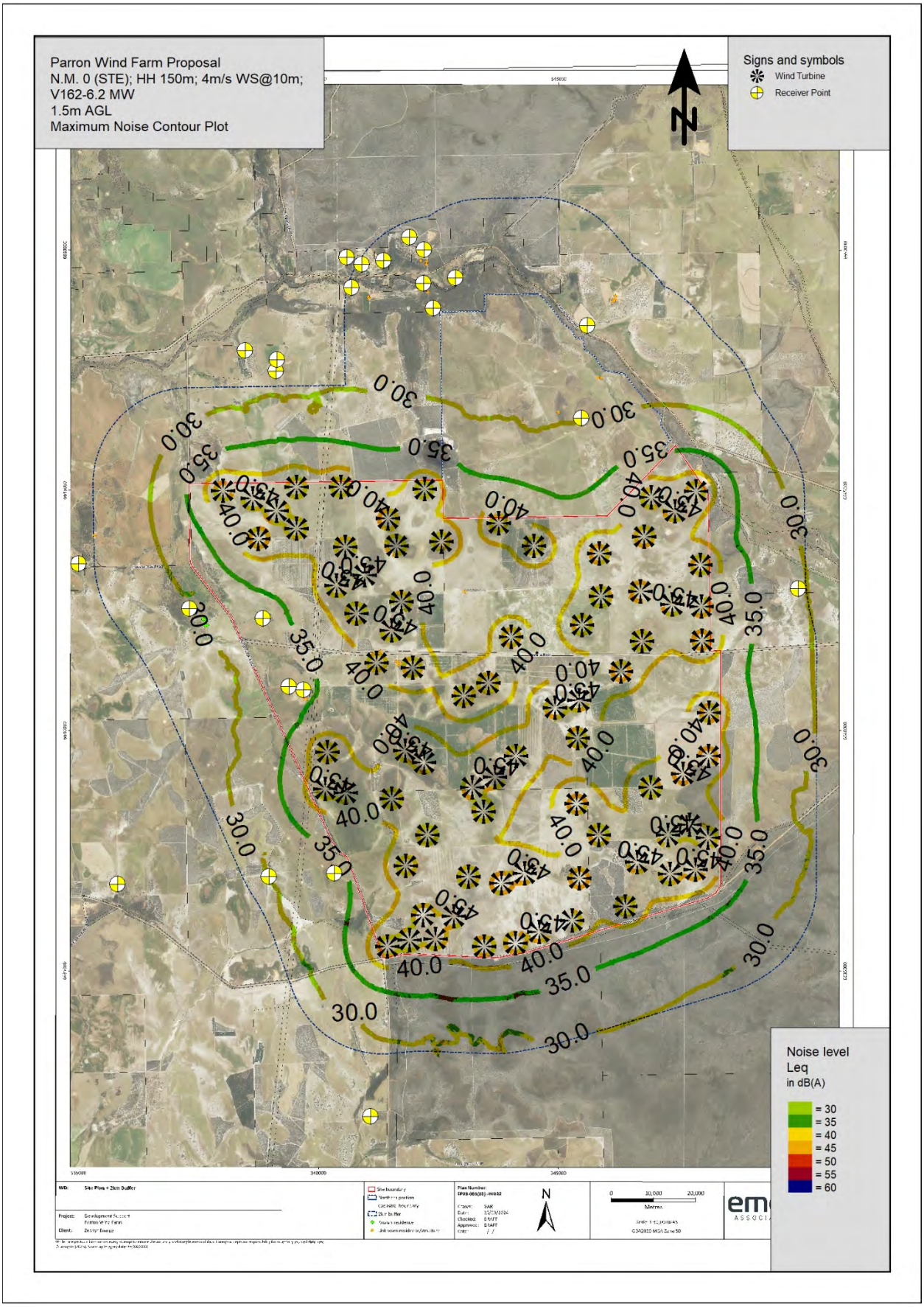
In case 10 m height wind speed references are required, recalculation of the stated values can be made using the following procedure:

1. The stated hub height wind speeds are recalculated to 10 m reference height.
2. Integer 10 m height wind speed related sound power levels are calculated using linear interpolation between the nearest non-integer values.

Recalculation is made using procedures as defined in IEC 61400-11 ed.3. Appendix D.

APPENDIX D

PREDICTED NOISE LEVEL CONTOURS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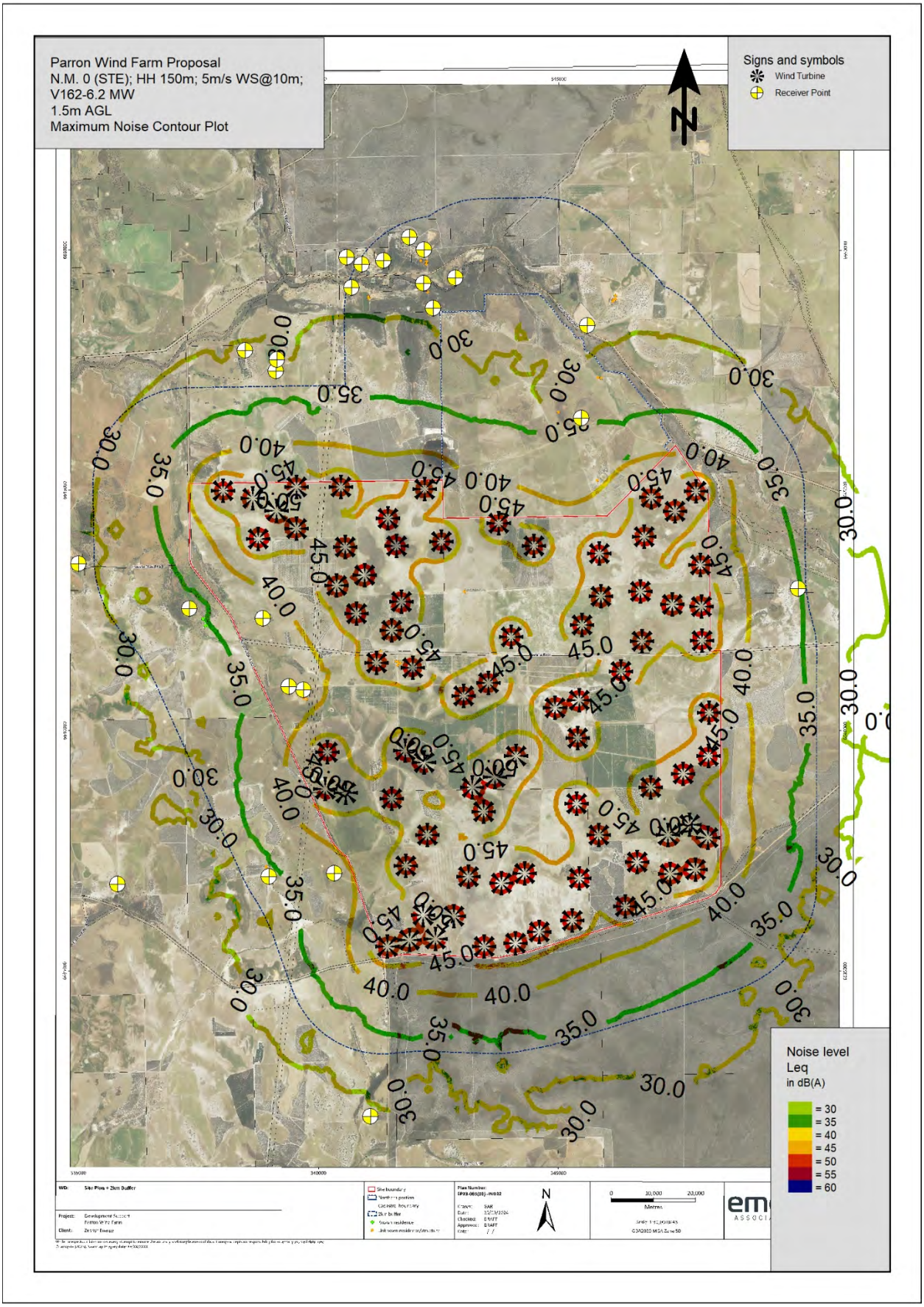
V162-6.2 MW
1.5m AGL
Maximum Noise Contour Plot
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
30.0
35.0
40.0
45.0
Metres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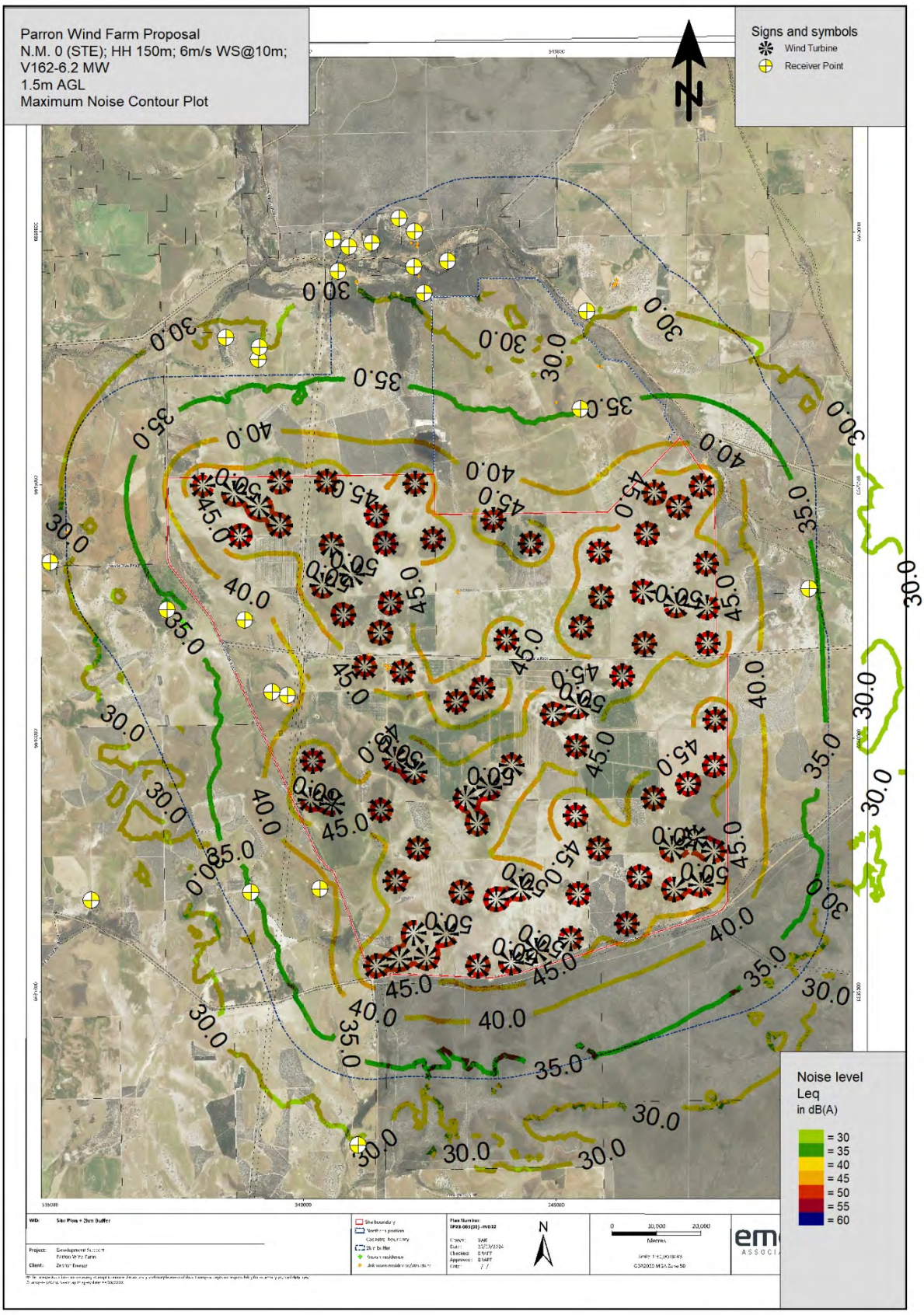
V162-6.2 MW
1.5m AGL
Maximum Noise Contour Plot
Signs and symbols
Wind Turbine
Receiver Point
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60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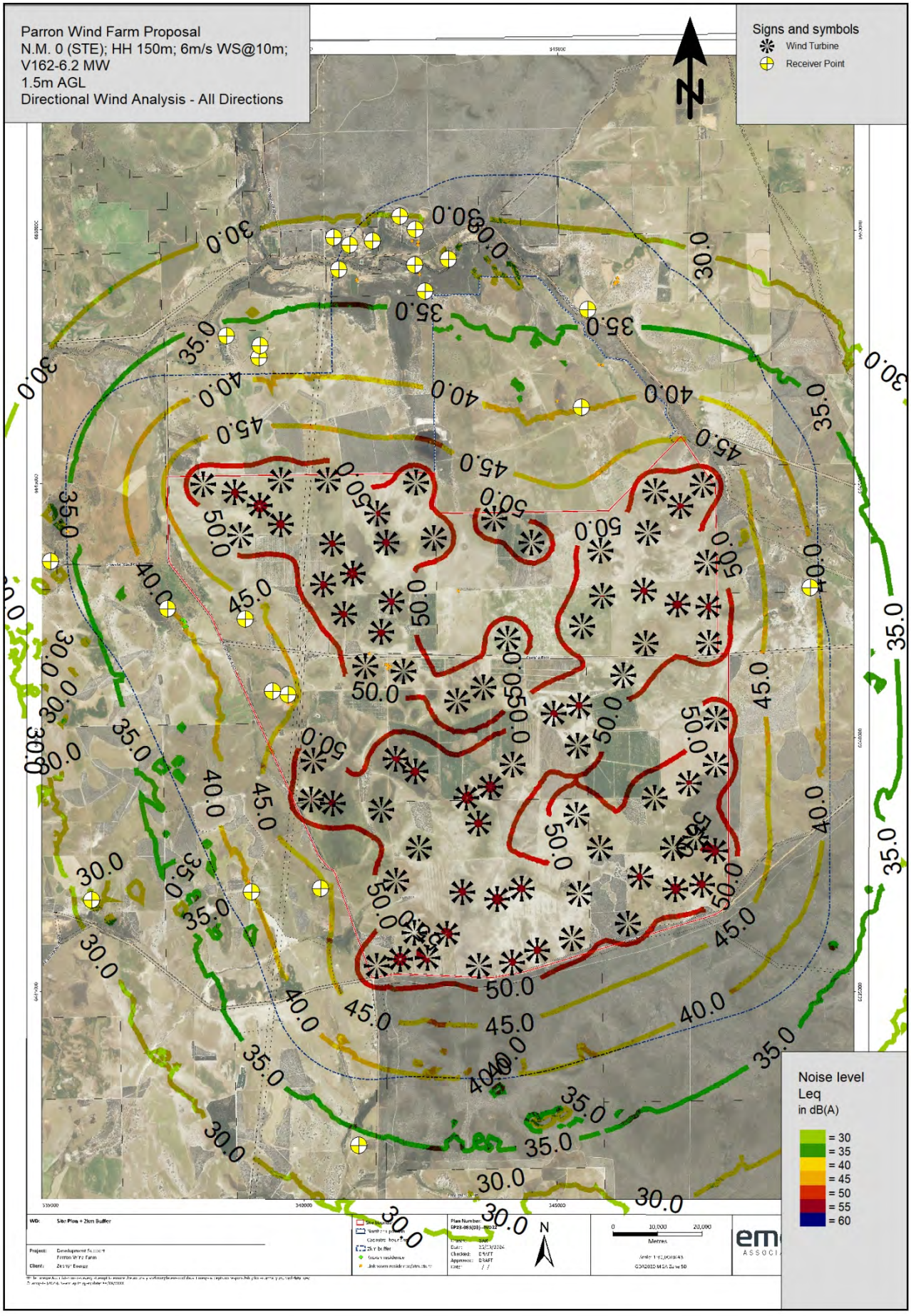
V162-6.2 MW
1.5m AGL
Maximum Noise Contour Plot
Signs and symbols
Wind Turbine
Receiver Point
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres

APPENDIX E

WIND DIRECTON ANALYSIS CONTOURS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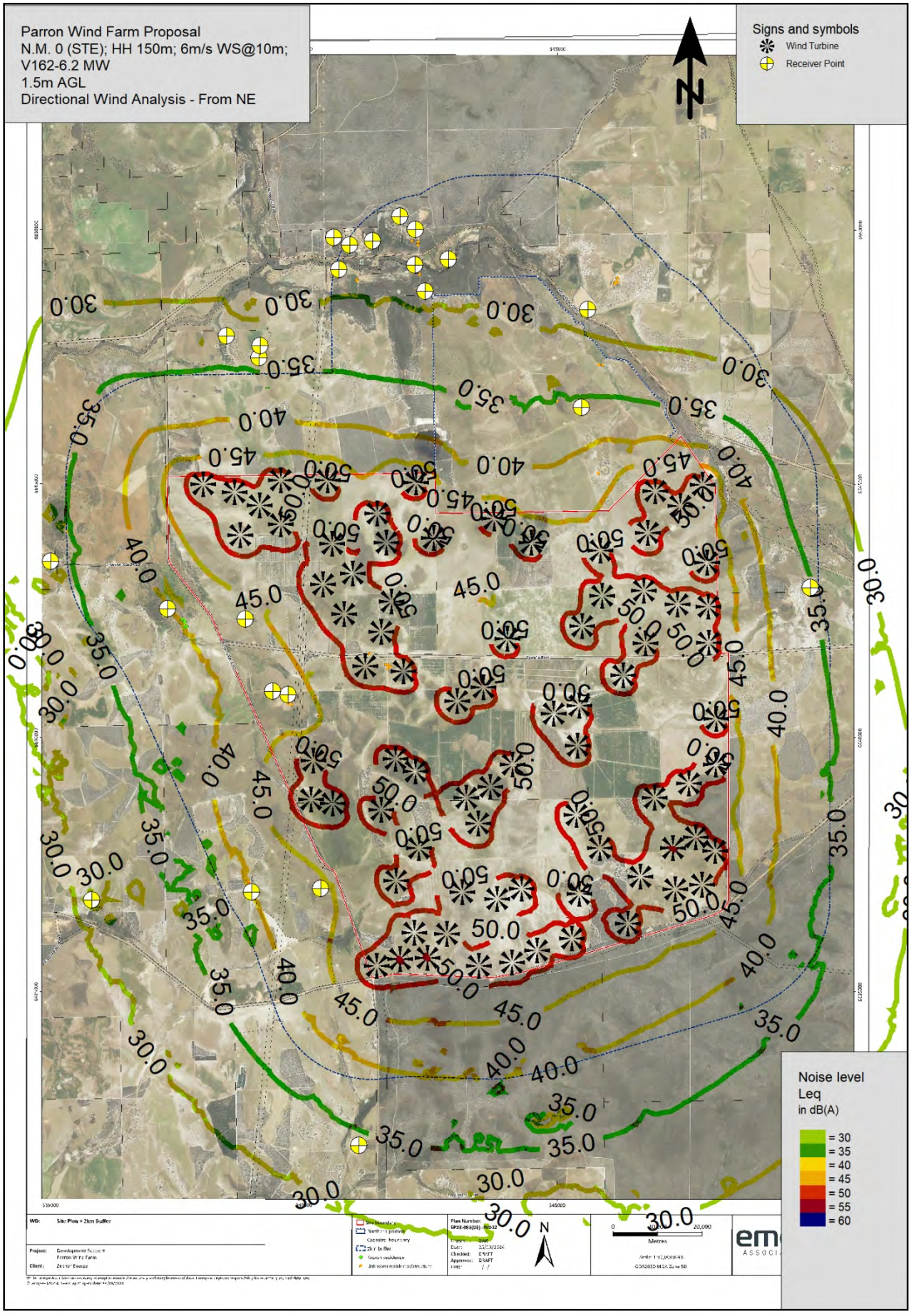
V162-6.2 MW
1.5m AGL
Directional Wind Analysis - All Directions
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres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V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From NE
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
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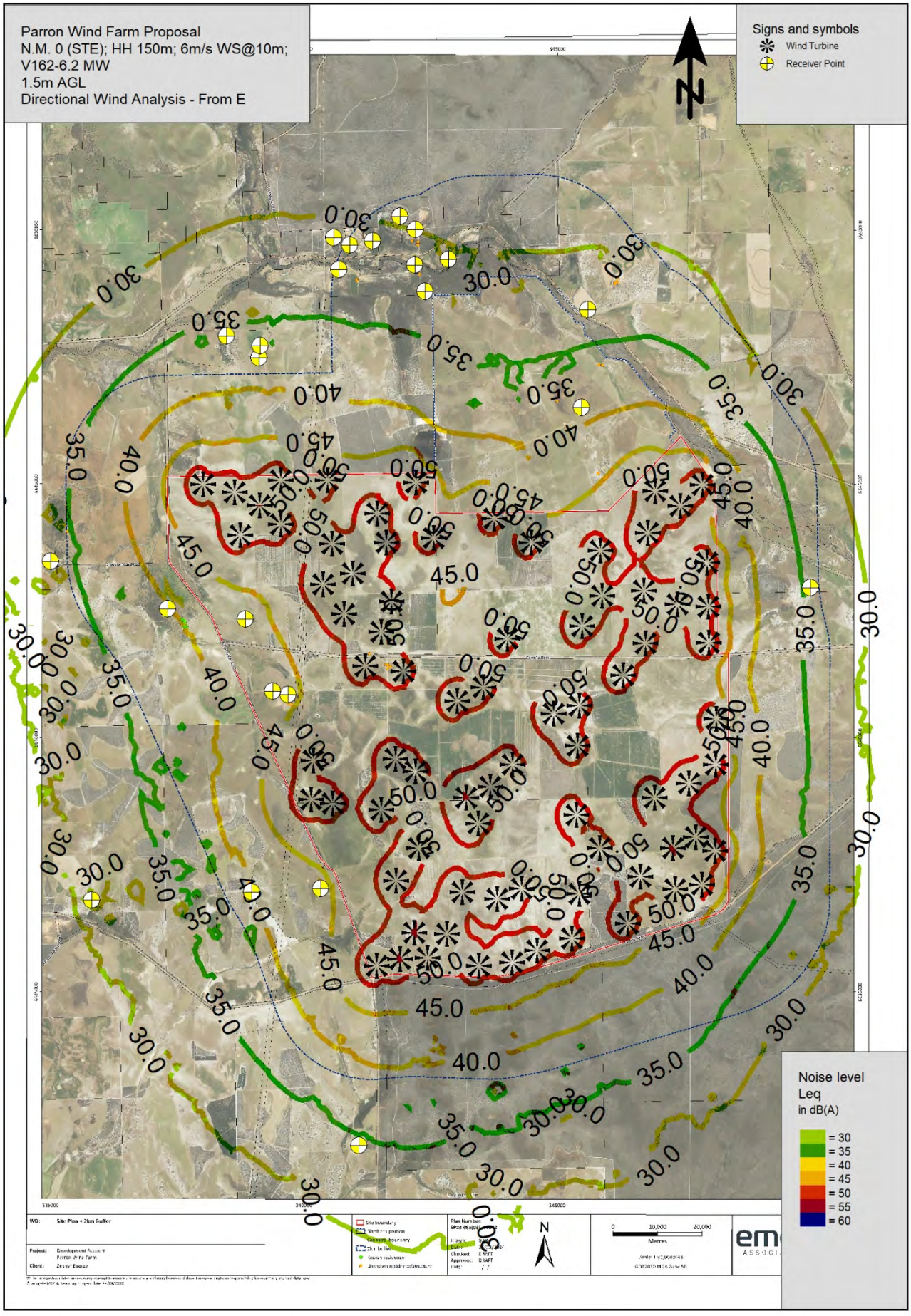
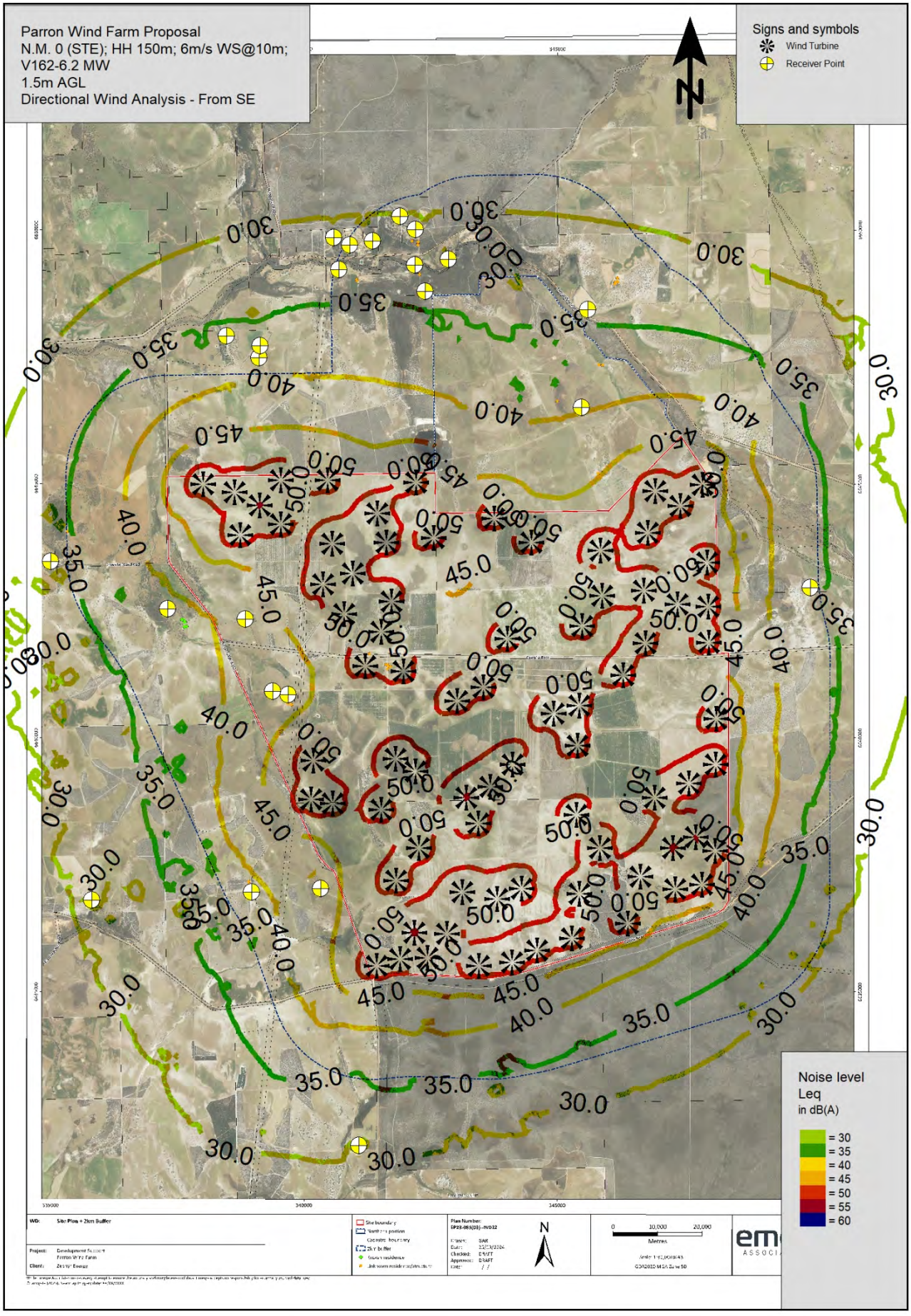
= 35
= 40
= 45
= 50
= 55
= 60
Metres


Parron Wind Farm Proposal
N.M. 0 (STE); HH 150m; 6m/s WS@10m;
V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From E
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres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V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From SE
Signs and symbols
Wind Turbine
Receiver Point
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Noise level
Leq
in dB(A)
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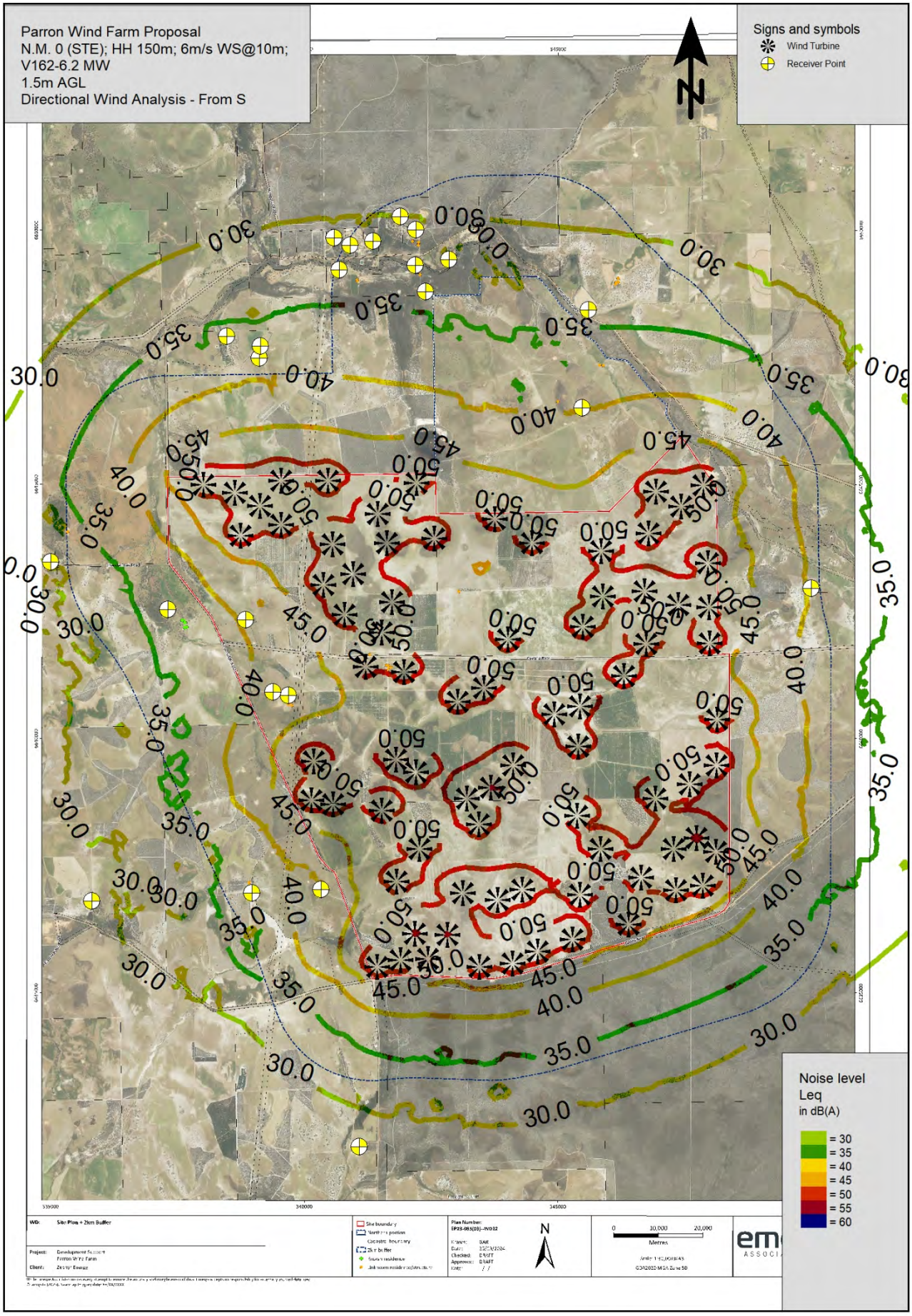
= 35
= 40
= 45
= 50
= 55
= 60
Metres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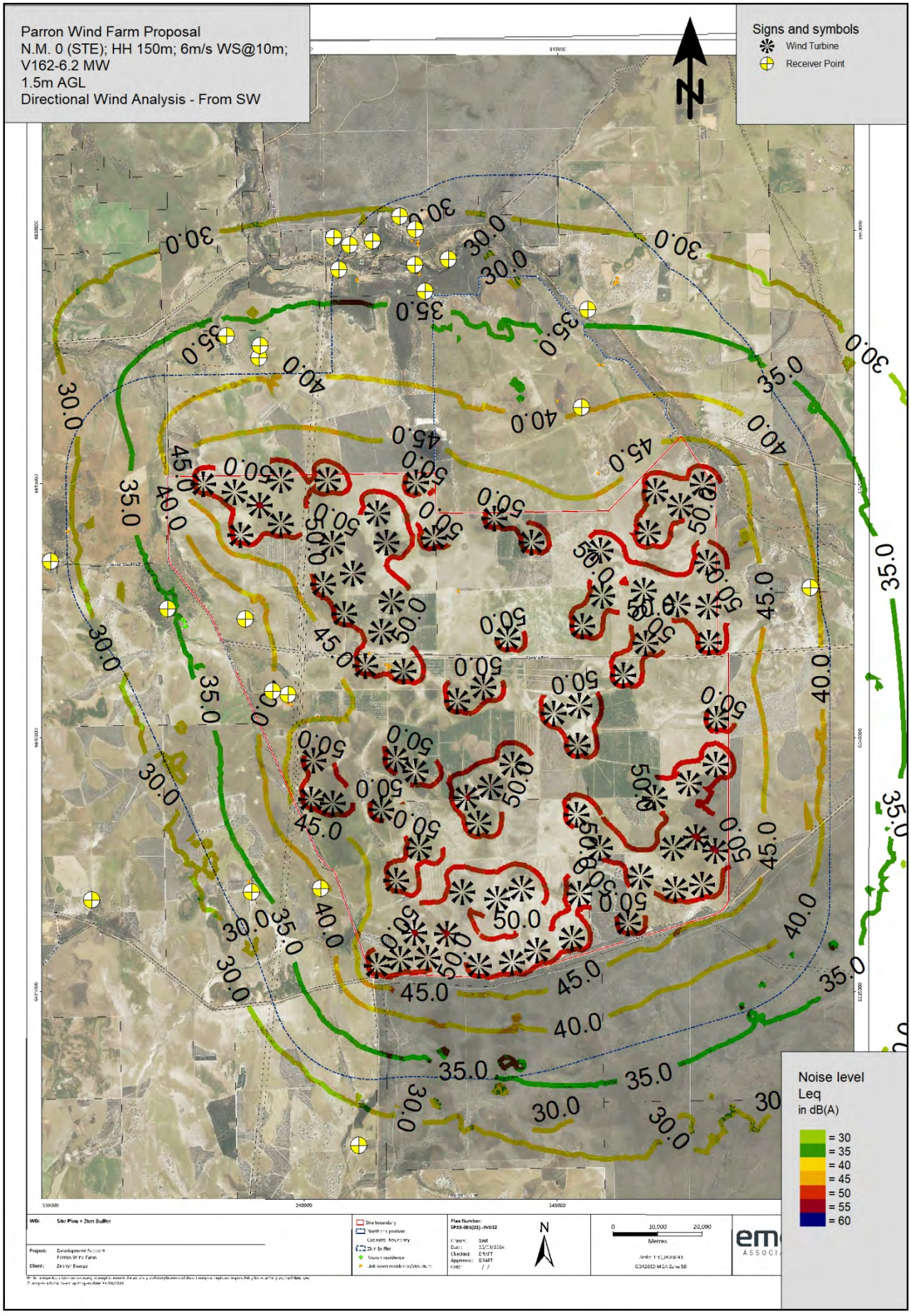
V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From S
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres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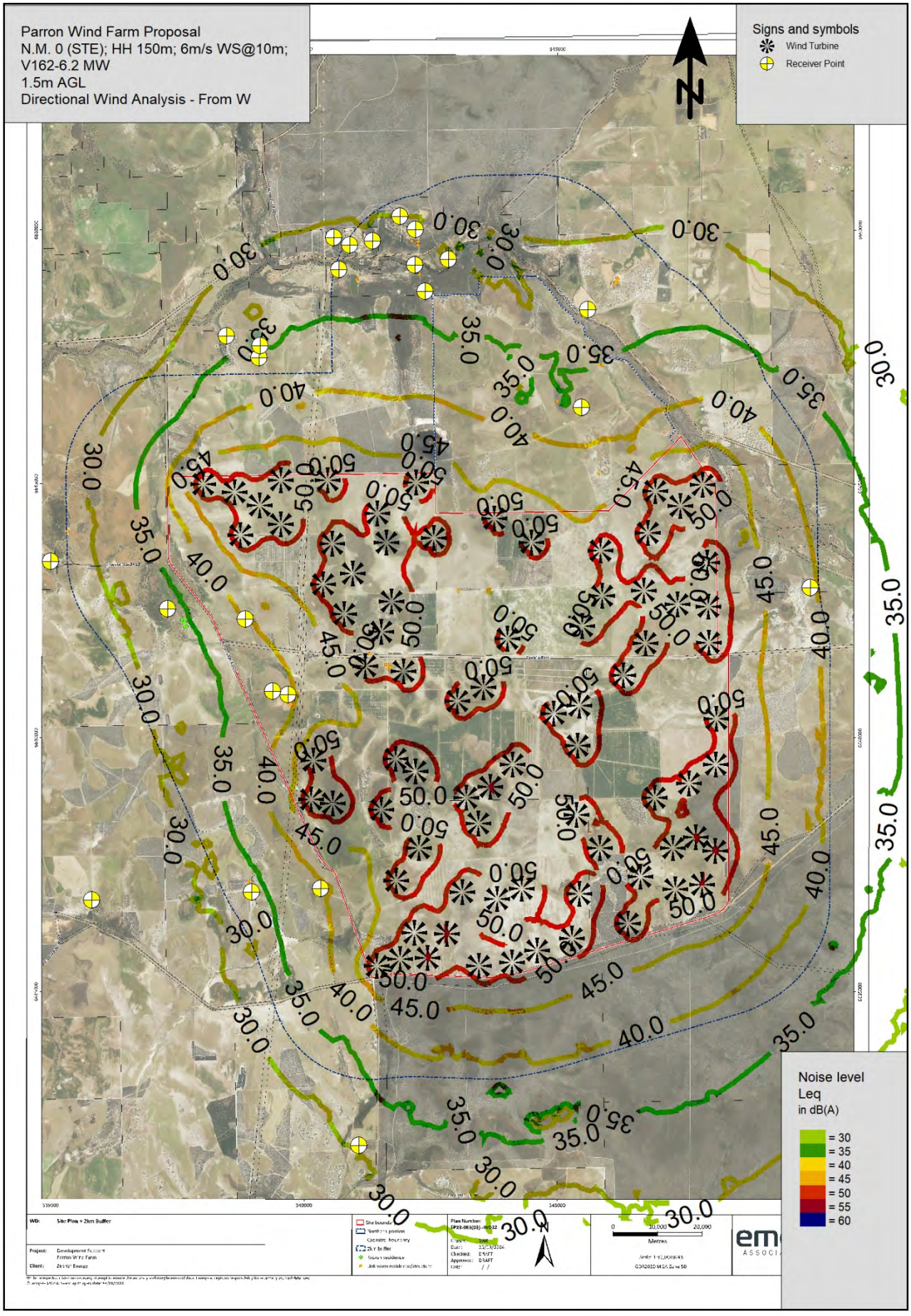
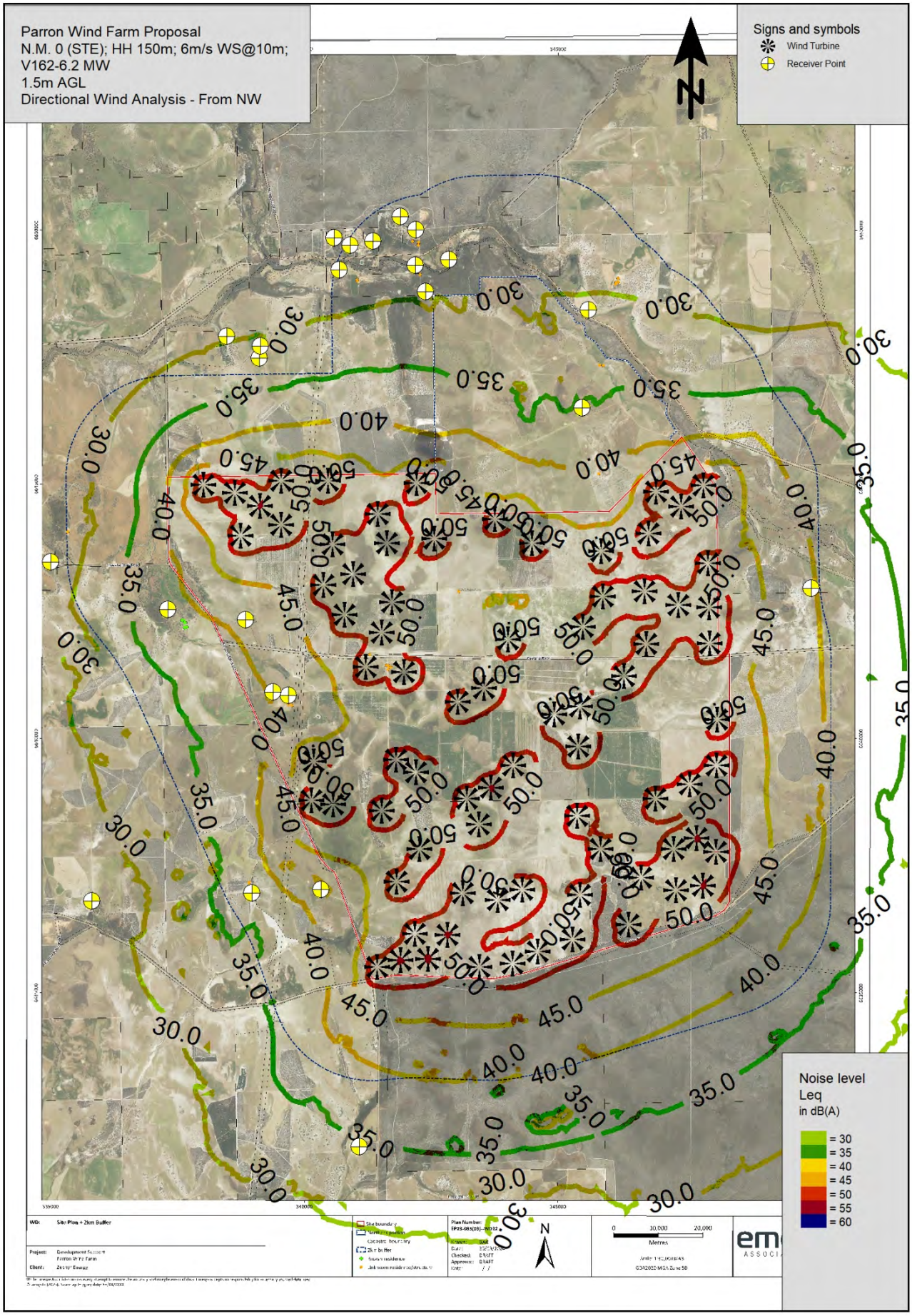
V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From SW
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres


Parron Wind Farm Proposal
N.M. 0 (STE); HH 150m; 6m/s WS@10m;
V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From W
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres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V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From NW
Signs and symbols
Wind Turbine
Receiver Point
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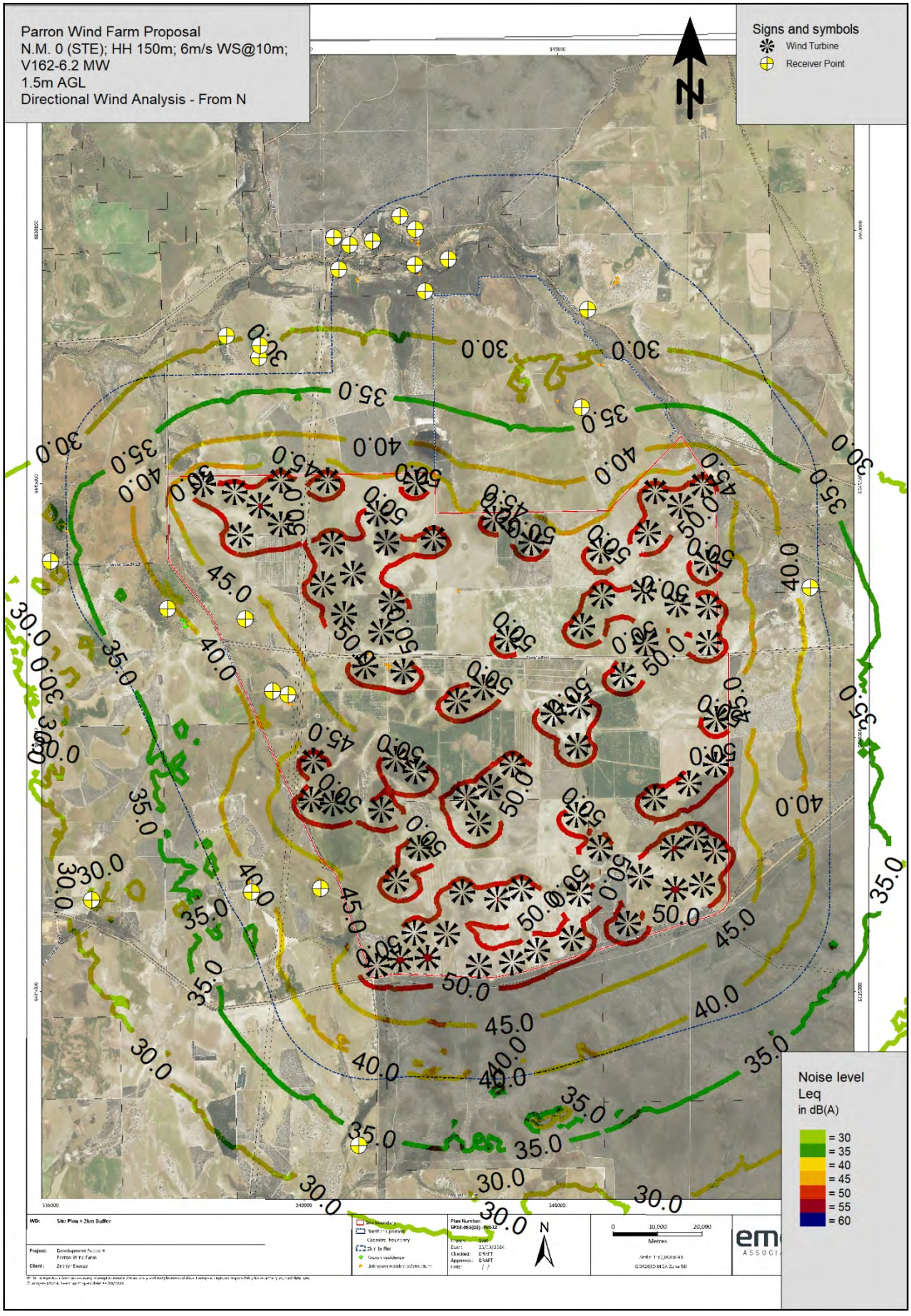
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres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V162-6.2 MW
1.5m AGL
Directional Wind Analysis - From N
Signs and symbols
Wind Turbine
Receiver Point
N
Noise level
Leq
in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
Metres

APPENDIX E

BACKGROUND NOISE MONITORING REPORT - 2007

Sonus Pty Ltd
280 Melbourne Street
NORTH ADELAIDE SA 5006
Phone: 8361 7844
Facsimile: 8361 7879
Mobile: 0417 845 720
ct@sonus.com.au
www.sonus.com.au
ABN: 67 882 843 130

BADGINGARRA WIND FARM

BACKGROUND NOISE ASSESSMENT

FOR ENTHALPY PTY LTD
198 Latrobe Terrace
PADDINGTON QLD 4064

July 2007

TABLE OF CONTENTS

1 INTRODUCTION

Stanwell Corporation and Griffin Energy propose to develop a wind farm located to the north of the existing Emu Downs Wind Farm in Western Australia. The wind farm, which is to be known as the Badgingarra Wind Farm, is presently in the pre-feasibility phase of development.

Sonus Pty Ltd has been engaged to make an environmental noise assessment of the project as part of the pre-feasibility phase. This report summarises the background noise measurements and resultant noise criteria.

Background noise levels were measured at 13 locations within the proposed site between March and May 2007. At the same time, the wind speed at 10m above ground was measured at the proposed wind farm site. From these background noise levels and the wind speeds, the applicable environmental noise criteria have been determined using the South Australian Environment Protection Authority "Wind Farm - Environmental Noise Guidelines" (SA Guidelines).

Data collected at times that included rain as well as data which may have been influenced by wind on the microphone have been discarded.

The nomenclature used in the report is summarised in Appendix A, the correlation of background noise and wind speed data is shown in Appendix B, photographs of the logger locations are presented in Appendix C and the grid coordinates of the logger locations are shown in Appendix D.

2 CRITERIA

In May 2004, the Western Australian Planning Commission released Planning Bulletin 67 titled "Guidelines for Wind Farm Development". This Planning Bulletin endorses the use of the "Wind Farms - Environmental Noise Guidelines" produced by the South Australian Environment Protection Authority (SA Guidelines).

The South Australian Environment Protection Authority has developed these guidelines based on the New Zealand Standard NZS 6808:1998[1].

The SA Guidelines state:

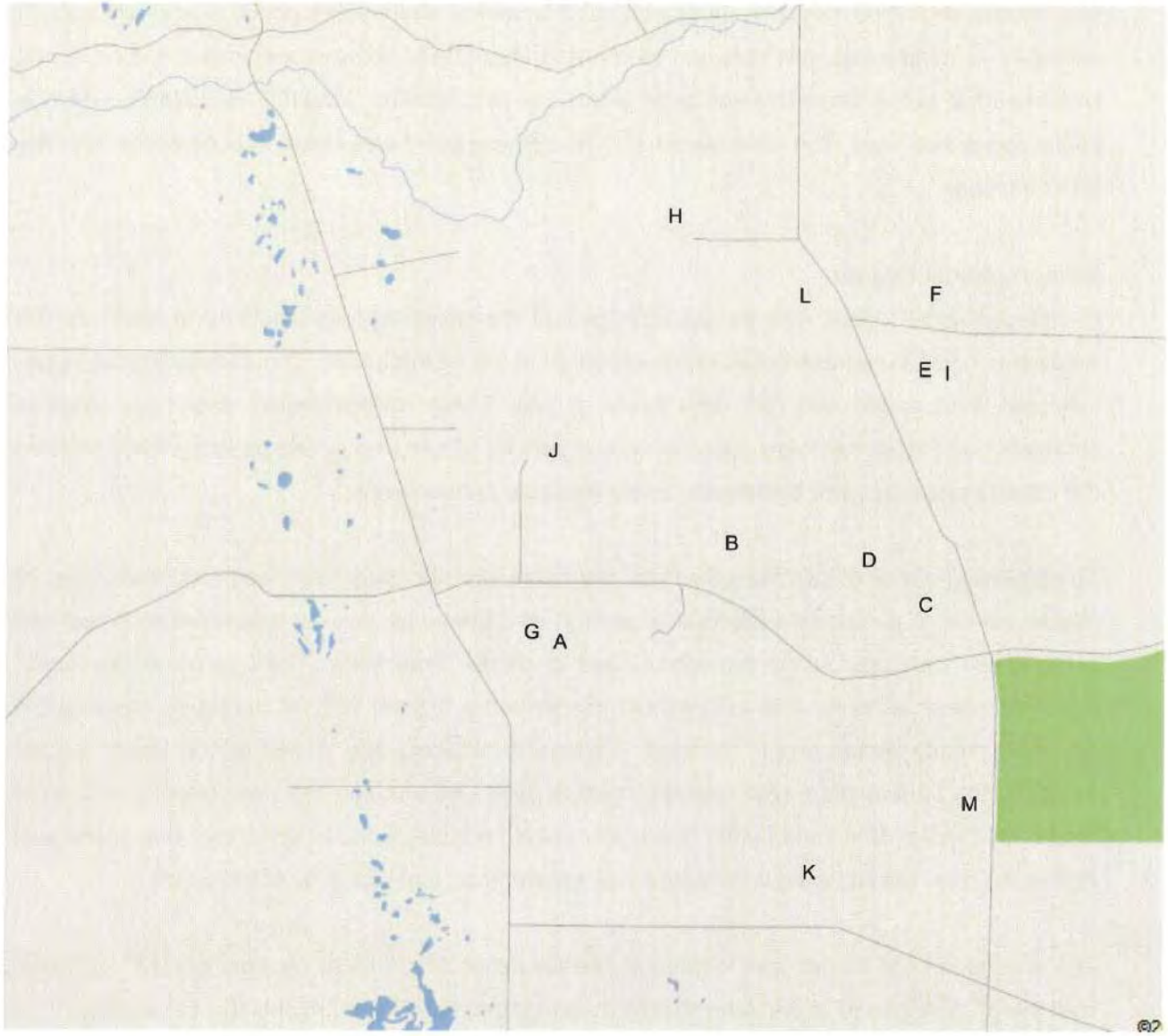
> "The predicted equivalent noise level ($L_{Aeq,10}$) adjusted for tonality in accordance with these guidelines should not exceed:
> - 35 dB(A) or
> - the background noise ($L_{A90,10}$) by more than 5 dB(A)
>
> whichever is greater, at all relevant receivers for each integer wind speed from cut in to rated power of the WTG."

In order to determine the background noise level at various wind speeds, the background noise level at dwellings is measured at the same time that the wind speed is measured at a location that is indicative of the closest wind generators to the dwelling. From this data, a regression curve is plotted that correlates the background noise level with wind speed.

[1] NZS 6808:1998, "Acoustics – The assessment and measurement of sound from wind turbine generators."

3 NOISE LOGGING LOCATIONS

Background noise was logged at the locations shown in the figure below:



Legend

A	Denis Murray	H	Deutcher North
B	Sudholz North	I	Brown South East
C	Deutcher South	J	Daniel Murray
D	Panizza North	K	Sudholz South
E	Brown South West	L	Teasdale
F	Brown North	M	Panizza South
G	John Murray		

Photographs of logger locations are shown in Appendix C and grid coordinates are in Appendix D.

4 MEASURED BACKGROUND NOISE LEVELS AND RESULTANT CRITERIA

The background noise level was measured at 13 locations, each over a period of approximately 3 weeks in 10 minute intervals between March and May 2007. At the same time, the wind speed was recorded at the Cowalla Peak mast located at grid location 335349E, 6638256N, which is 240m above sea level. The wind speed at 10m above ground was used, in accordance with the SA Guidelines.

Meteorological Logger

A meteorological logger was placed near one of the noise logging locations to measure the weather conditions representative of the exposure at the microphones. The meteorological logger collected wind speed and rain data every minute. These meteorological data were used to eliminate noise data that were collected during periods of rain and during periods where wind on the microphone may have contributed to the measured noise levels.

To eliminate periods of rain from the data, the data were not used if rain was recorded in the 10 minute period. It is common practice in general environmental noise measurements to exclude noise levels measured when the wind speed is greater than 5m/s. The L_{A90} noise descriptor, which has been used for this assessment, discards the highest 90% of the noise measured in every 10 minute period and is therefore effective in reducing any impact of wind gusts on the microphone. To eliminate any potential residual effect of wind on the microphone, data were discarded if in the 10 minute period, there was not a 1 minute period in which the wind speed was less than 5m/s. That is, if the wind speed was greater than 5m/s for 90% of the period.

The meteorological logger was located at the Deutcher South Dwelling from the 13th of March until the 3rd of April and at the John Murray dwelling from the 4th of April until the 14th of May.

Least Squares Regression Analysis

A least squares regression analysis of the data was undertaken to determine the line of best fit. The data and the regression curve are shown in Appendix B. Based on this regression analysis, the background noise level at a range of wind speeds within the operating range of the generators is shown in the table below as well as the resultant criterion based on the SA Guidelines.

	Dwelling		Windpeed (m/s)								
			4	5	6	7	8	9	10	11	12
A	Denis Murray	L_{90}	29	31	33	35	38	41	43	46	47
		Criterion	35	36	38	40	43	46	48	51	52
B	Sudholz North	L_{90}	29	30	31	33	35	37	40	43	47
		Criterion	35	35	36	38	40	42	45	48	52
C	Deutcher South	L_{90}	29	29	30	31	33	35	37	39	40
		Criterion	35	35	35	36	38	40	42	44	45
D	Panizza North	L_{90}	27	28	31	34	38	42	46	49	51
		Criterion	35	35	36	39	43	47	51	54	56
E	Brown South West	L_{90}	27	33	38	41	44	47	50	53	56
		Criterion	35	38	43	46	49	52	55	58	61
F	Brown North	L_{90}	26	30	33	37	40	42	44	46	47
		Criterion	35	35	38	42	45	47	49	51	52
G	John Murray	L_{90}	24	27	30	34	37	41	44	47	49
		Criterion	35	35	35	39	42	46	49	52	54
H	Deutcher North	L_{90}	24	29	33	35	37	38	40	43	46
		Criterion	35	35	38	40	42	43	45	48	51
I	Brown South East	L_{90}	26	31	35	38	40	42	44	47	50
		Criterion	35	36	40	43	45	47	49	52	55
J	Daniel Murray	L_{90}	28	30	32	33	34	36	37	39	41
		Criterion	35	35	37	38	39	41	42	44	46
K	Sudholz South	L_{90}	28	29	31	33	36	38	41	43	46
		Criterion	35	35	36	38	41	43	46	48	51
L	Teasdale	L_{90}	24	27	30	33	35	37	39	40	41
		Criterion	35	35	35	38	40	42	44	45	46
M	Panizza South	L_{90}	30	31	33	35	37	39	42	44	46
		Criterion	35	36	38	40	42	44	47	49	51

5 CONCLUSION

The background noise level was continually logged in ten minute intervals at thirteen dwellings in the vicinity of the proposed Badgingarra Wind Farm.

Data that was collected during periods of rain as well as data that may have been influenced by wind on the microphone were discarded.

The remaining noise data were correlated with wind speed data and a regression curve fitted to show the correlation between wind speed and background noise level at each of the dwellings.

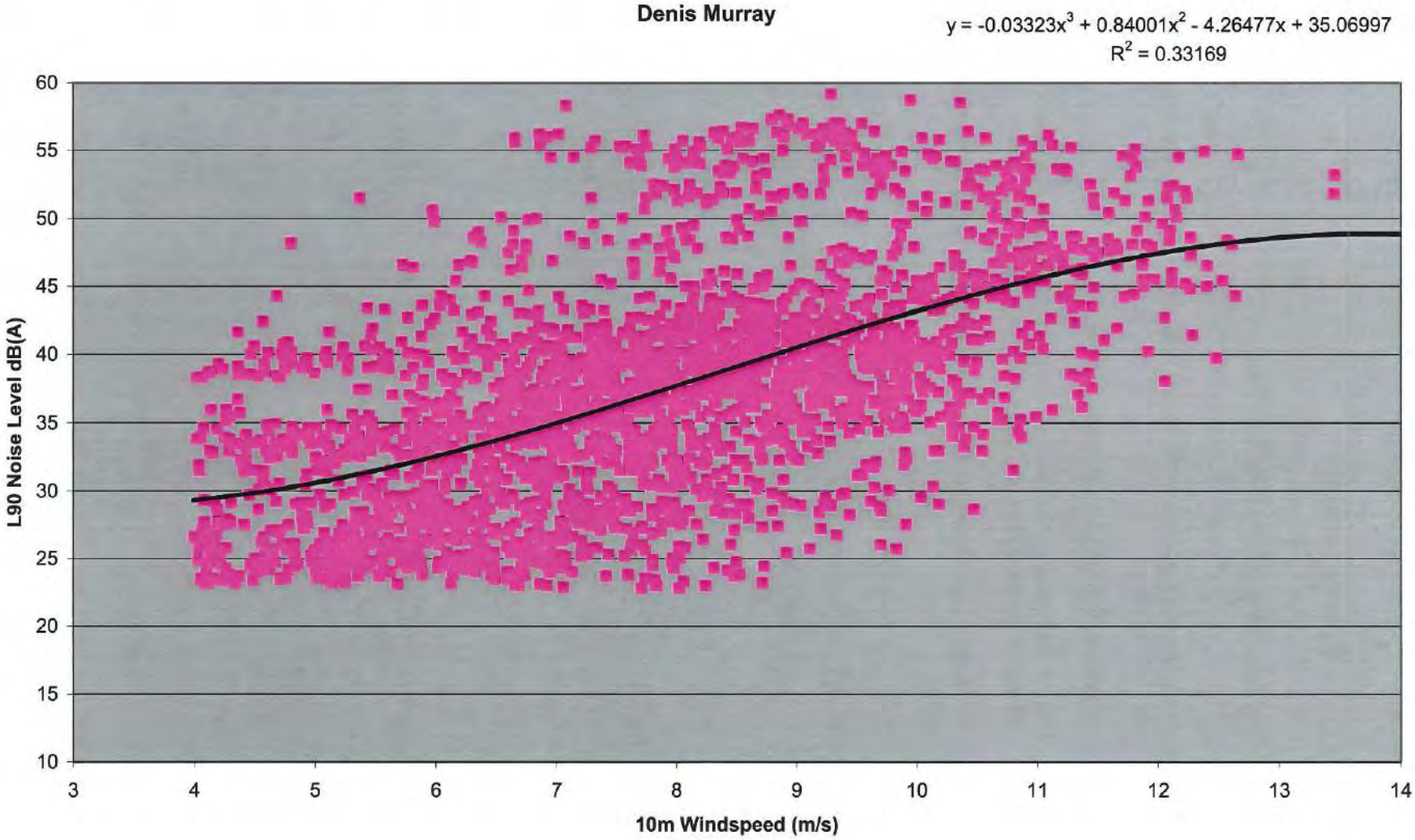
These regression curves were used to determine the criteria for the dwellings in accordance with the South Australian EPA Wind Farm – Environmental Noise Guidelines.

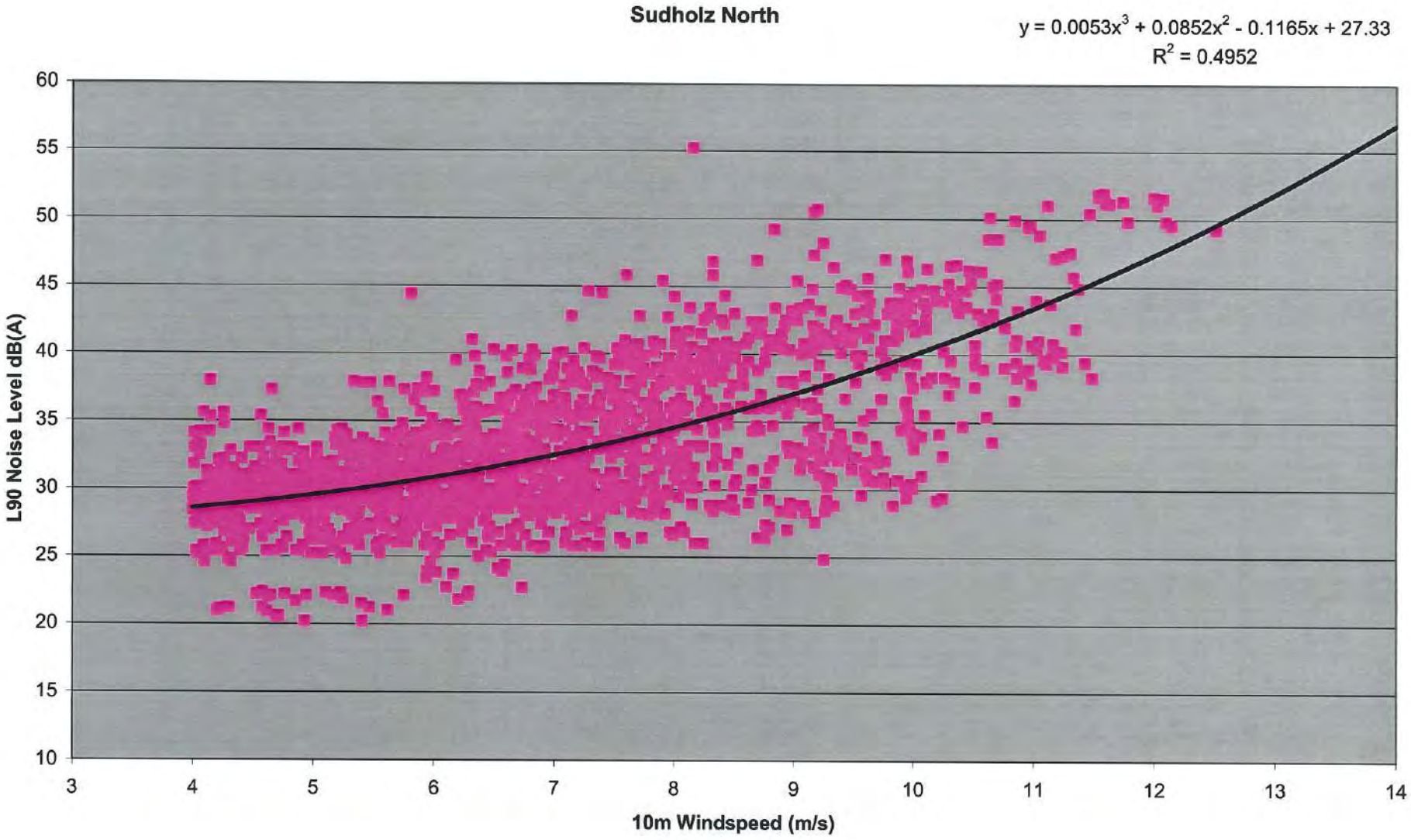
APPENDIX A NOMENCLATURE

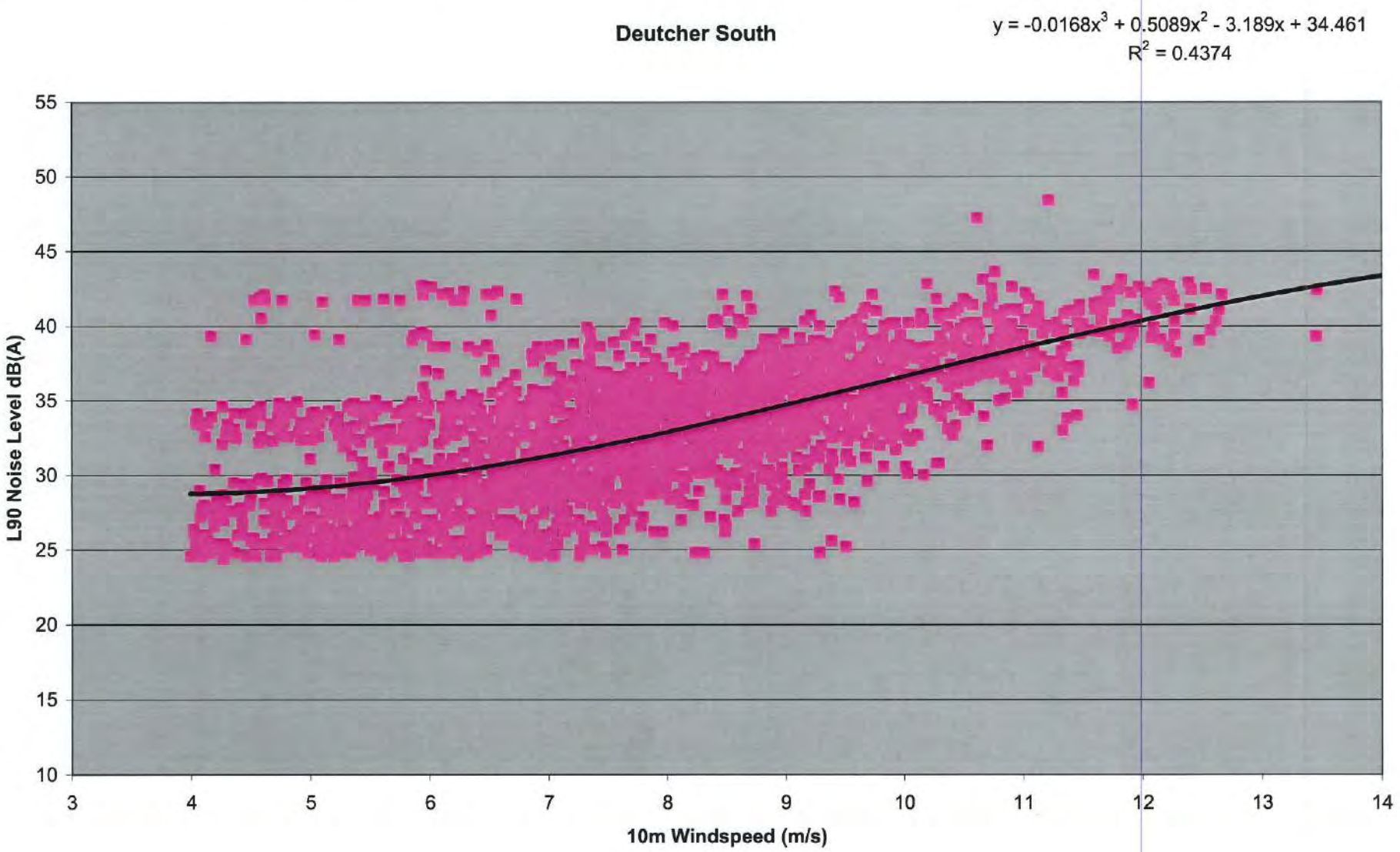
The noise level terminology used is summarised below :

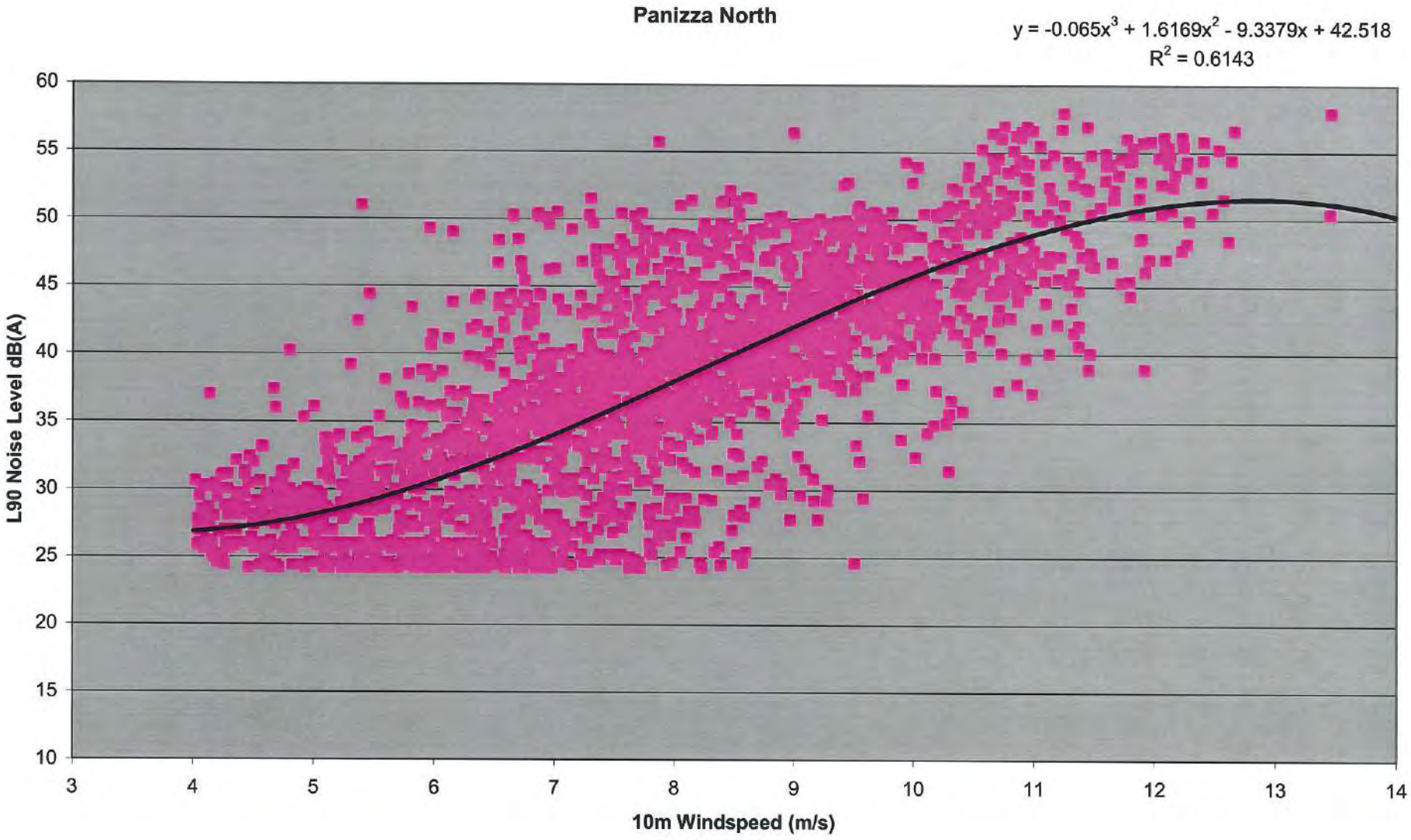
'A' Weighted	Frequency filter applied to measured noise levels to replicate the frequency response of the human ear.
dB(A)	'A' Weighted overall sound pressure level.
L_{A90}	The 'A' Weighted noise level exceeded 90% of the measurement period. This descriptor is used to represent the background noise level.
L_{Aeq}	'A' weighted time based equivalent (or average) noise level measured over a time period.
$L_{A90,10}$	The L_{A90} measured over a 10 minute period.
$L_{Aeq,10}$	The L_{Aeq} measured over a 10 minute period.

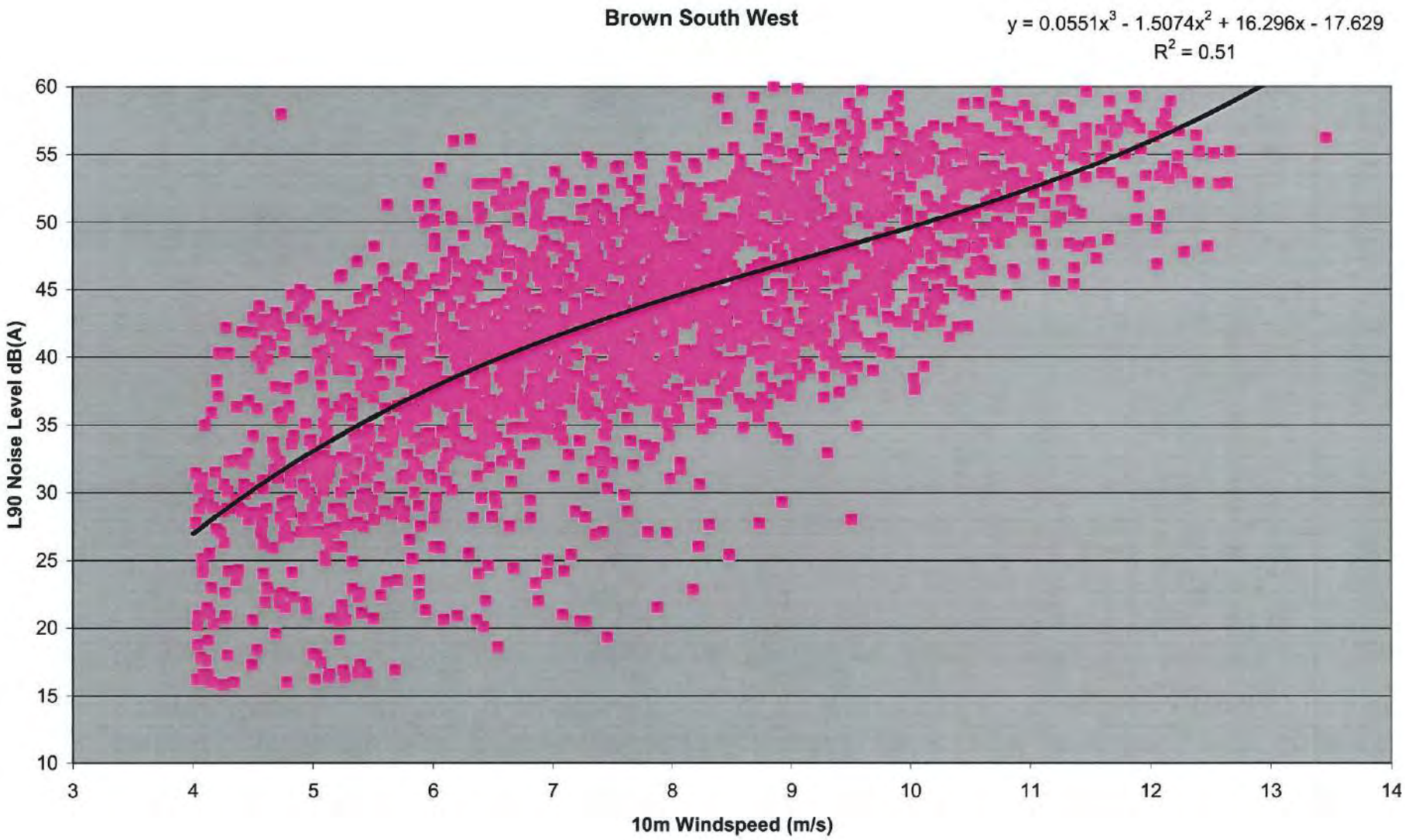
APPENDIX B WIND SPEED AND BACKGROUND NOISE REGRESSION CURVES

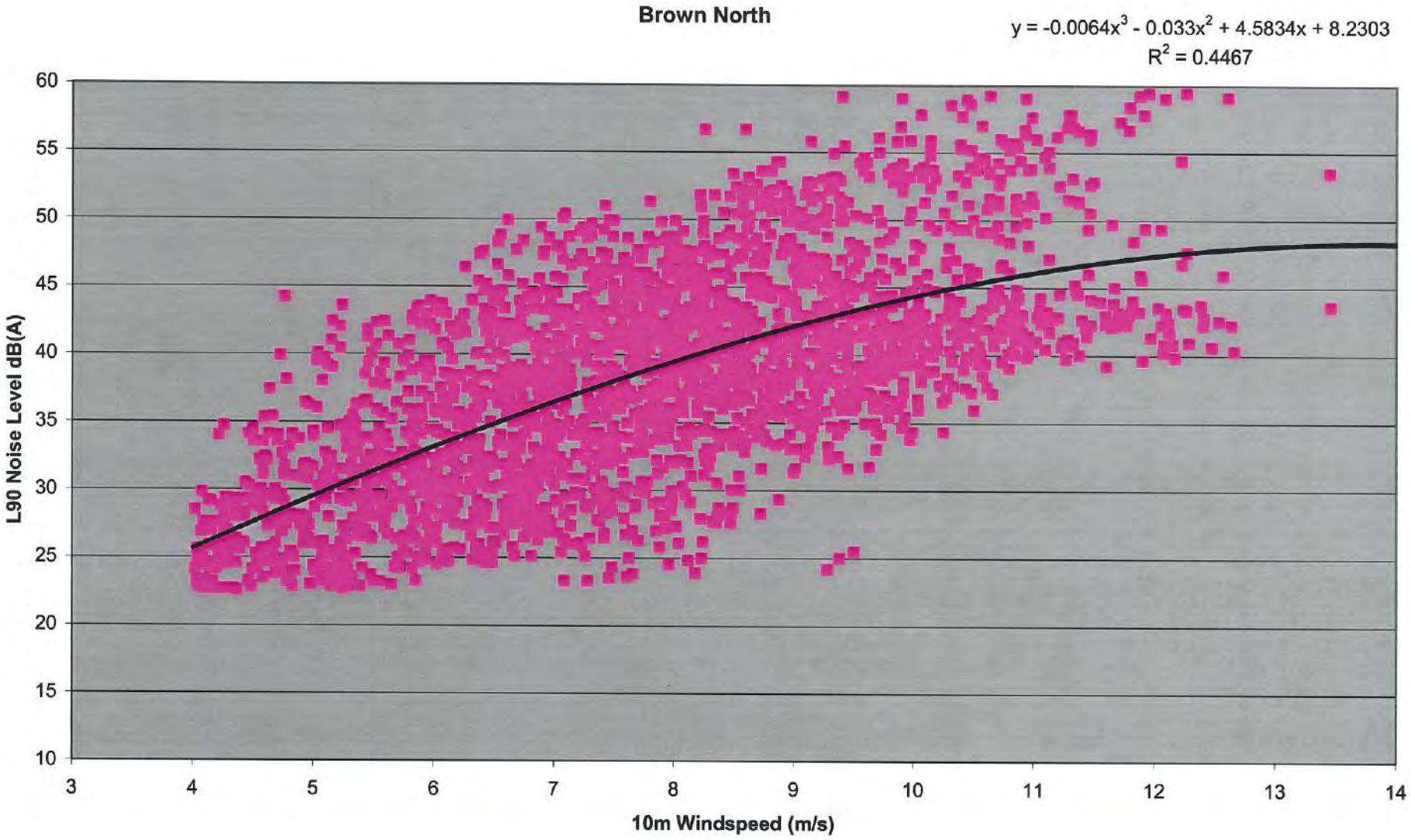


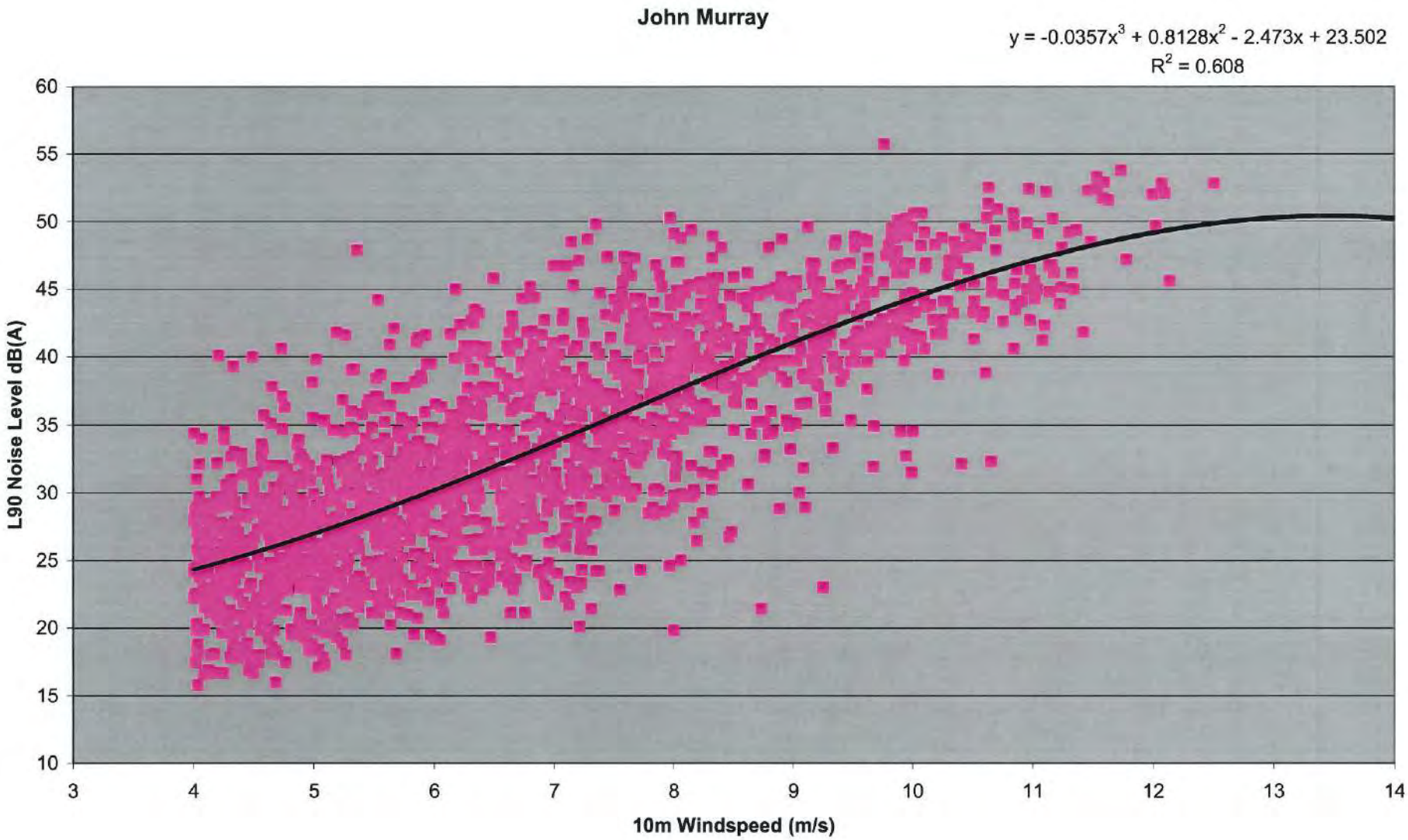

Sudholz North
y = 0.0053x3 + 0.0852x2 - 0.1165x + 27.33
R2 = 0.4952
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)

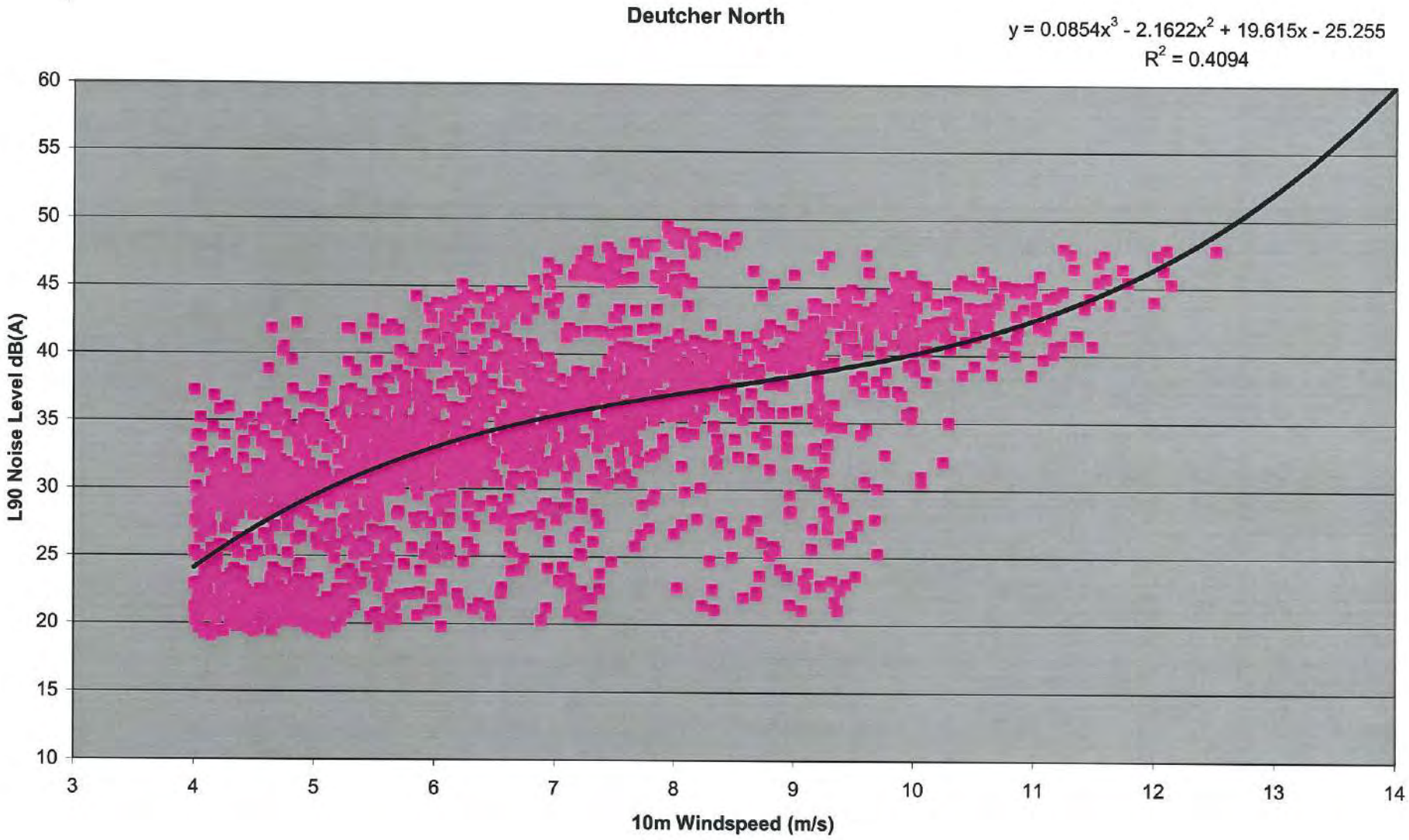

Deutcher South
y = -0.0168x^3 + 0.5089x^2 - 3.189x + 34.461
R^2 = 0.4374
L90 Noise Level dB(A)
10m Windspeed (m/s)
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14

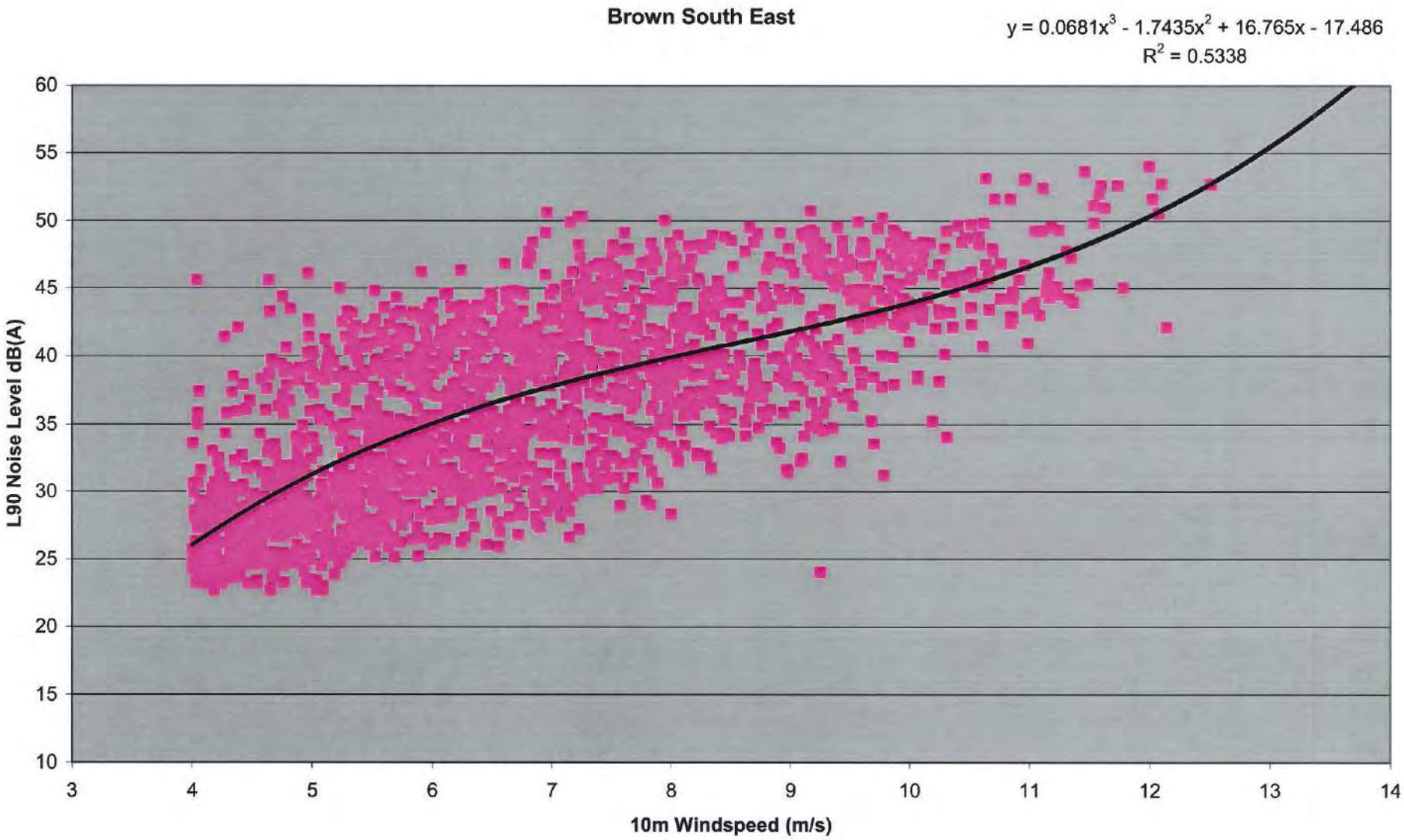

Panizza North
y = -0.065x3 + 1.6169x2 - 9.3379x + 42.518
R2 = 0.6143
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)

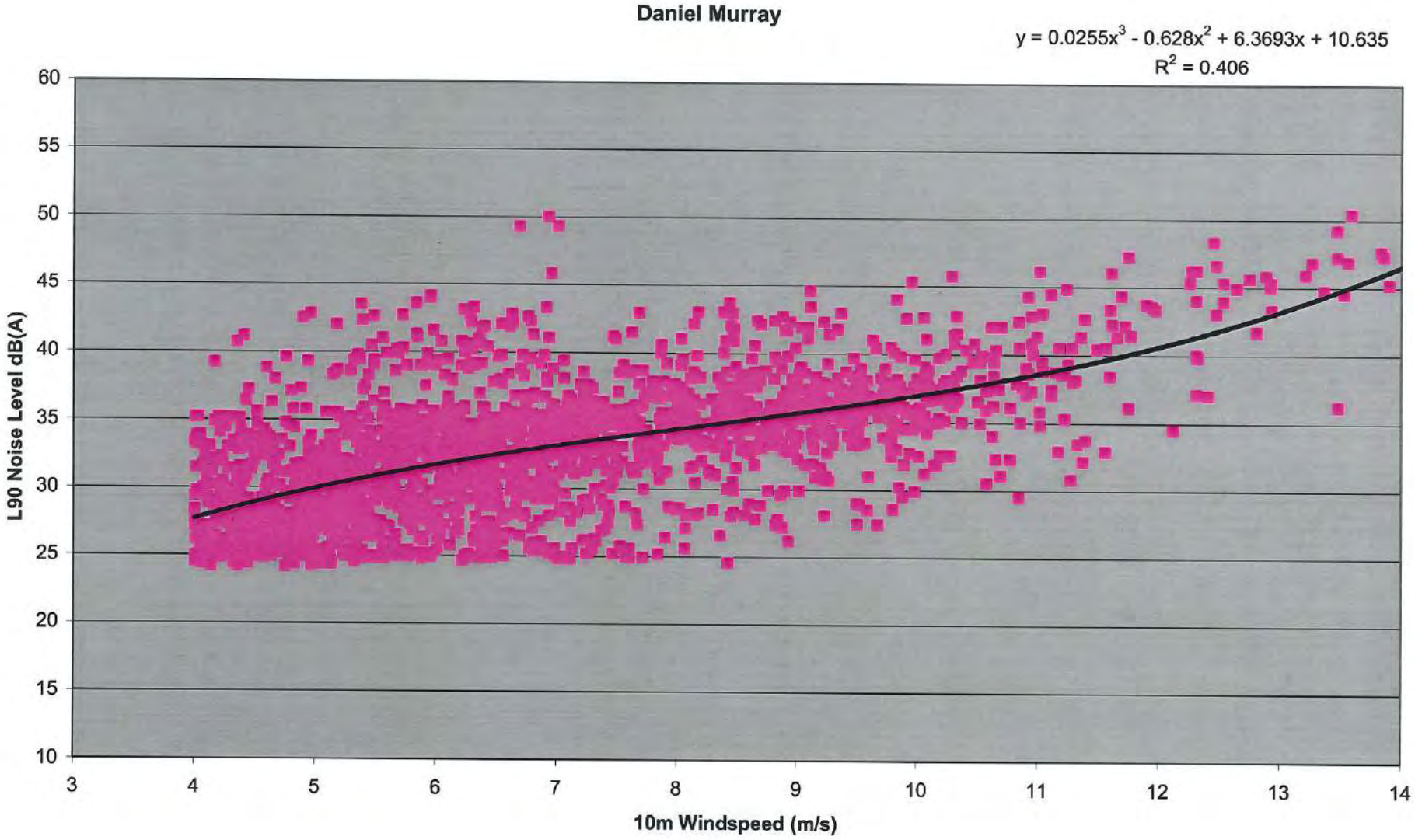

Brown South West
y = 0.0551x3 - 1.5074x2 + 16.296x - 17.629
R2 = 0.51
L90 Noise Level dB(A)
10m Windspeed (m/s)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14

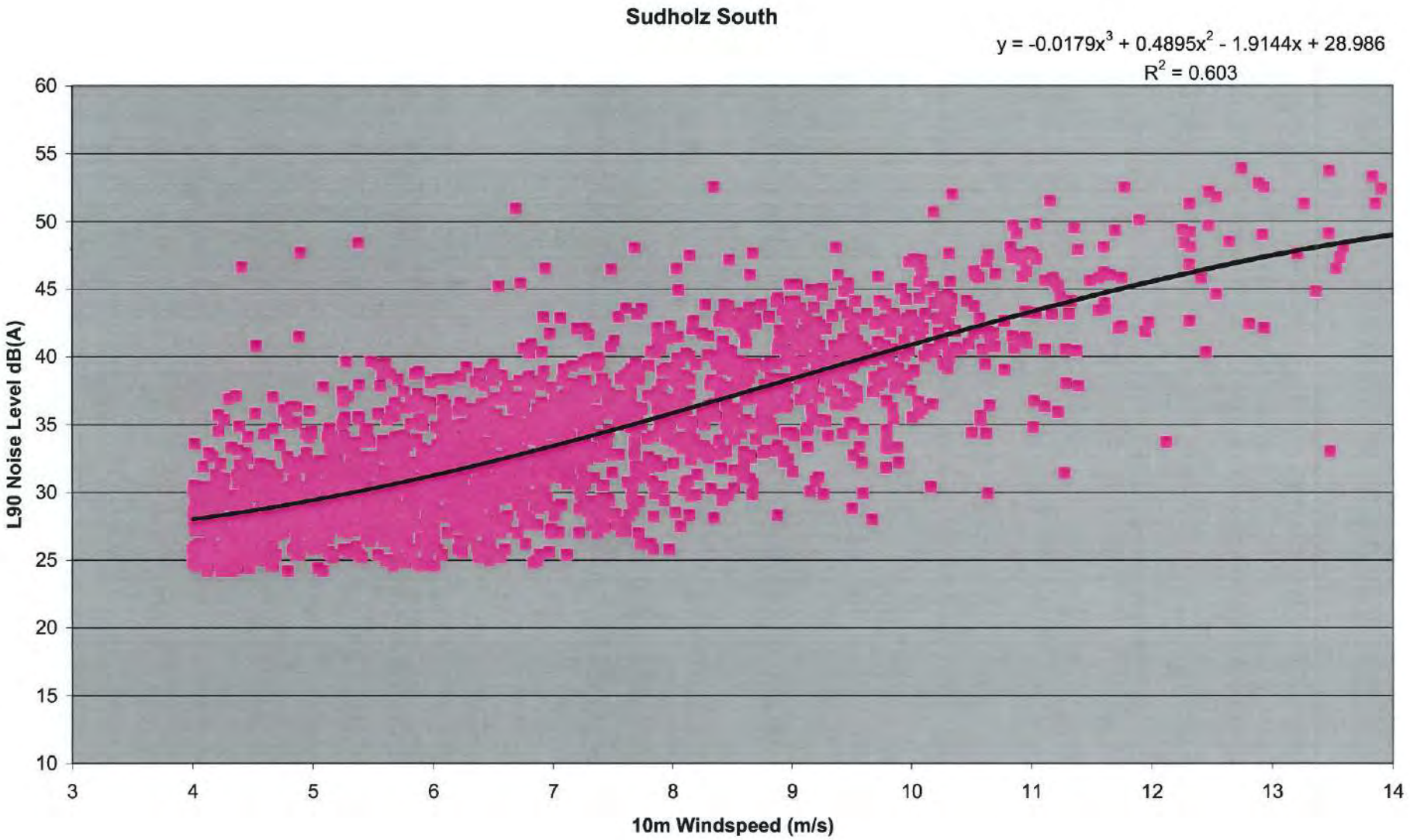

Brown North
y = -0.0064x3 - 0.033x2 + 4.5834x + 8.2303
R2 = 0.4467
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)

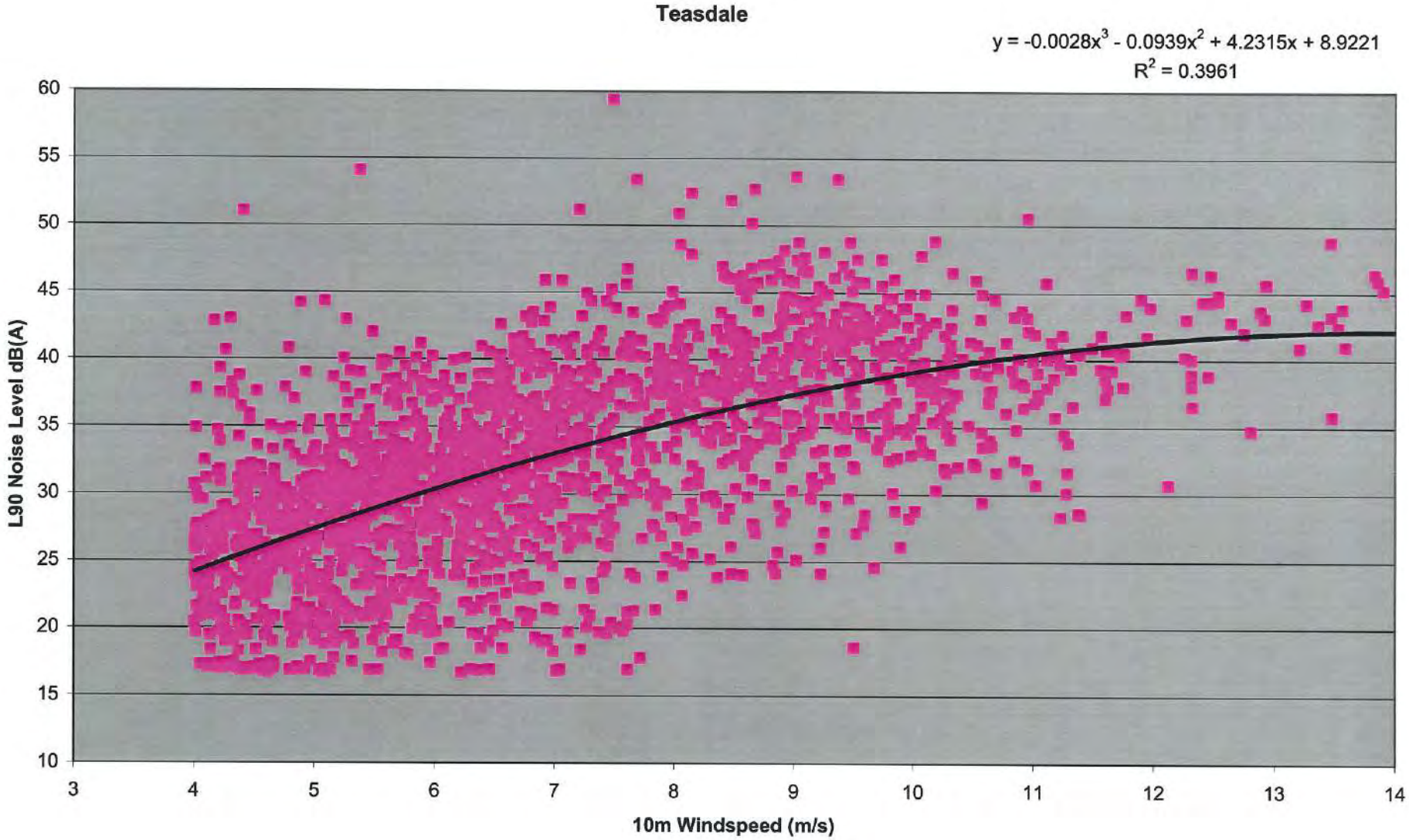

John Murray
y = -0.0357x3 + 0.8128x2 - 2.473x + 23.502
R2 = 0.608
L90 Noise Level dB(A)
10m Windspeed (m/s)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14

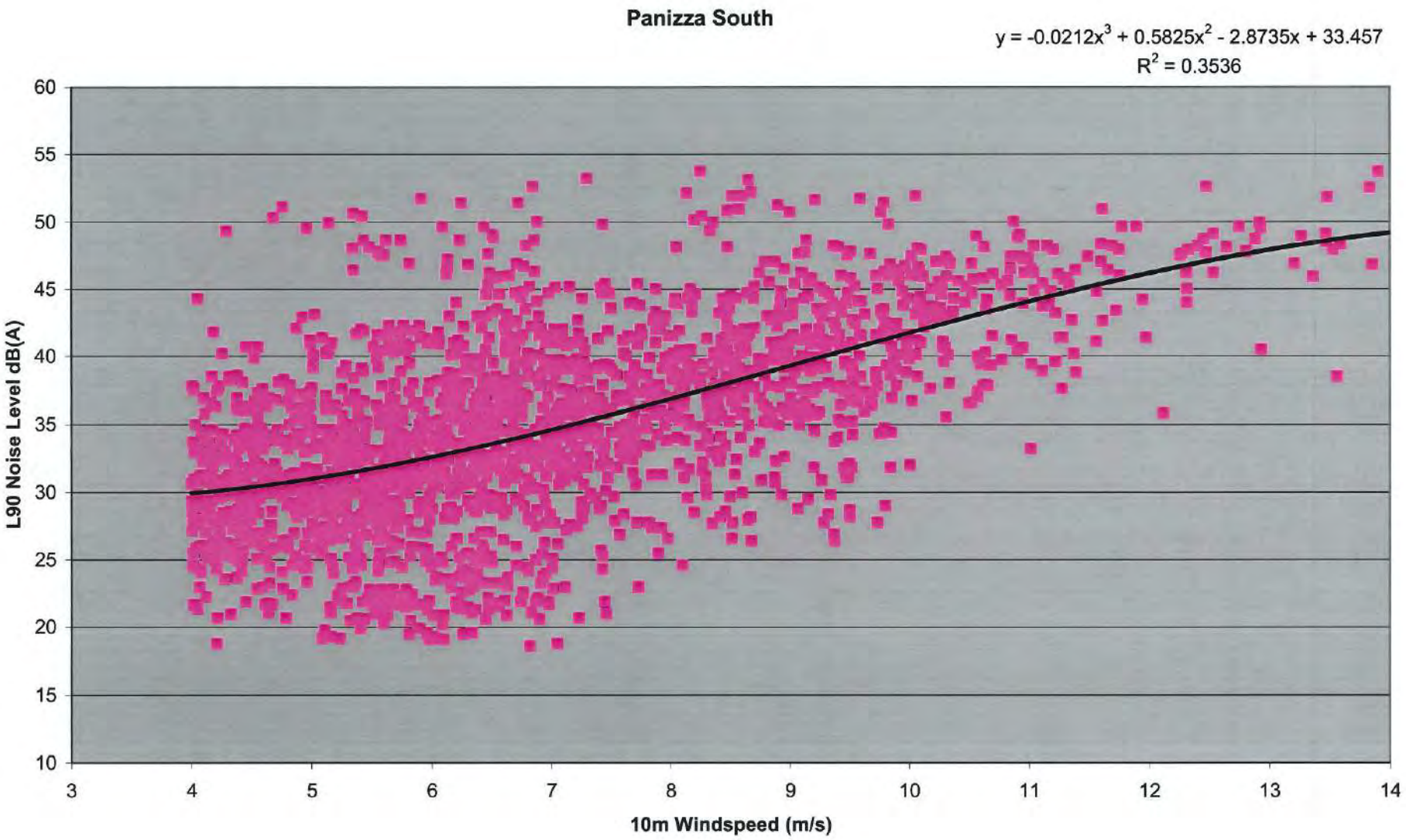

Deutcher North
y = 0.0854x3 - 2.1622x2 + 19.615x - 25.255
R2 = 0.4094
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)


Brown South East
y = 0.0681x3 - 1.7435x2 + 16.765x - 17.486
R2 = 0.5338
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)


Daniel Murray
y = 0.0255x3 - 0.628x2 + 6.3693x + 10.635
R2 = 0.406
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)


Sudholz South
y = -0.0179x3 + 0.4895x2 - 1.9144x + 28.986
R2 = 0.603
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)


Teasdale
y = -0.0028x3 - 0.0939x2 + 4.2315x + 8.9221
R2 = 0.3961
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)


Panizza South
y = -0.0212x3 + 0.5825x2 - 2.8735x + 33.457
R2 = 0.3536
L90 Noise Level dB(A)
60
55
50
45
40
35
30
25
20
15
10
3
4
5
6
7
8
9
10
11
12
13
14
10m Windspeed (m/s)

APPENDIX C NOISE LOGGER PHOTOGRAPHS

Denis Murray

Sudholz North

Deutcher South

Panizza North

Brown North

Brown South West

John Murray

Brown South East

Deutcher North

Daniel Murray

Sudholz South

Teasdale

Panizza South

APPENDIX D NOISE LOGGER GRID COORDINATES

The GPS grid coordinates at the logger locations are shown in the table below:

	Dwelling	Easting	Northing
A	Denis Murray	333182	6634838
B	Sudholz North	335817	6636762
C	Deutcher South	340346	6636986
D	Panizza North	338982	6636914
E	Brown South West	339404	6640886
F	Brown North	338853	6642312
G	John Murray	332983	6634812
H	Deutcher North	335001	6643457
I	Brown South East	339708	6640824
J	Daniel Murray	332947	6641235
K	Sudholz South	337402	6630320
L	Teasdale	337321	6642518
M	Panizza South	341102	6631909

The coordinates are MGA Zone 50, Datum GDA 94

APPENDIX F

BACKGROUND NOISE MONITORING REPORT - 2024

ZEPHYR ENERGY

PARRON WIND FARM
BADGINGARRA

BACKGROUND NOISE MONITORING

SEPTEMBER 2024

OUR REFERENCE: 33363-1-24117-03

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
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DOCUMENT CONTROL PAGE

BACKGROUND NOISE MONITORING

BADGINGARRA WIND FARM

Job No: 24117-03

Document Reference : 33363-1-24117-03

FOR

ZEPHYR ENERGY

DOCUMENT INFORMATION			
Author:	George Watts	**Checked By:**	Tim Reynolds
Date of Issue:	16 September 2024		

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Revision	Description	Date	Author	Checked

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CONTENTS

APPENDICIES

1. INTRODUCTION

Herring Storer Acoustics were commissioned to carry out background noise monitoring for the proposed wind farm located in the vicinity of Badgingarra.

This work is understood to have been requested to complement the original background noise monitoring undertaken by Sonus between March and May 2007, for locations further to the south. This campaign of background noise monitoring was for the northern area of the wind farm only.

The proposed development site is located 5km to the north of the existing Emu Downs Wind Farm.

Background noise monitoring was commissioned to enable the results to be used in the noise impact assessment, carried out in accordance with the EPA of South Australia *"Wind Farms – Environmental noise guidelines– July 2009, Updated November 2021"* (Guidelines) which is the guidelines recognised by the Western Australian Department Water Environment and Regulation for the assessment of wind farms.

Noise monitoring was carried out between 4th July 2024 and 16th August 2024 at 4 locations, with monitoring occurring for approximately 1.5 months at each location.

This report presents the results of the monitoring and analysis.

2. SUMMARY

Based on the results of background noise monitoring within the proposed wind farm development area, the applicable criteria for each location would be as listed in Table 2.1.

TABLE 2.1 – NOISE CRITERIA BASED ON BACKGROUND NOISE LEVELS FOR WIND SPEEDS AT 150m AGL HUB HEIGHT, dB(A)

Location	BACKGROUND NOISE LEVEL (dB(A) / WIND SPEED AT 150m ABOVE GROUND LEVEL (m/s)										
	3	4	5	6	7	8	9	10	11	12	13
1	35	35	35	35	35	35	35	35	37	38	42
2	47	48	48	49	50	48	49	48	48	49	48
3	39	39	39	40	41	42	42	43	43	44	45
4	35	35	35	35	35	35	36	37	39	40	42

Local fauna noise (frogs) at Location 2 – whilst part of the background noise levels at the time of year for the monitoring – increased the background noise level to higher than what would ordinarily be expected given the locale. It is recommended that Location 3 background noise levels be utilised for Location 2, given the similarity in vegetation at both locations, however, minus the local fauna noise.

3. METHODOLOGY

Background noise levels were monitored at four locations within the proposed development area in accordance with the Guidelines and AS4959-2010. Locations are detailed in Table 3.1, the monitoring location map is attached in Appendix A.

TABLE 3.1 – MONITORING LOCATION DETAILS

Location	Easting (m)	Northing (m)
1	345501	6646473
2	342174	6649144
3	340890	6649650
4	339133	6647455
Wind Monitor	345895	6641075

Monitored noise levels were then paired with corresponding wind data, provided by the Sodar wind monitoring station located within the proposed wind farm area.

The hub heights considered in our background noise monitoring, was 150m above ground level.

Rain affected data was removed from the collected data using weather information attained from the BOM.

The Guidelines requires 2000 valid data points to be collected for each site, and also recommends that not less than 500 data points collected for downwind conditions.

Wind direction for downwind conditions is defined as + - 45 degrees from the line connecting the receptor and the nearest turbine. In this instance, the background monitoring sites are all located generally to the north of the proposed wind farm.

The Guidelines recognises that the collection of 500 valid points for the downwind condition will not always be practical to achieve given prevailing wind conditions for some monitoring locations.

The number of data points – both downwind and for all directions– are listed below in Table 3.2.

TABLE 3.2 – NUMBER OF VALID BACKGROUND NOISE MONITORING POINTS @ 150m AGL

Location	Total Data Points	Downwind
1	3684	187
2	3483	187
3	3667	175
4	3251	188

The number of downwind condition data points collected at each background monitoring location did not exceed 500 in all cases. Given that the land uses in the surrounding area of each location is consistent in use and noise generating sources (i.e. vegetation state surrounding each location is the same) it is considered that the monitoring undertaken is representative of background noise levels at each location and wind direction.

Background noise levels were plotted against the corresponding wind speed measurement (see Appendix C).

The background noise levels monitored were correlated to wind speed, and processed in accordance with the Guidelines, with the resultant noise criteria at each hub height wind speed (from cut in rated power of the wind turbine generator) as listed below :

- 35 dB(A), or
- The background noise ($L_{A90,10\ minutes}$) by more than 5 dB(A)*.

*Whichever is greater.

Calibration certificates for meters used are attached in Appendix F.

4. RESULTS

Background noise monitoring for each of the four locations is presented in Appendix C, with time history charts presented in Appendix D.

Refer to Appendix A and B for location information for each noise logger.

Processing the collected data in accordance with the Guidelines, Table 4.1 summarises the background noise criteria at each location for each integer hub height wind speed, from cut in speed to rated power.

TABLE 4.1 – NOISE CRITERIA ACCOUNTING FOR BACKGROUND NOISE LEVELS FOR WIND SPEED AT 150m AGL

Location	WIND SPEED AT 150m ABOVE GROUND LEVEL (m/s)										
	3	4	5	6	7	8	9	10	11	12	13
1	35	35	35	35	35	35	35	35	37	38	42
2	47	48	48	49	50	48	49	48	48	49	48
3	39	39	39	40	41	42	42	43	43	44	45
4	35	35	35	35	35	35	36	37	39	40	42

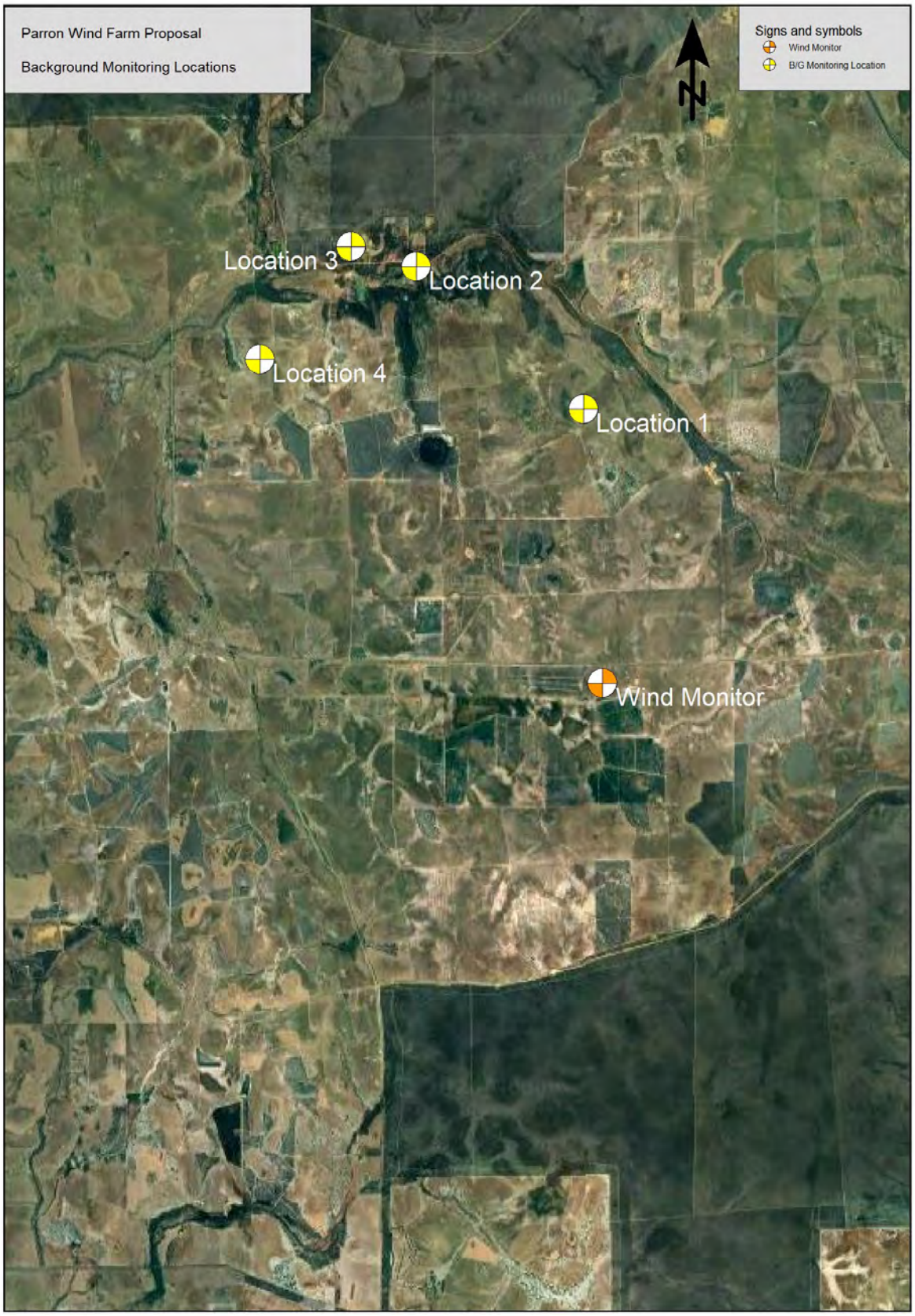
5. DISCUSSION

The background noise levels at Location 2 was investigated, as in comparison to the other locations, the noise levels seemed to be higher. This higher background noise at Location 2 is considered attributable to local fauna noise – namely frogs. Given the similarity in vegetation at Location 3, it could be considered pertinent to utilise Location 3 background noise levels for Location 2 – as it is assumed that frog noise is to present all year round.

All other locations exhibited noise levels that are consistent with what would be expected from the locale.

APPENDIX A

MONITORING LOCATIONS


Parron Wind Farm Proposal
Background Monitoring Locations
Signs and symbols
Wind Monitor
B/G Monitoring Location
N
Location 3
Location 2
Location 4
Location 1
Wind Monitor

APPENDIX B

MONITORING LOCATION DETAILS

LOCATION 1

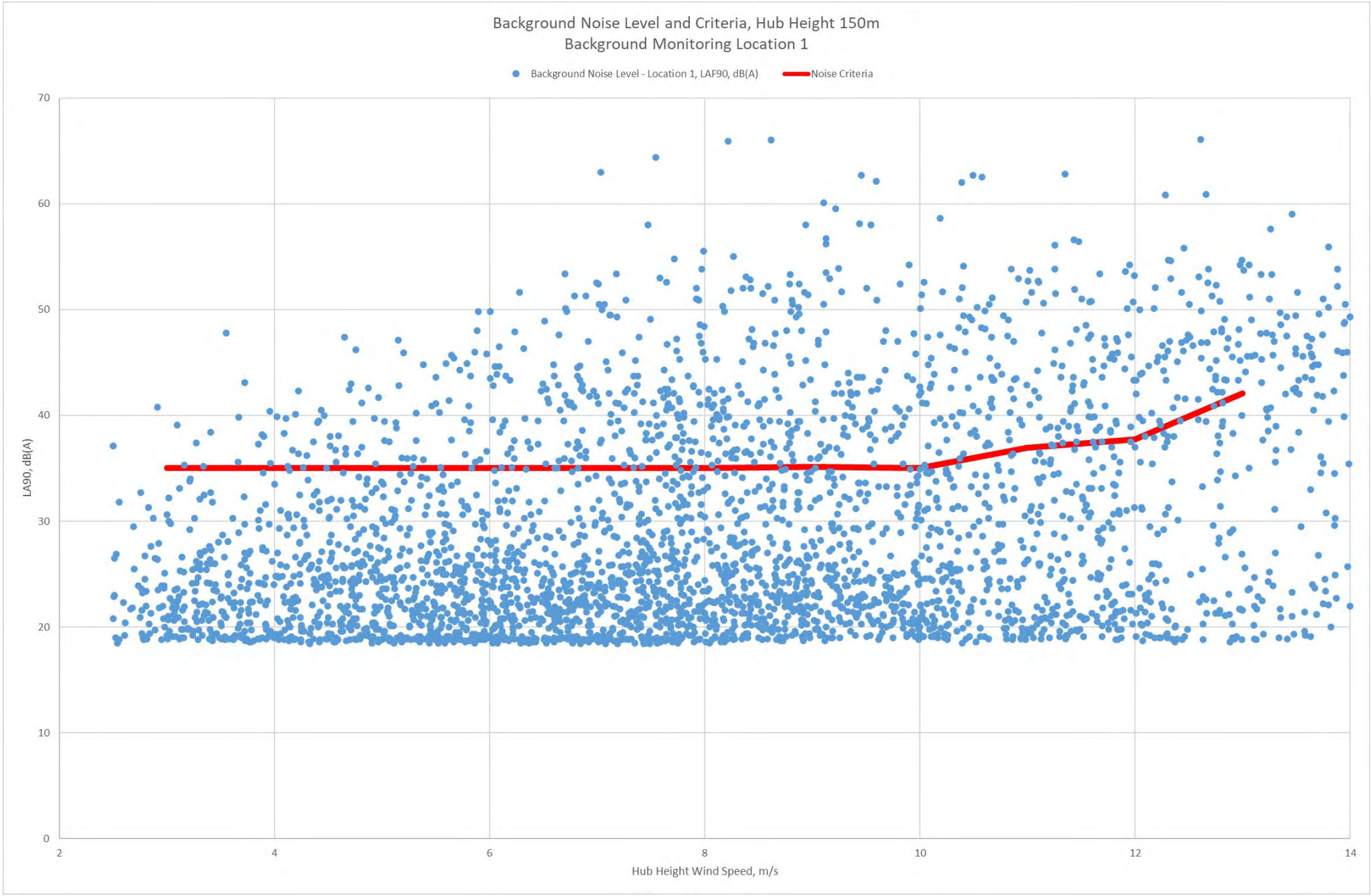
LOCATION 2

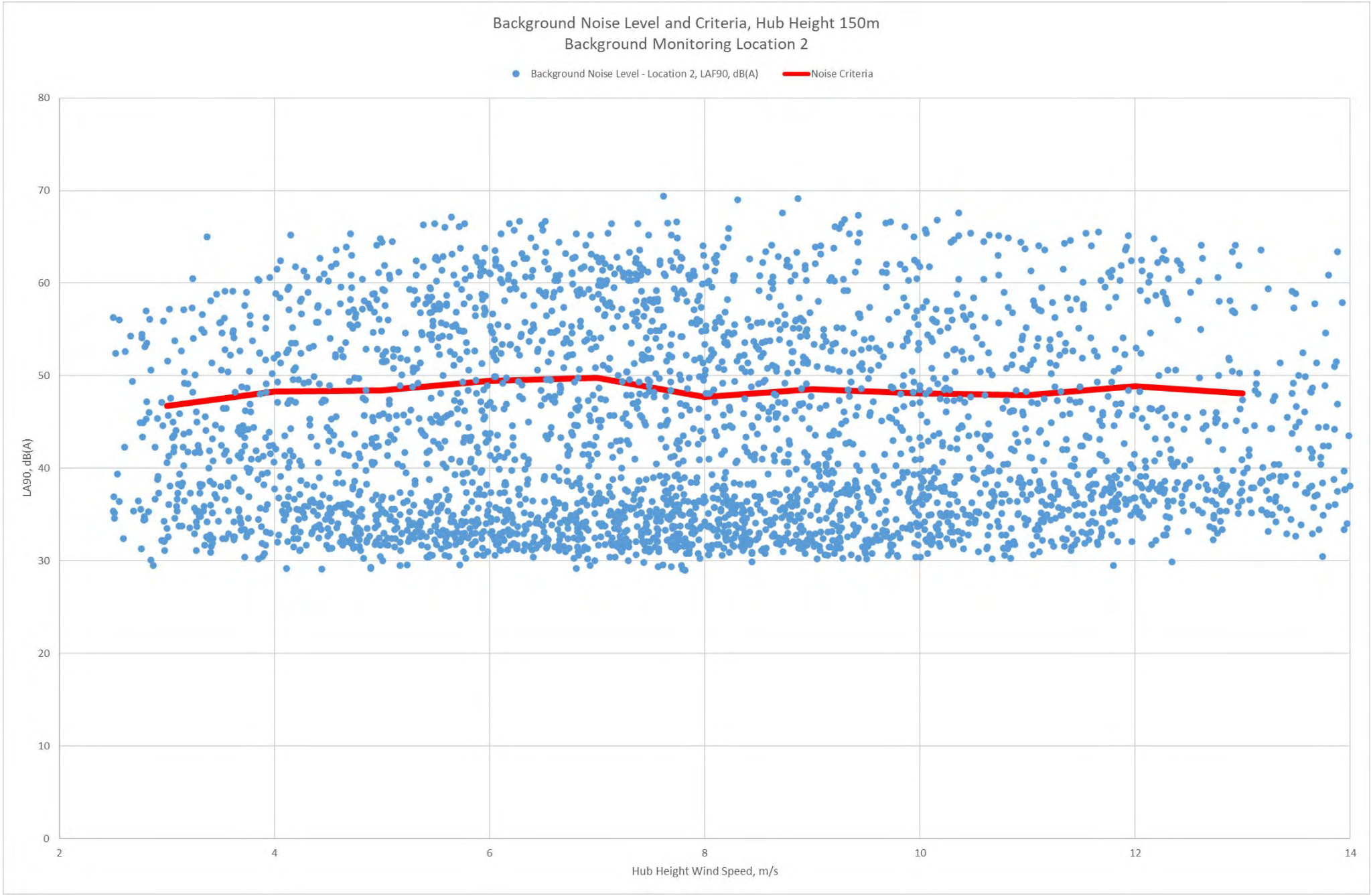
LOCATION 3

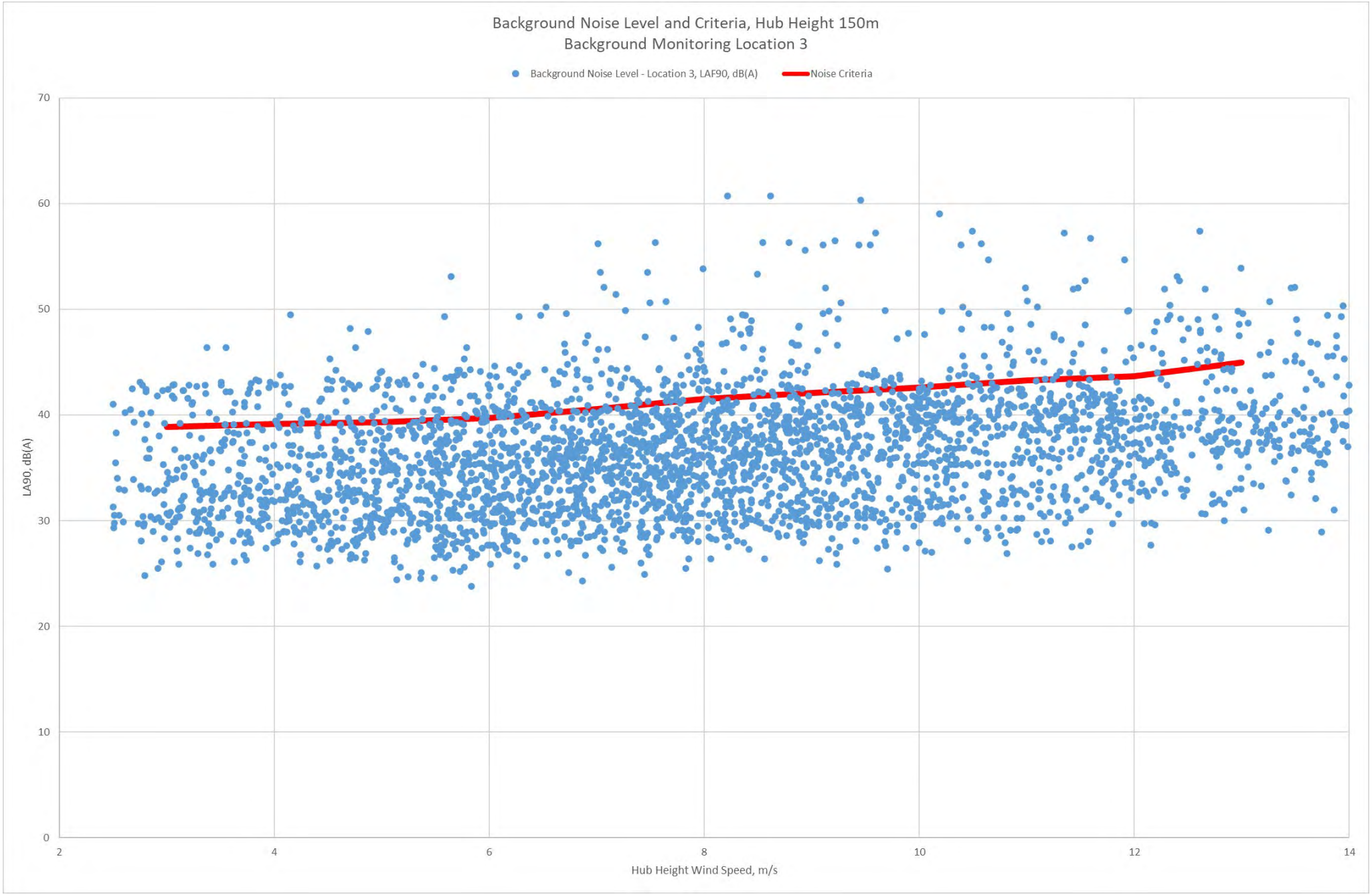
LOCATION 4

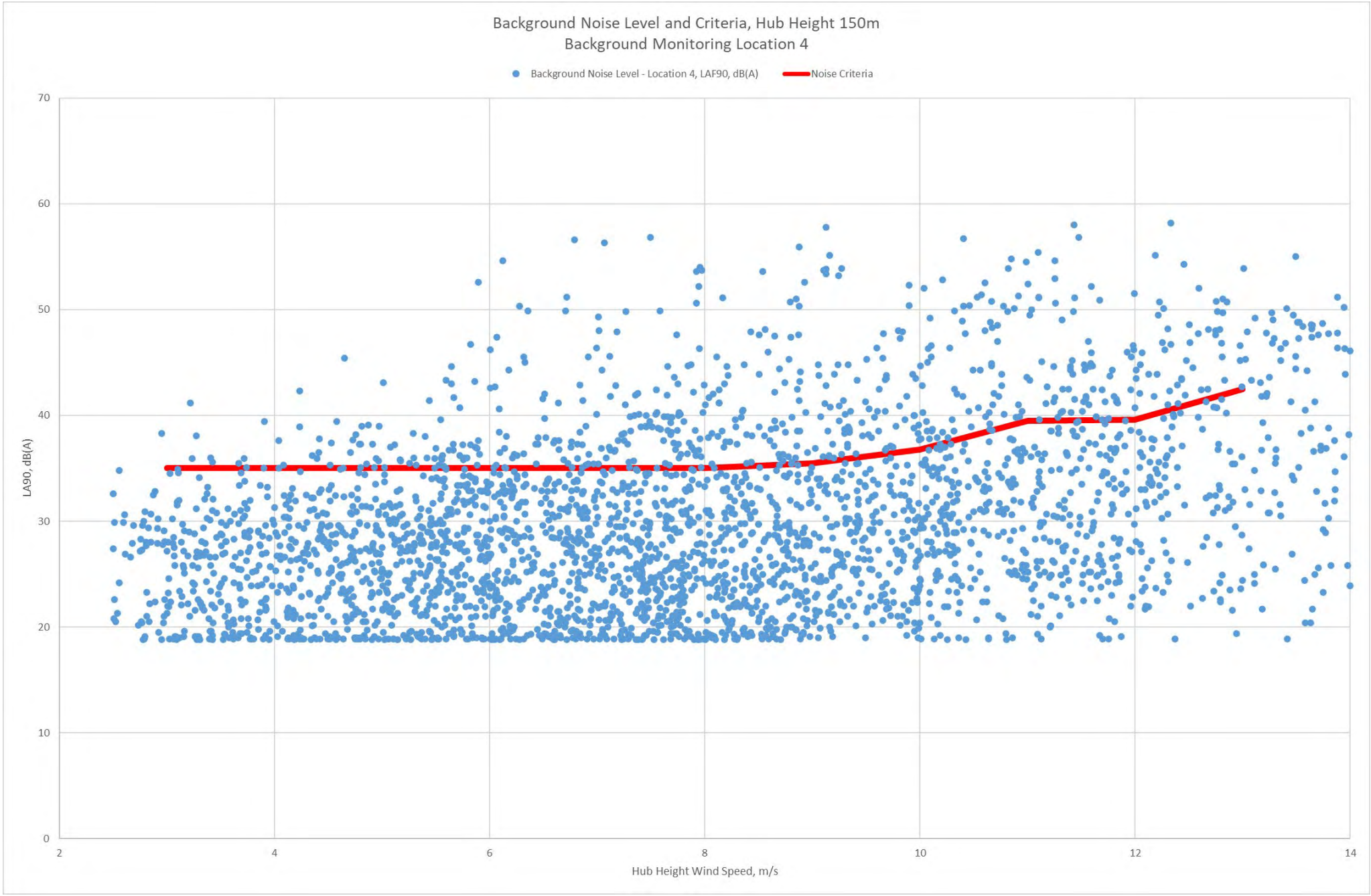
APPENDIX C

BACKGROUND NOISE LEVELS vs WIND SPEED PLOTS
150m AGL


Background Noise Level and Criteria, Hub Height 150m
Background Monitoring Location 1
Background Noise Level - Location 1, LAF90, dB(A)
Noise Criteria
LA90, dB(A)
Hub Height Wind Speed, m/s
0
10
20
30
40
50
60
70
2
4
6
8
10
12
14

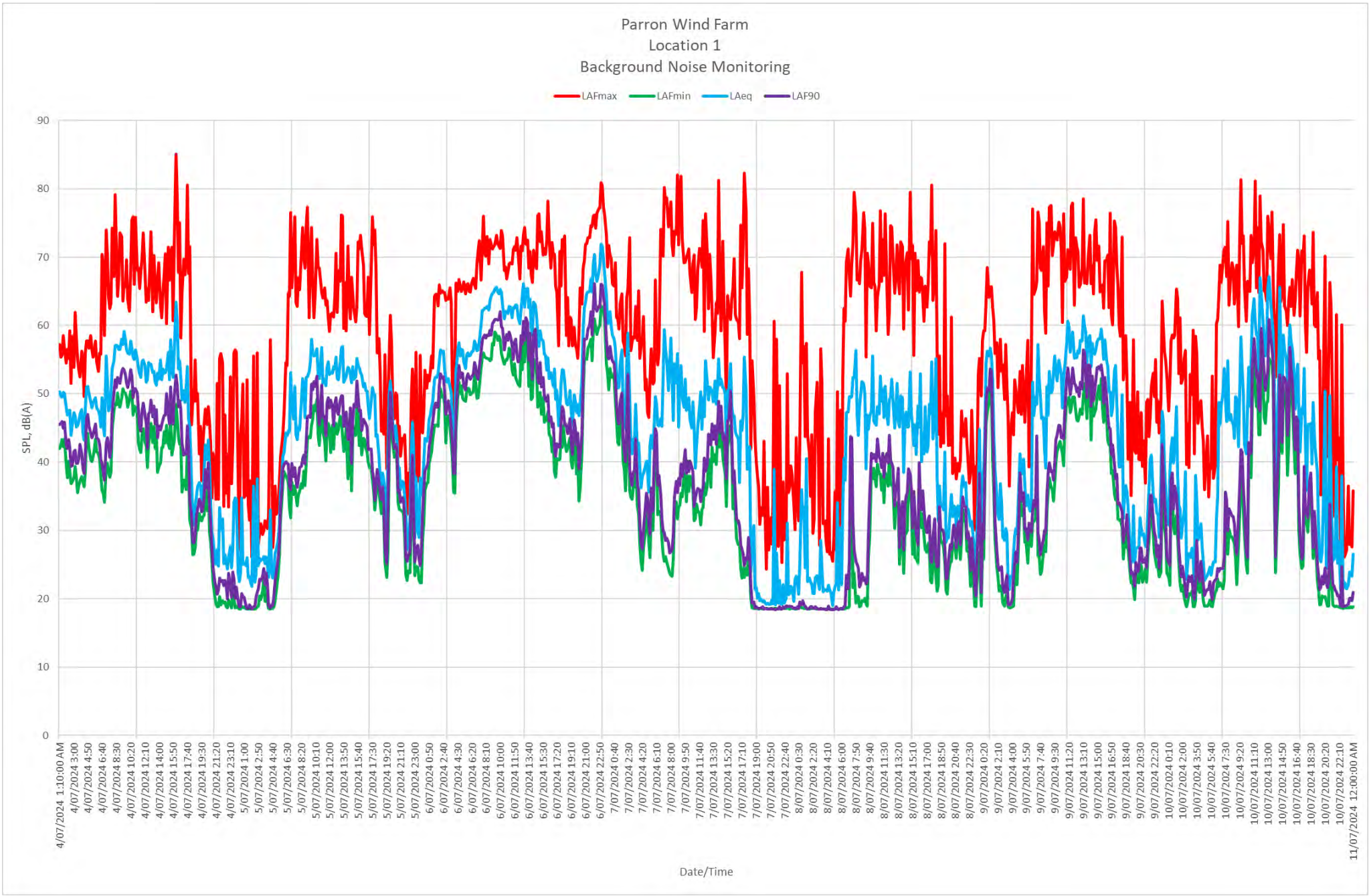

Background Noise Level and Criteria, Hub Height 150m
Background Monitoring Location 2
Background Noise Level - Location 2, LAF90, dB(A)
Noise Criteria
LA90, dB(A)
Hub Height Wind Speed, m/s
0
10
20
30
40
50
60
70
80
2
4
6
8
10
12
14

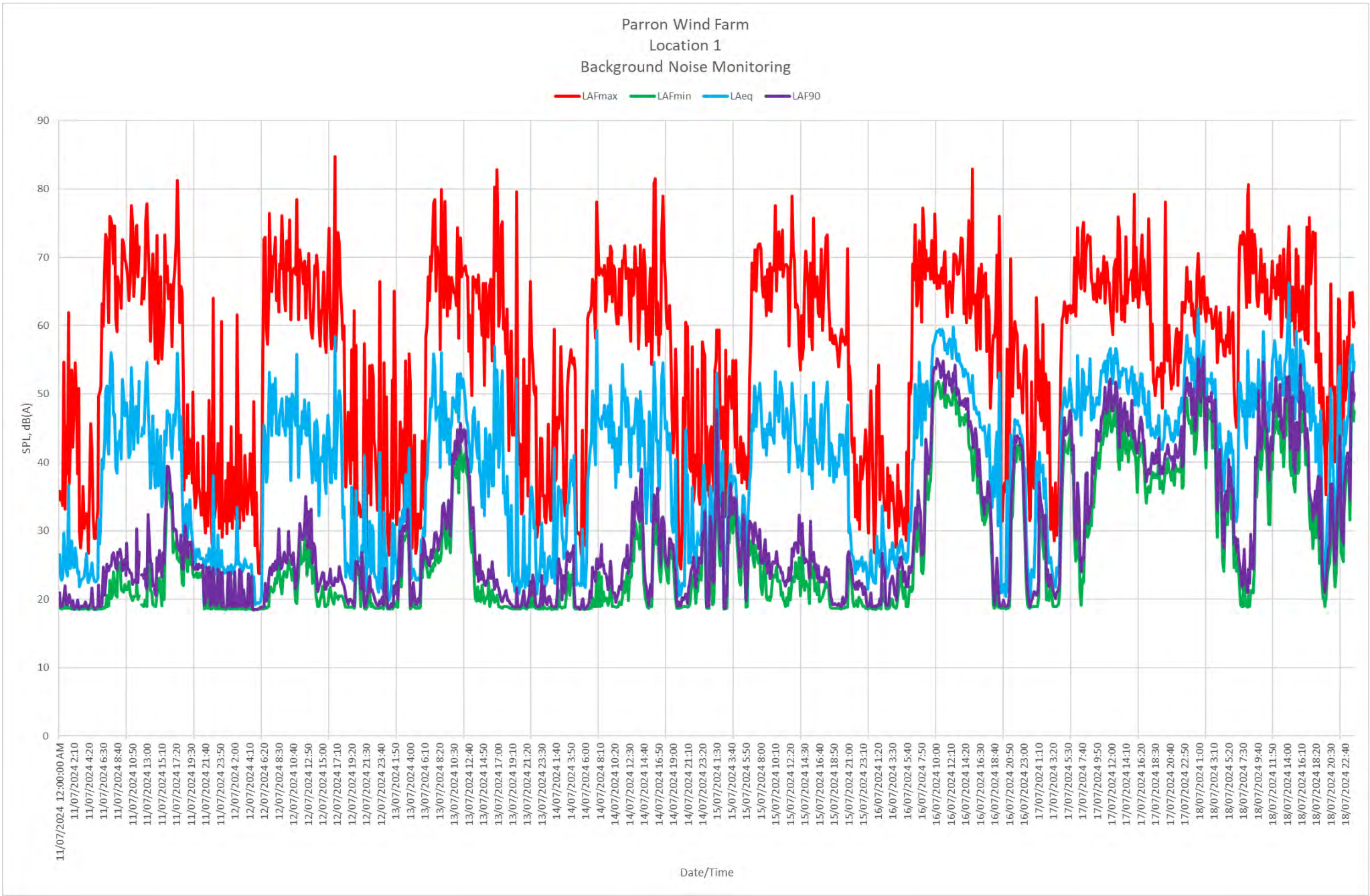

Background Noise Level and Criteria, Hub Height 150m
Background Monitoring Location 3
Background Noise Level - Location 3, LAF90, dB(A)
Noise Criteria
LA90, dB(A)
Hub Height Wind Speed, m/s
0
10
20
30
40
50
60
70
2
4
6
8
10
12
14

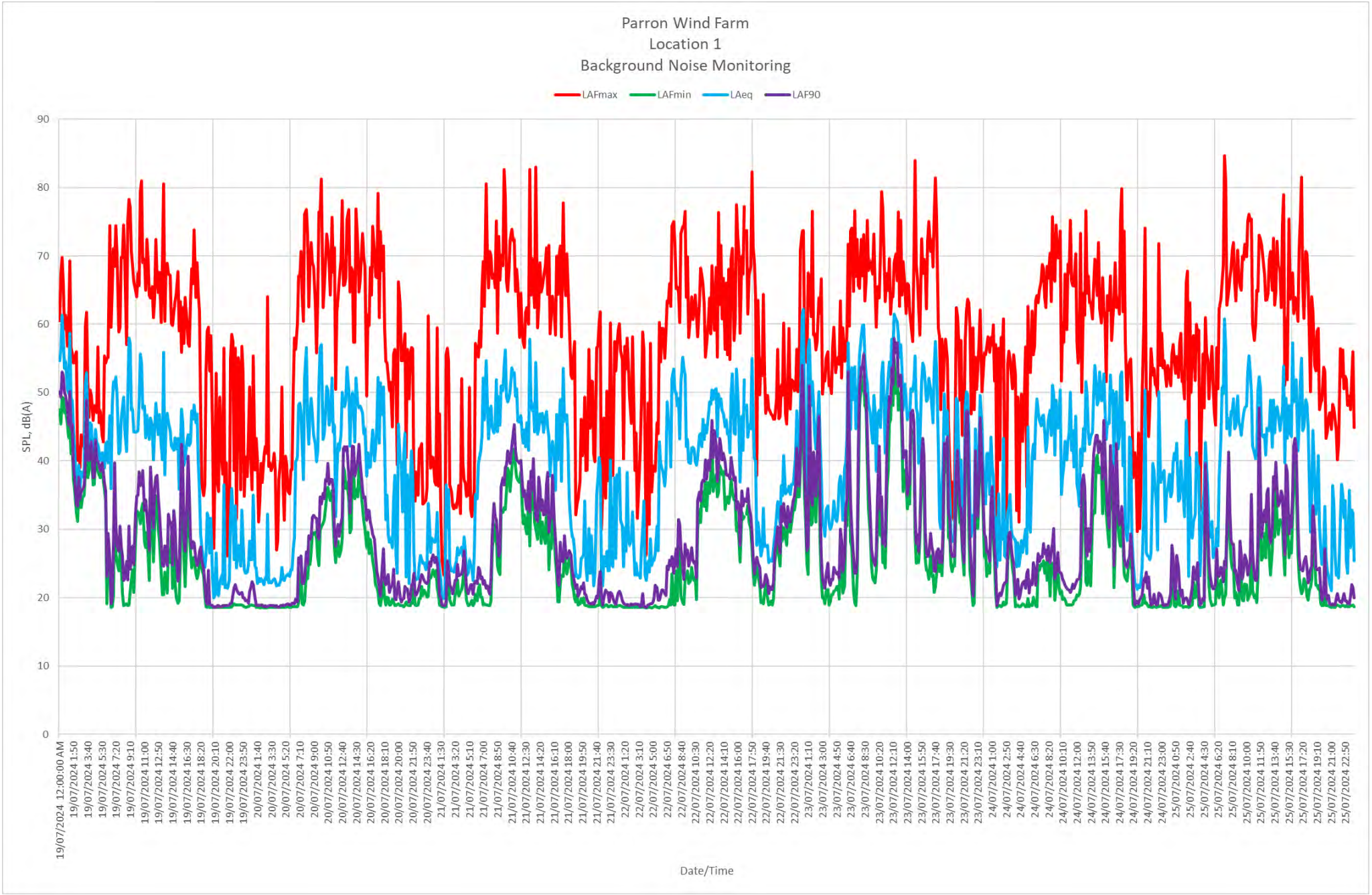

Background Noise Level and Criteria, Hub Height 150m
Background Monitoring Location 4
Background Noise Level - Location 4, LAF90, dB(A)
Noise Criteria
LA90, dB(A)
Hub Height Wind Speed, m/s
0
10
20
30
40
50
60
70
2
4
6
8
10
12
14

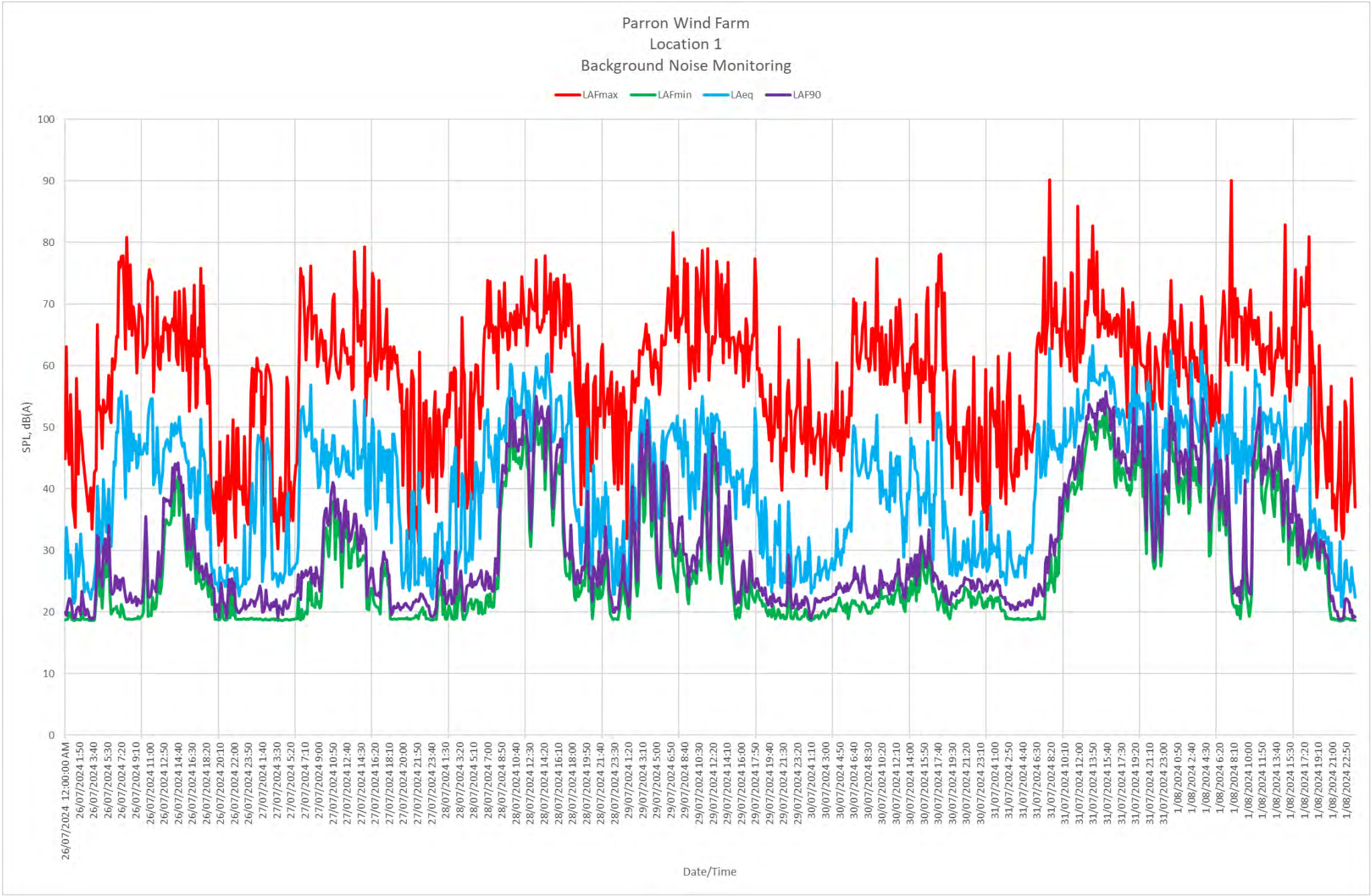
APPENDIX D

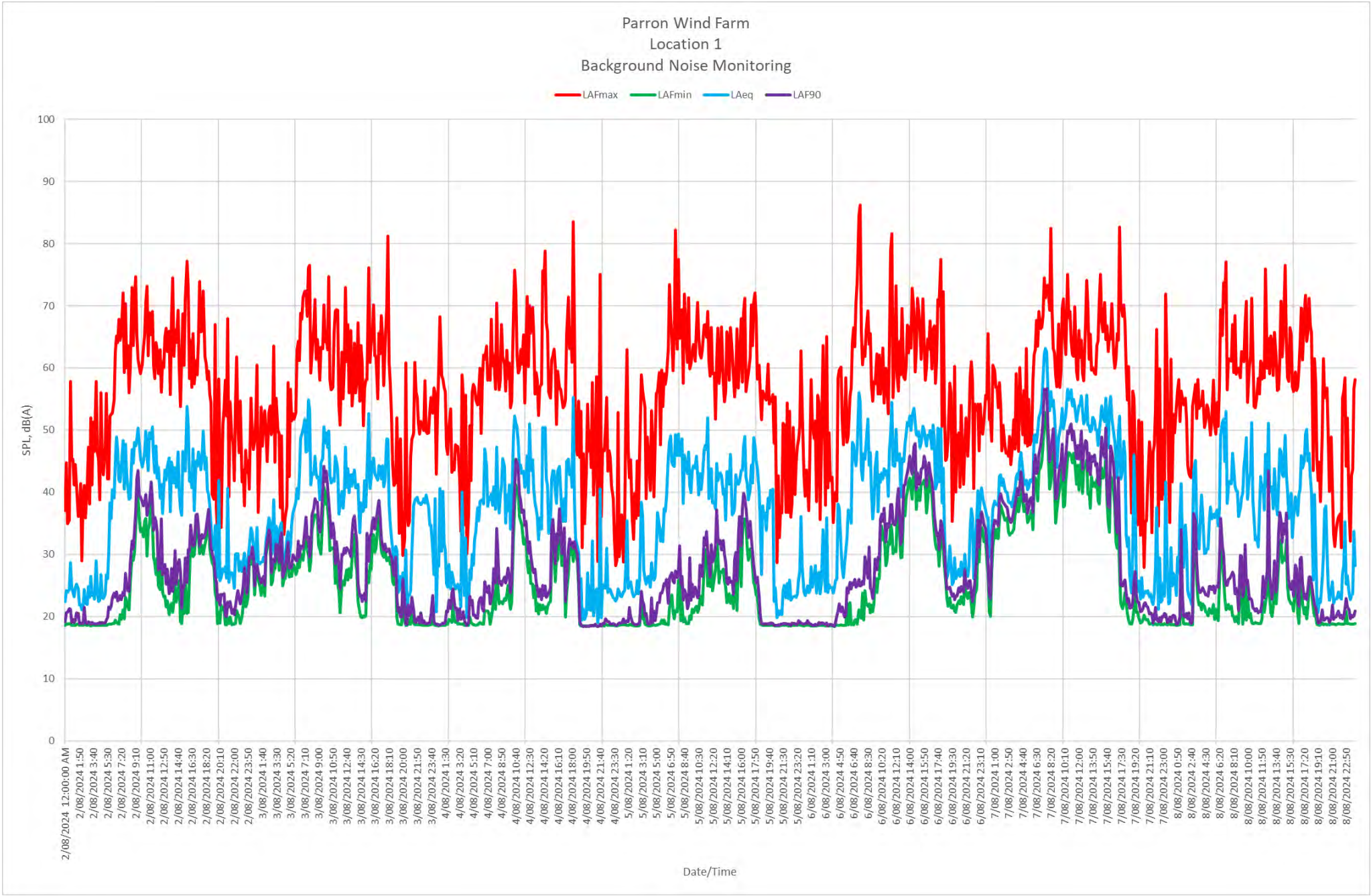
BACKGROUND NOISE LEVELS TIME HISTORY PLOTS

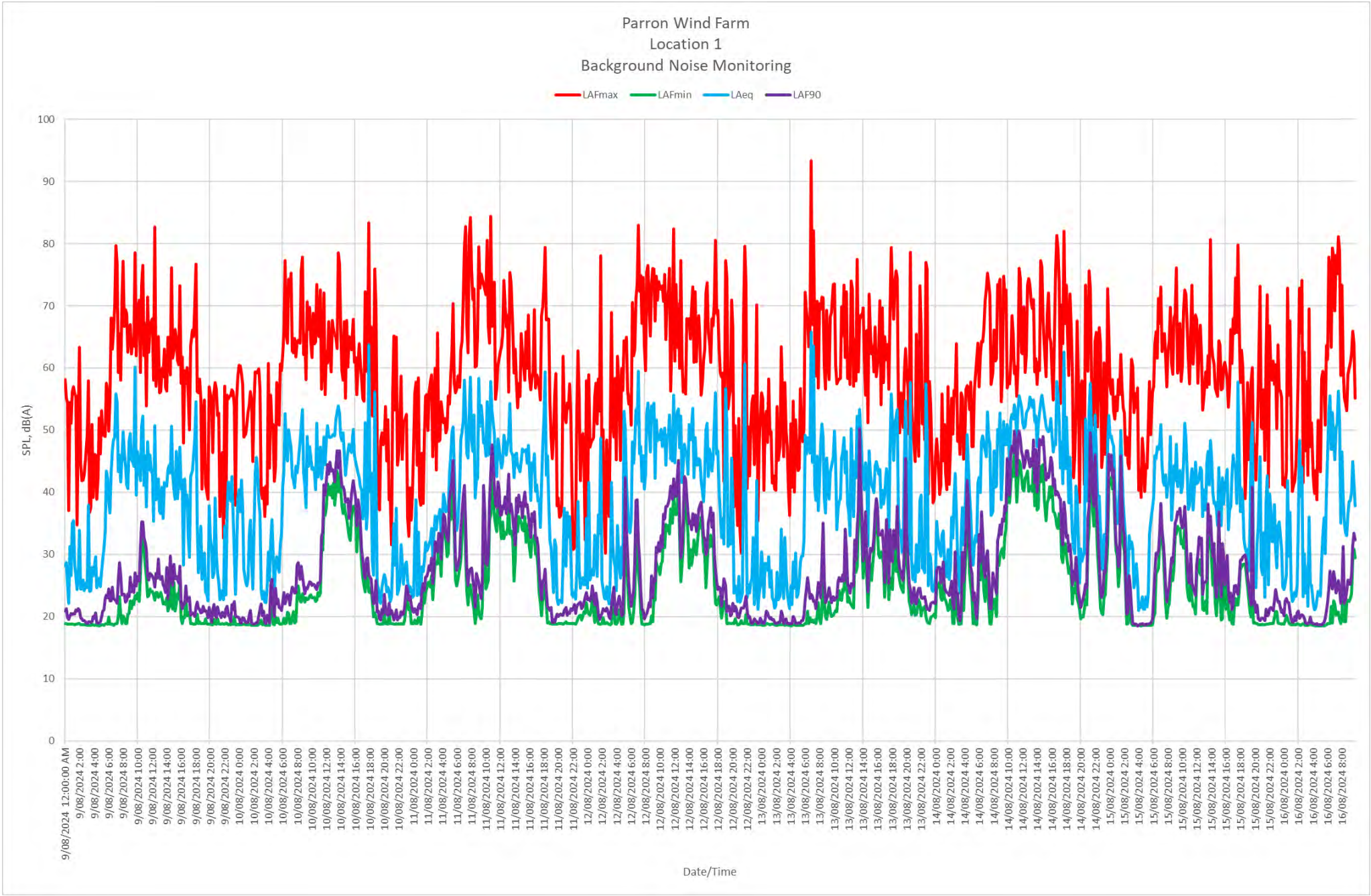

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

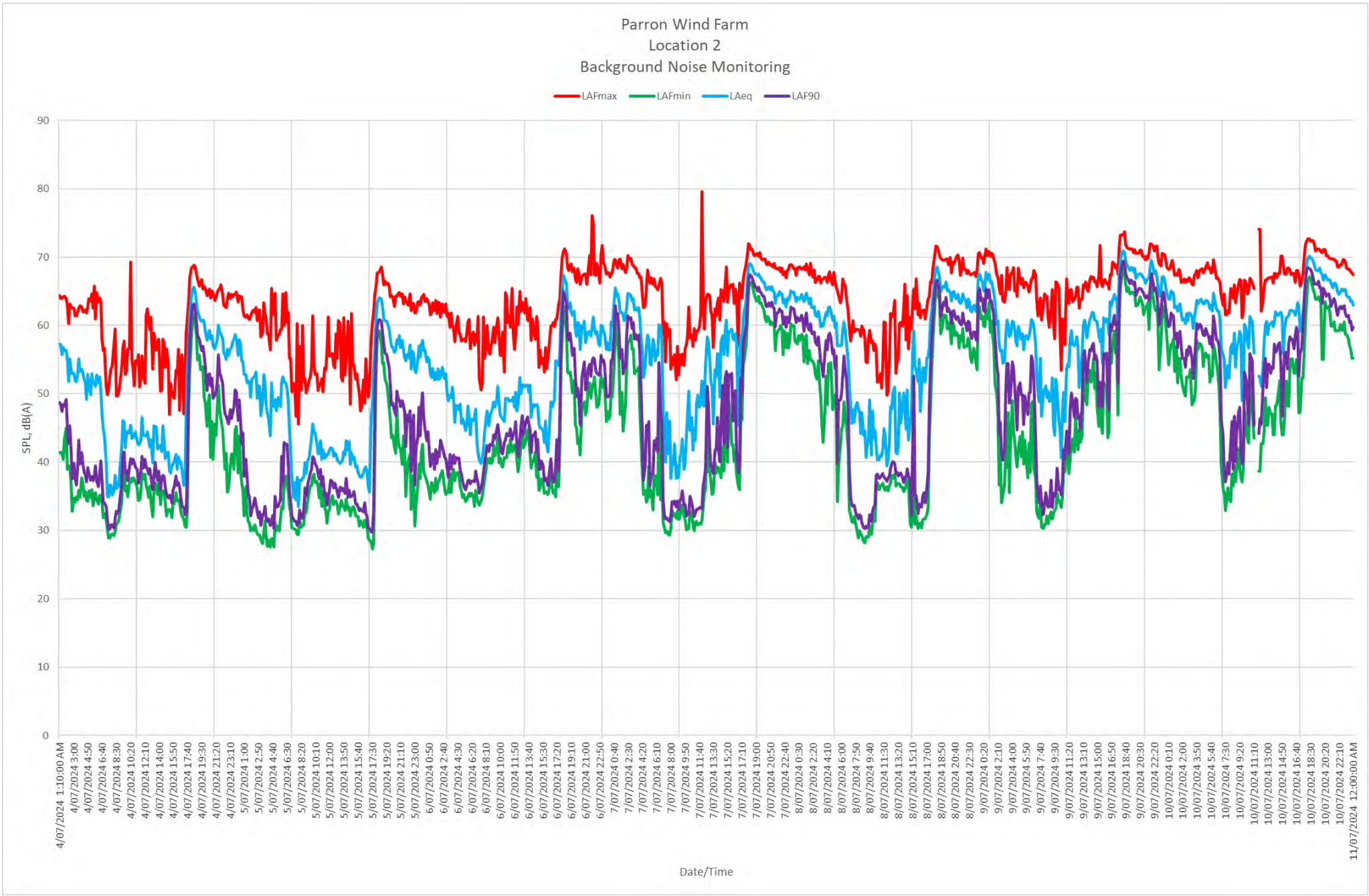

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

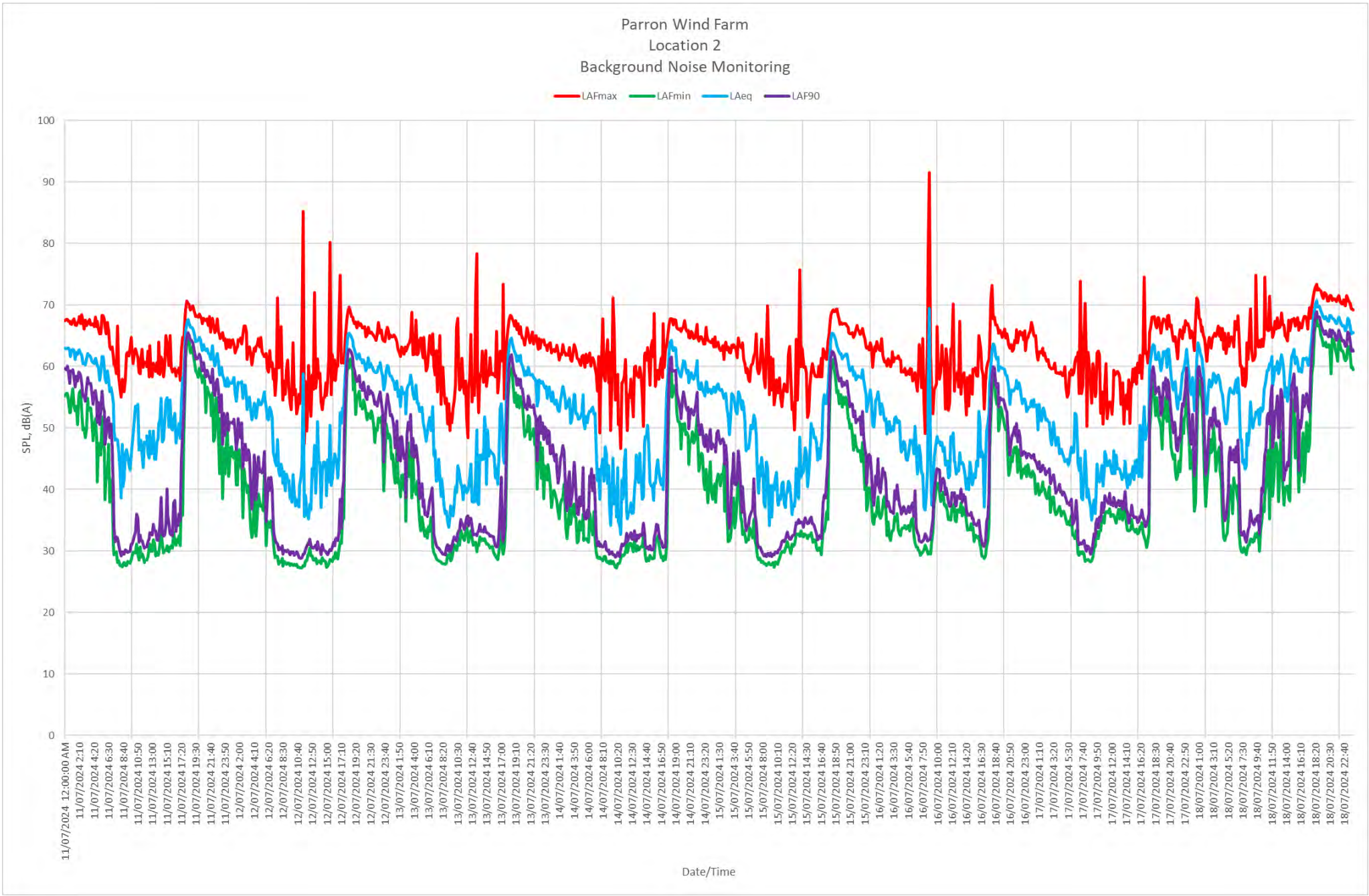

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

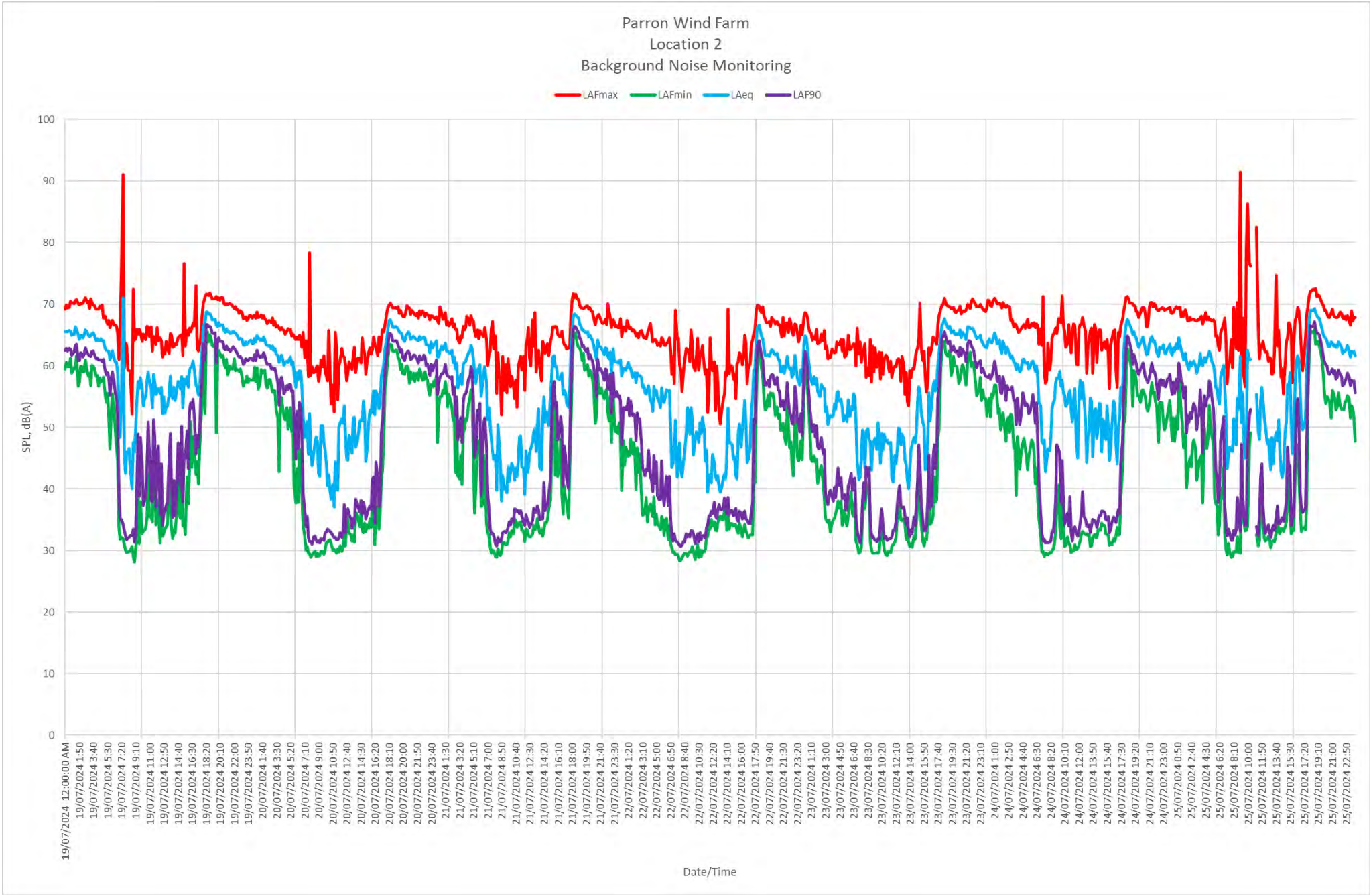

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

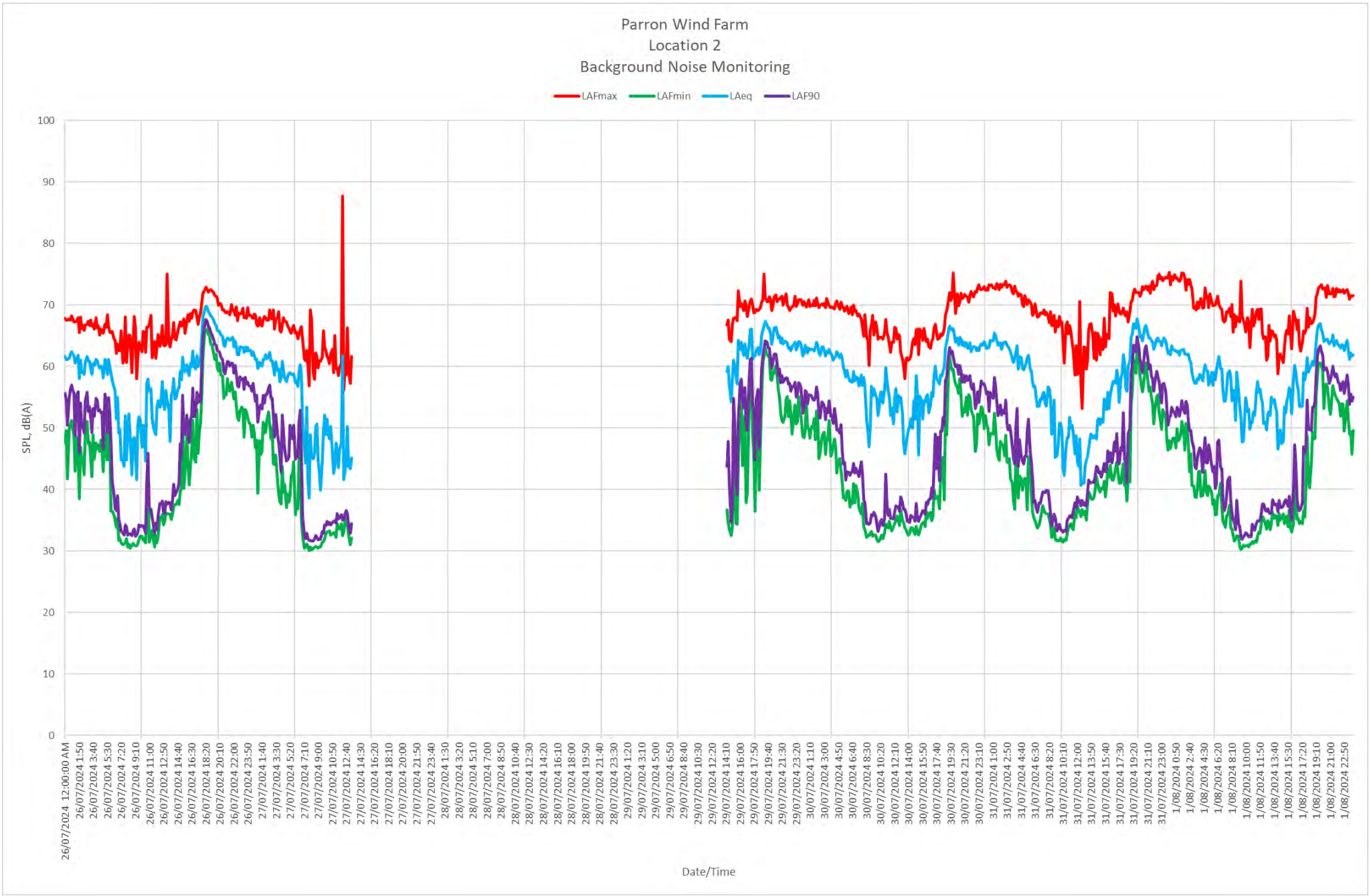

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

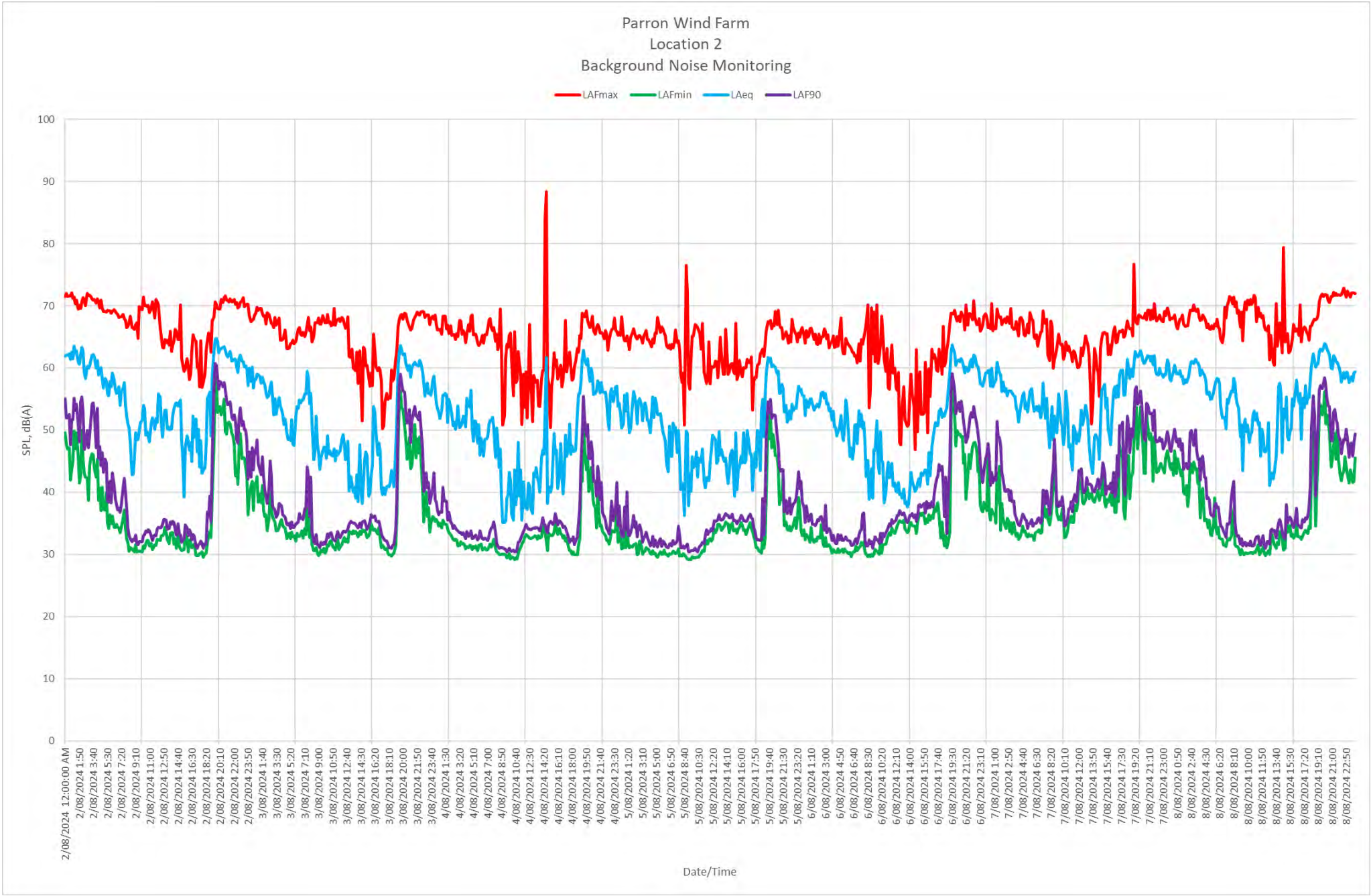

Parron Wind Farm
Location 1
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

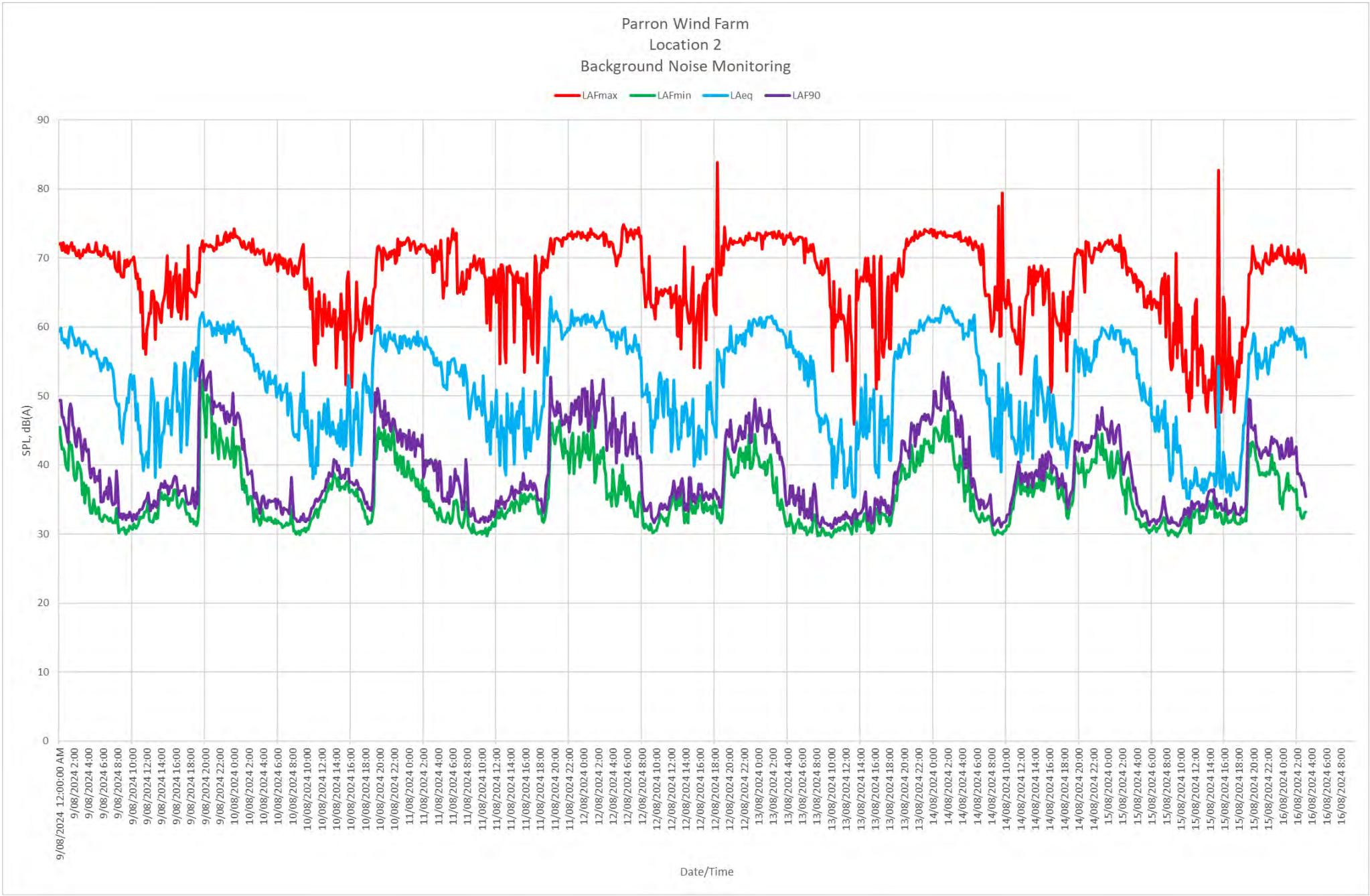

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

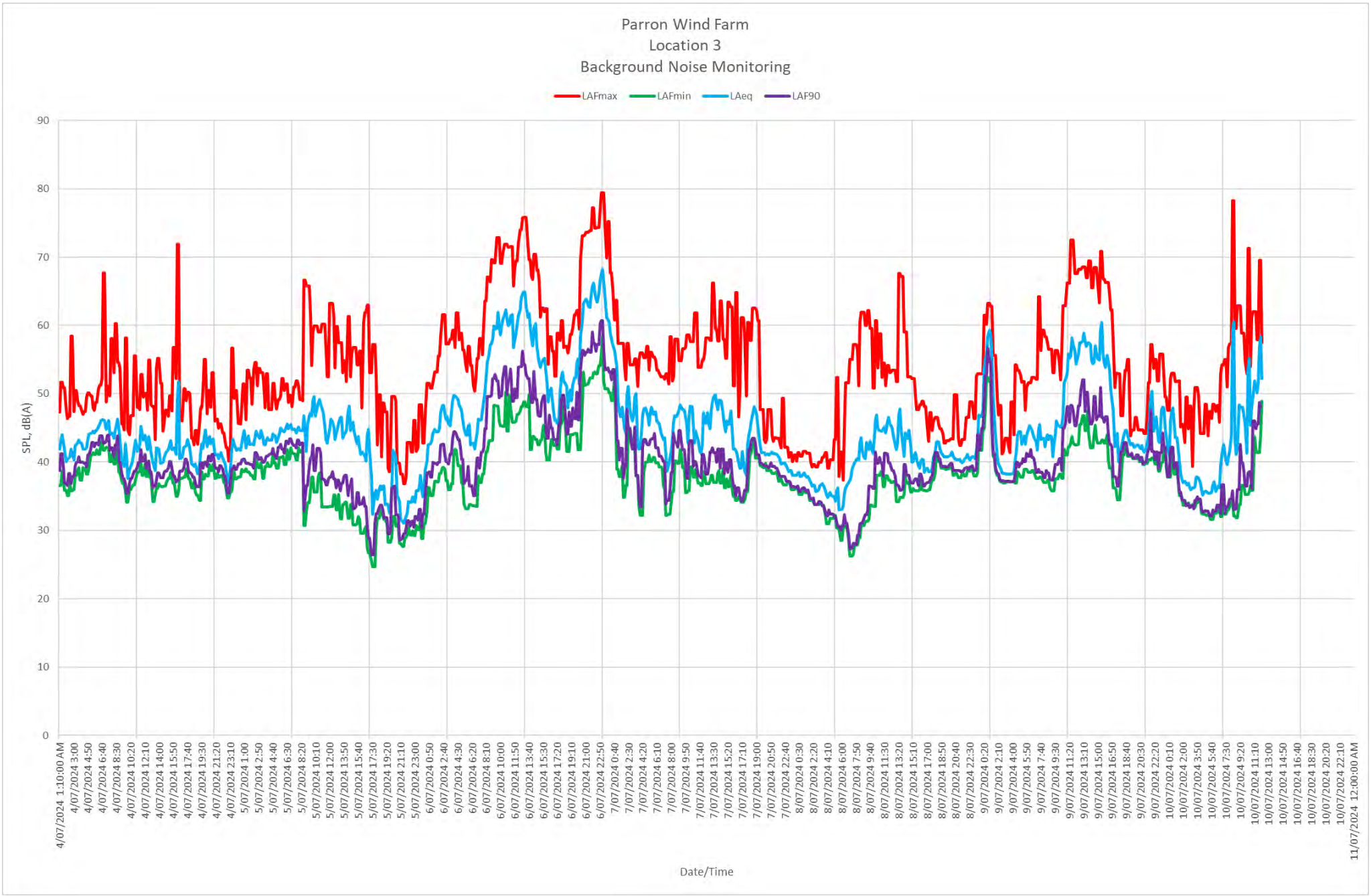

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

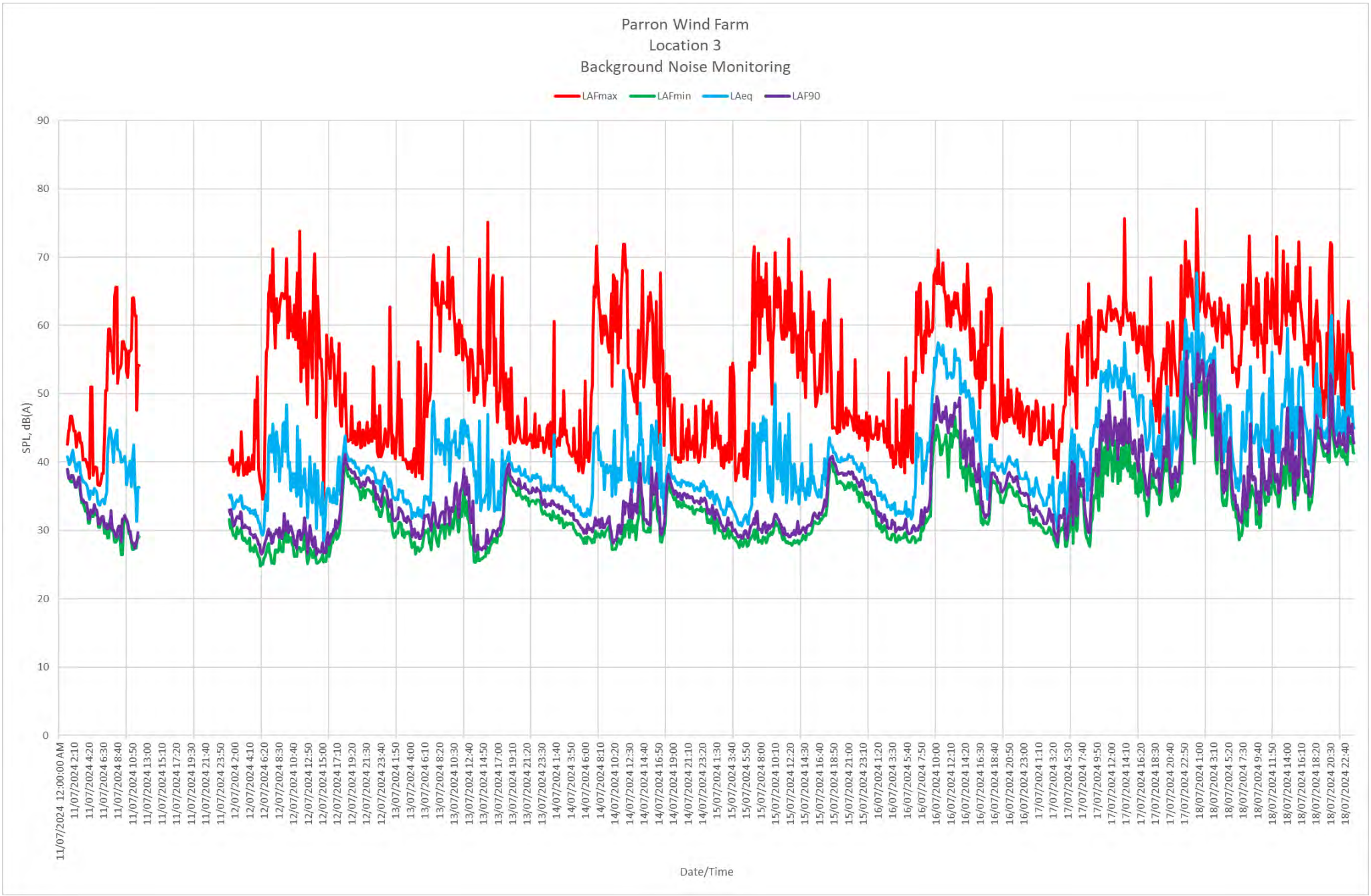

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

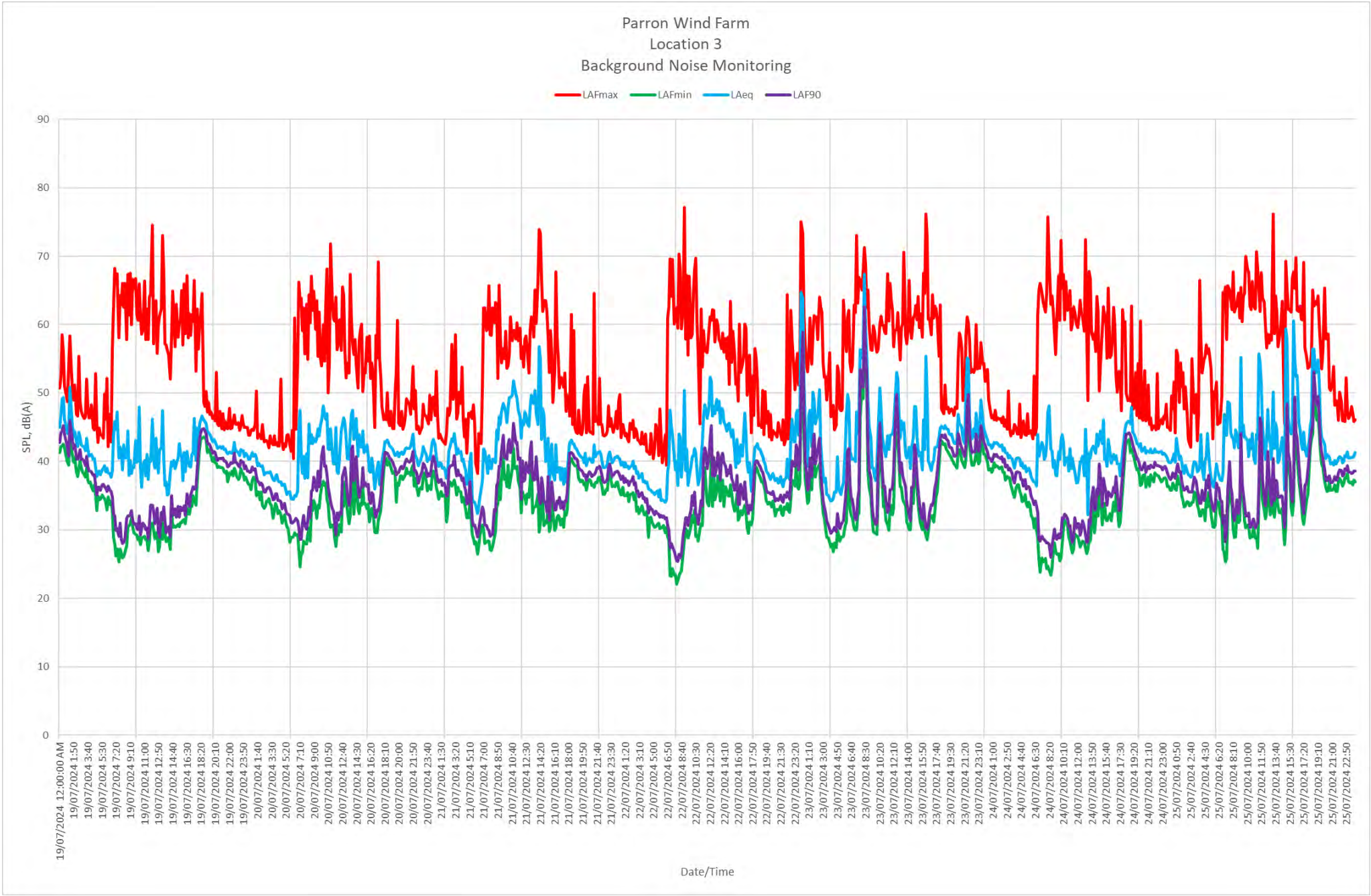

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

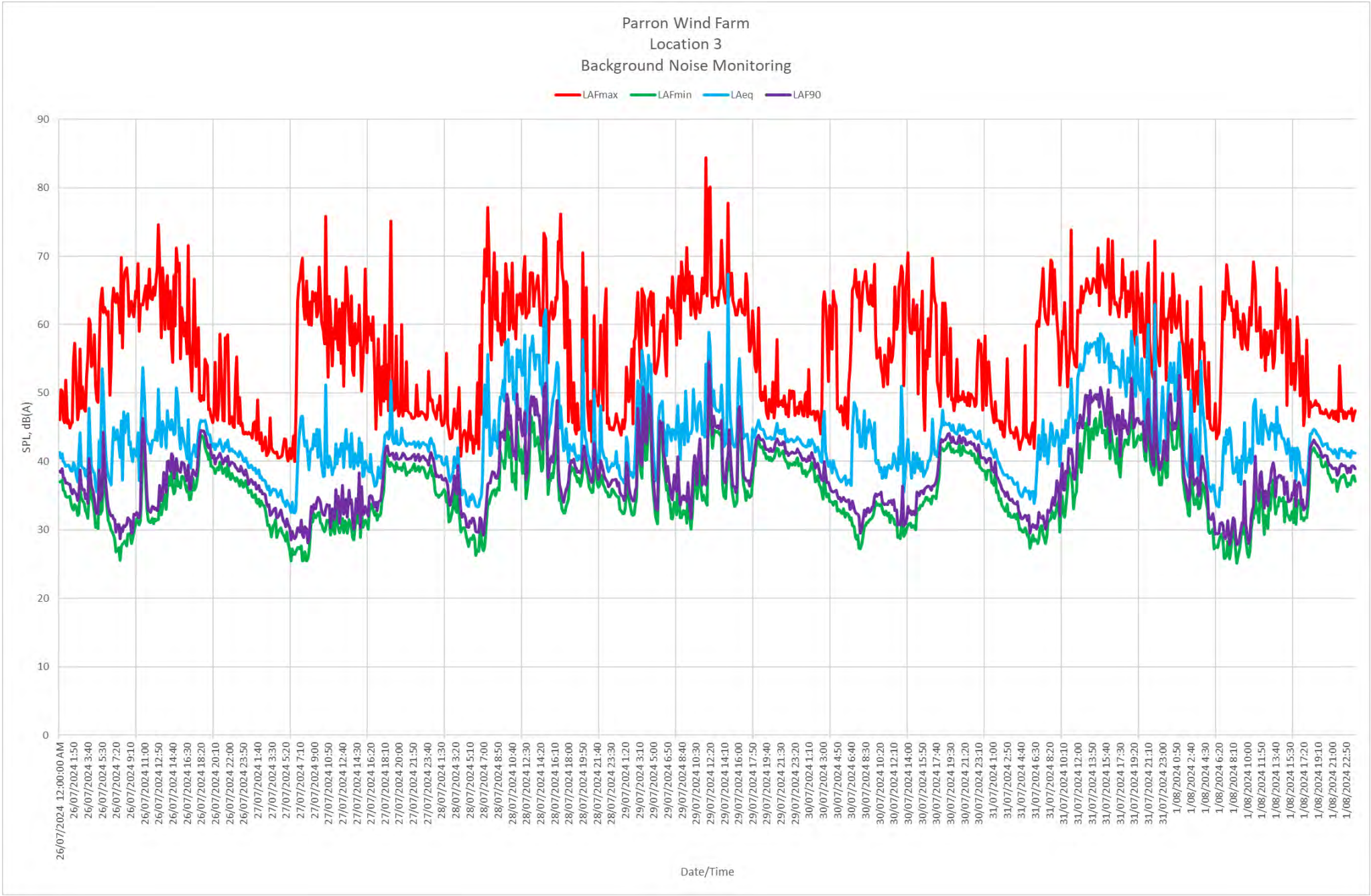

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

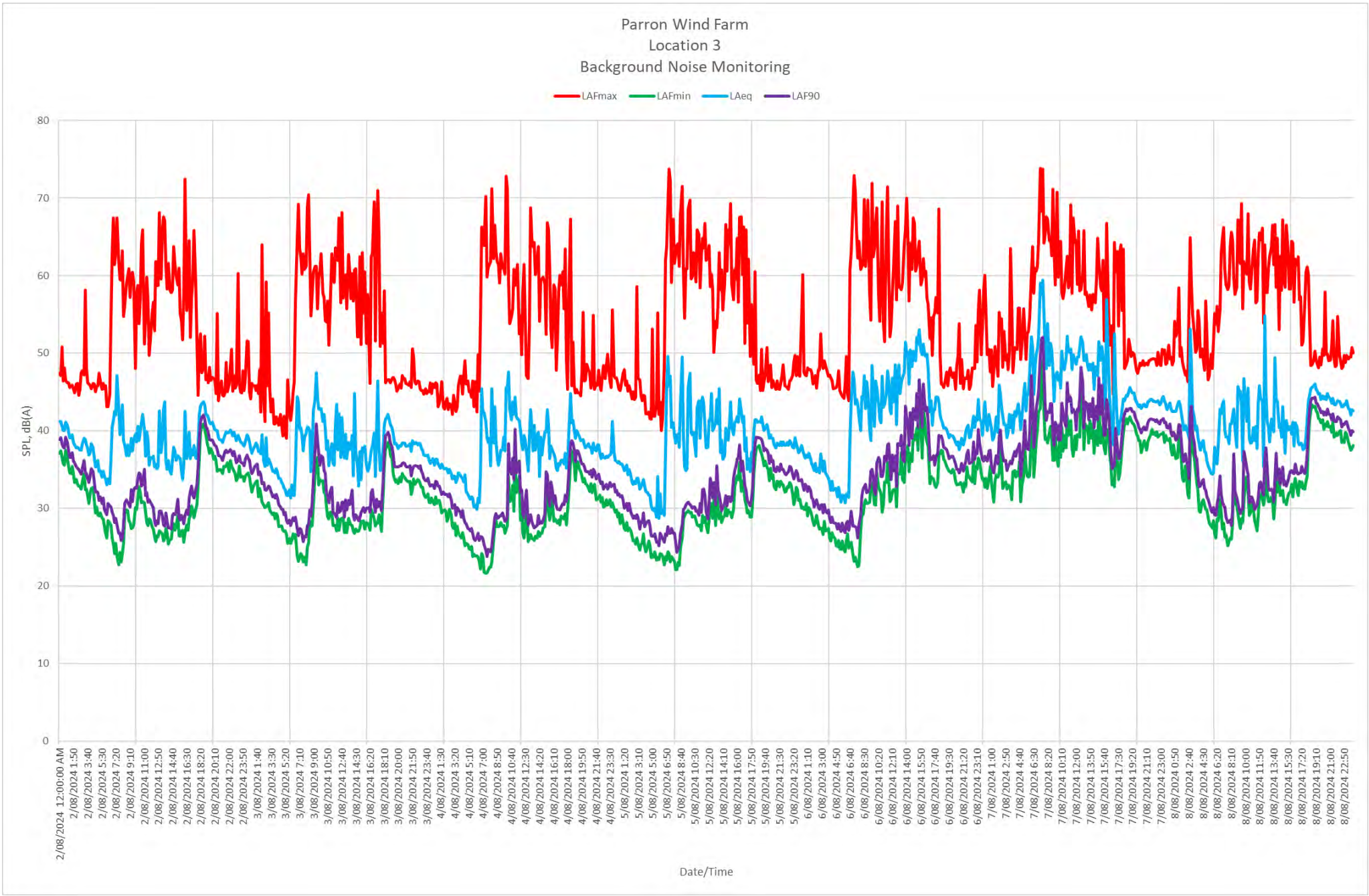

Parron Wind Farm
Location 2
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

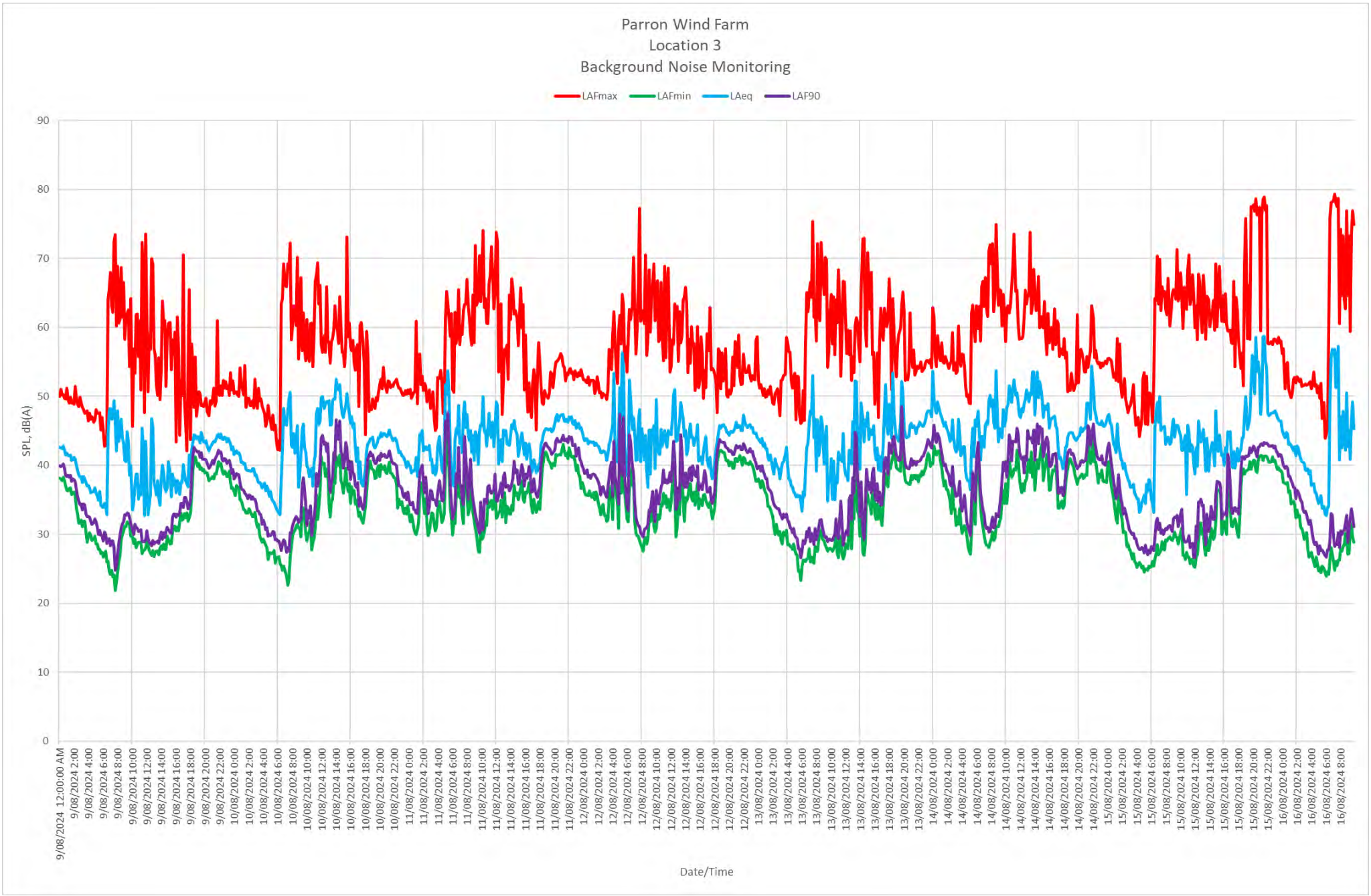

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

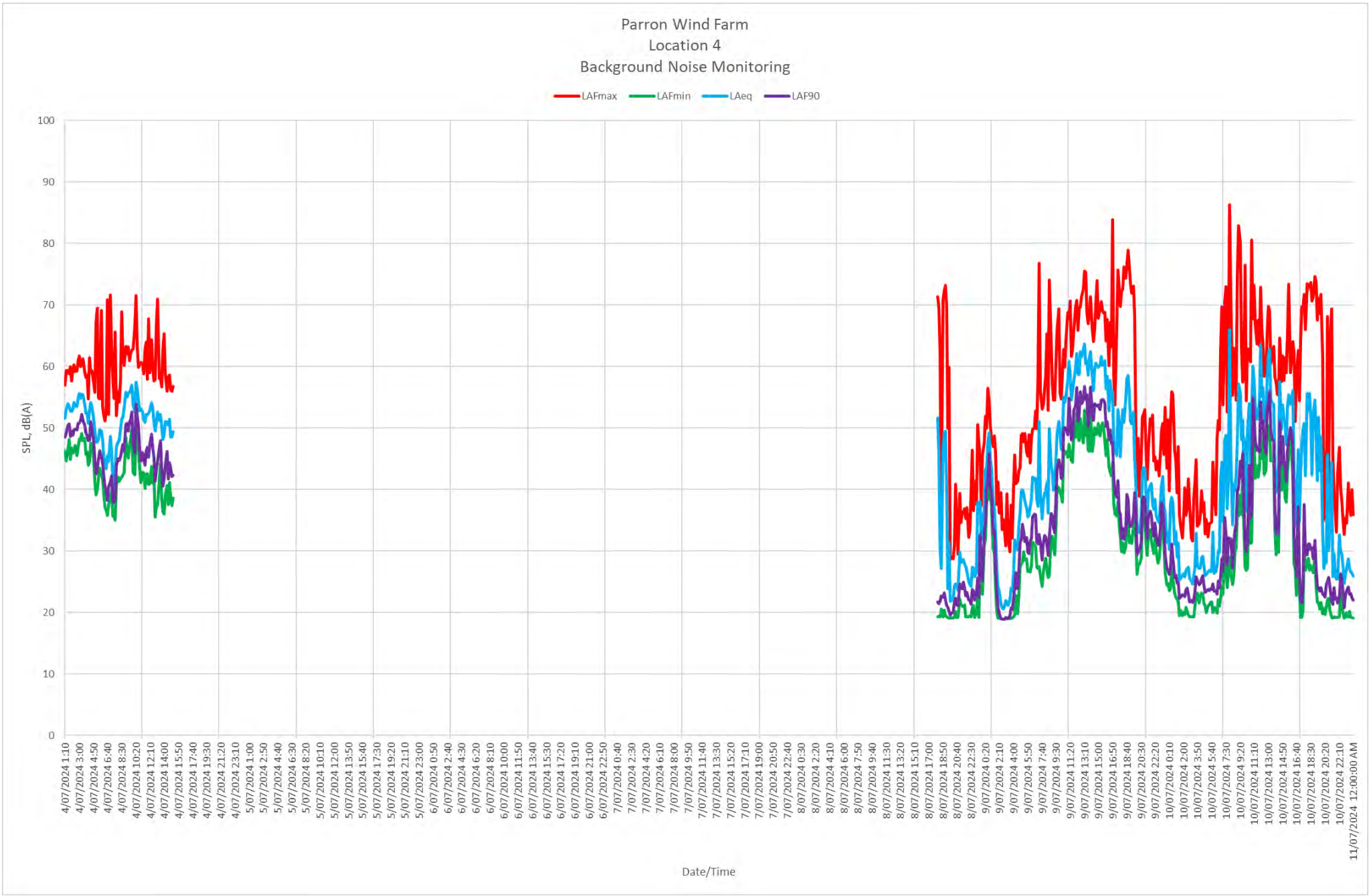

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

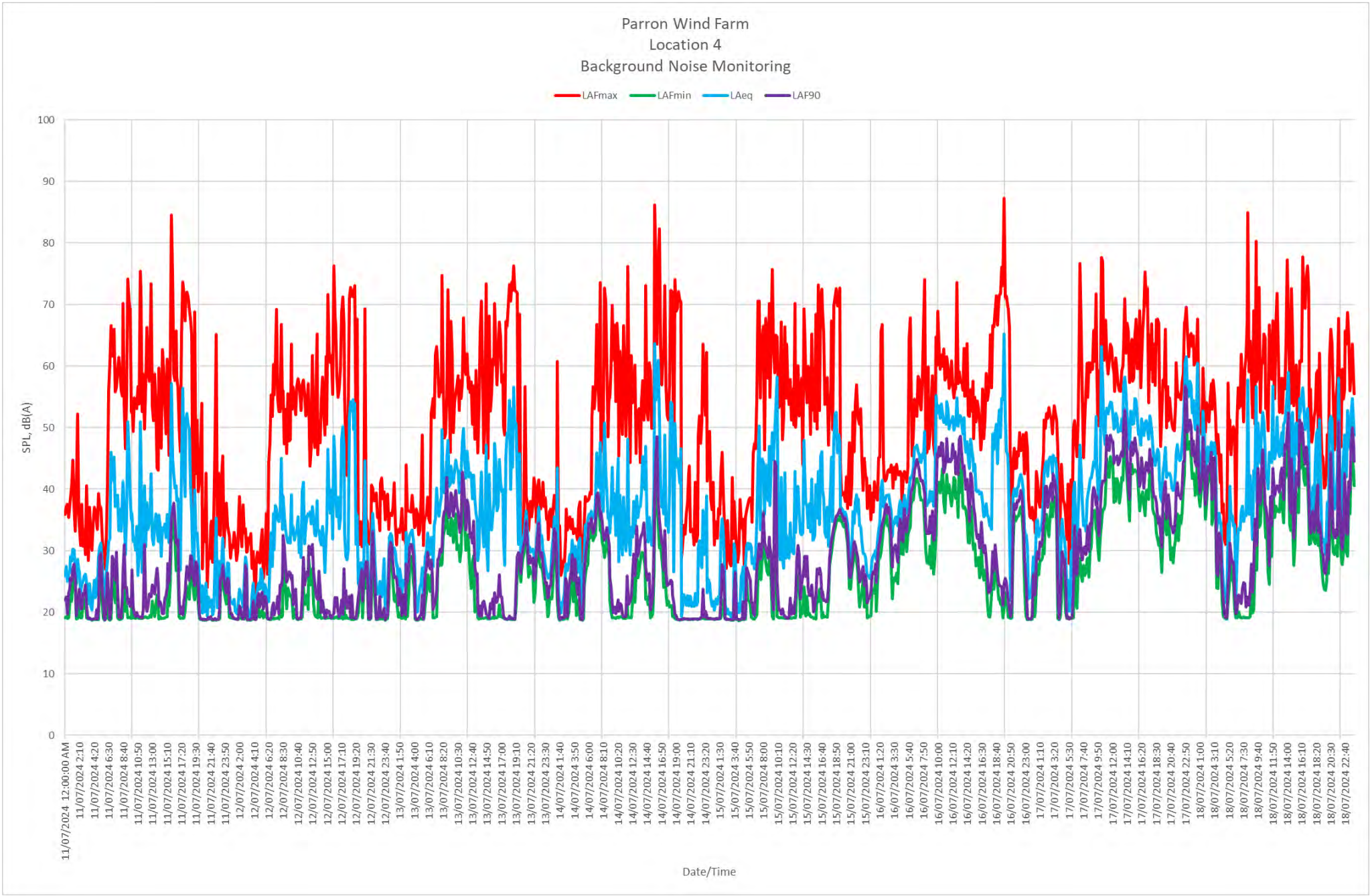

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

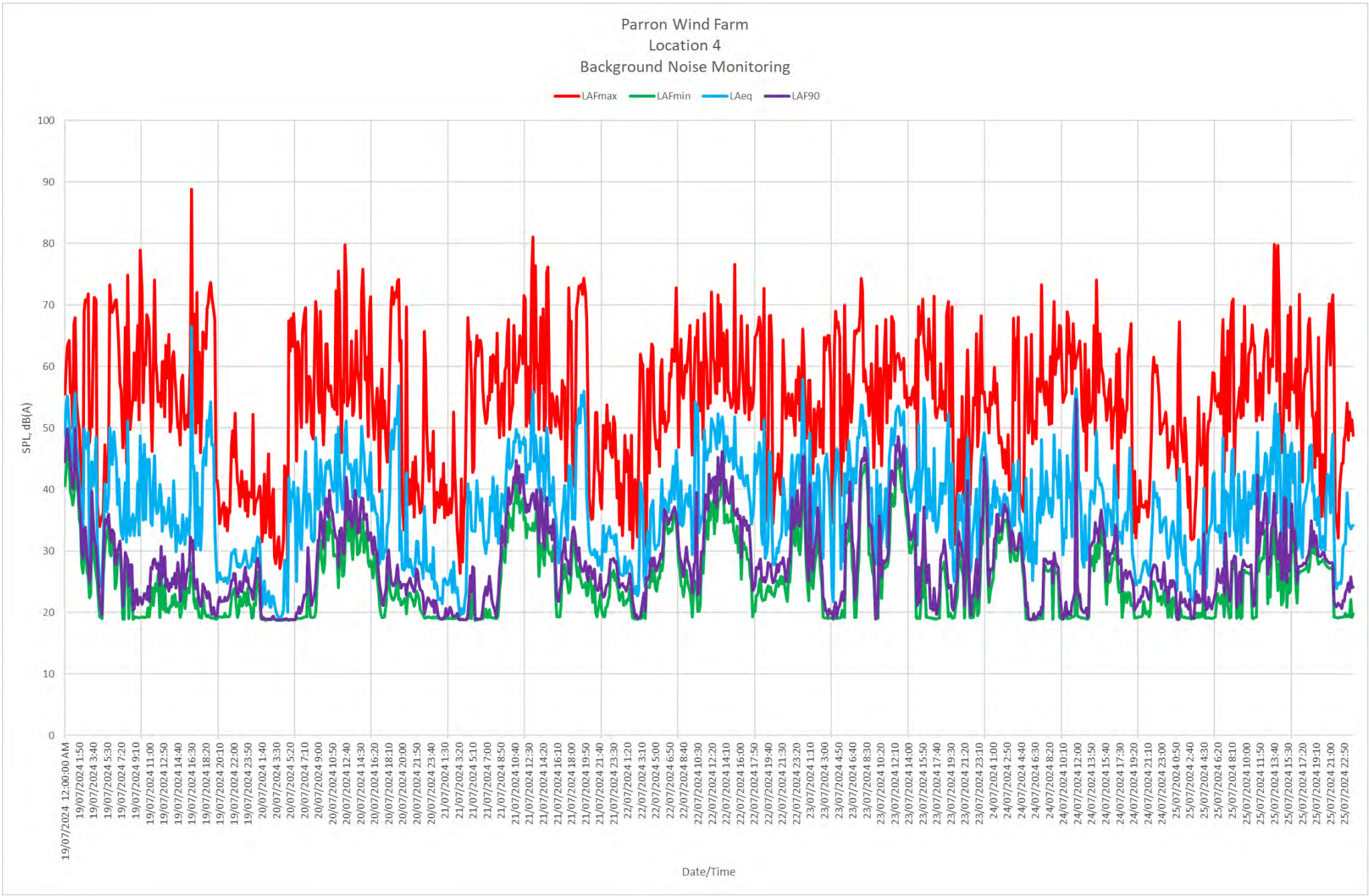

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

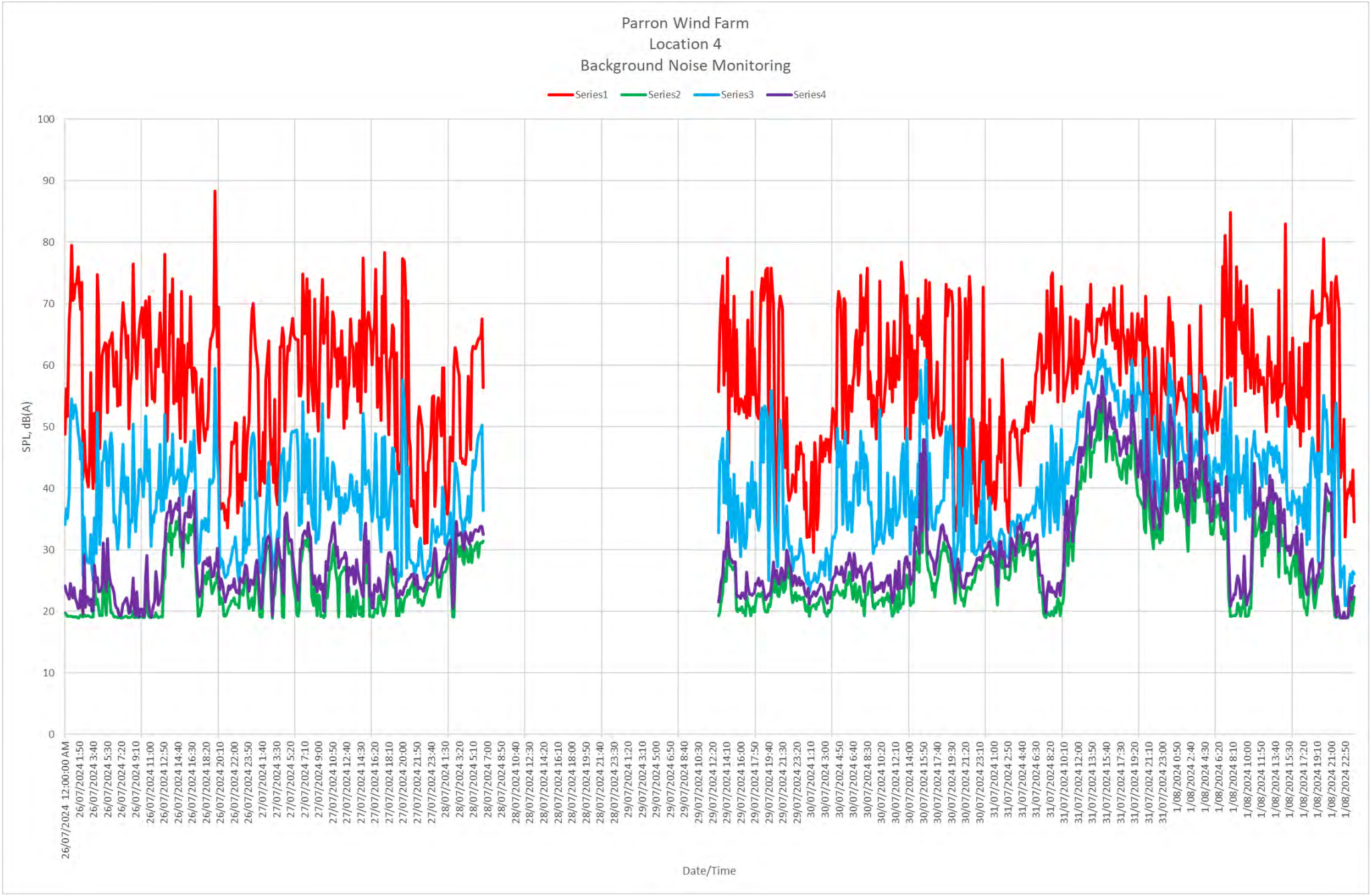

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

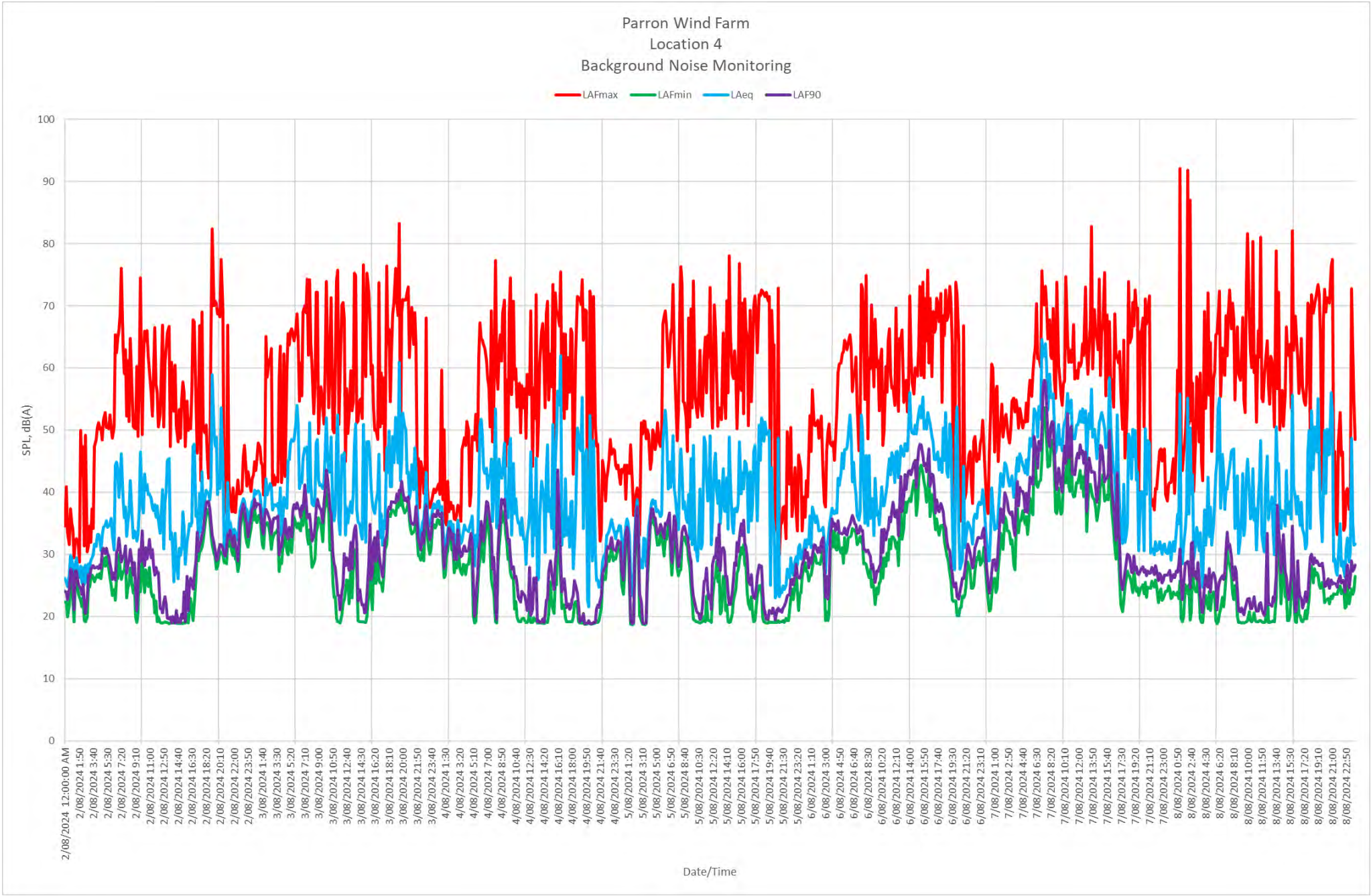

Parron Wind Farm
Location 3
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

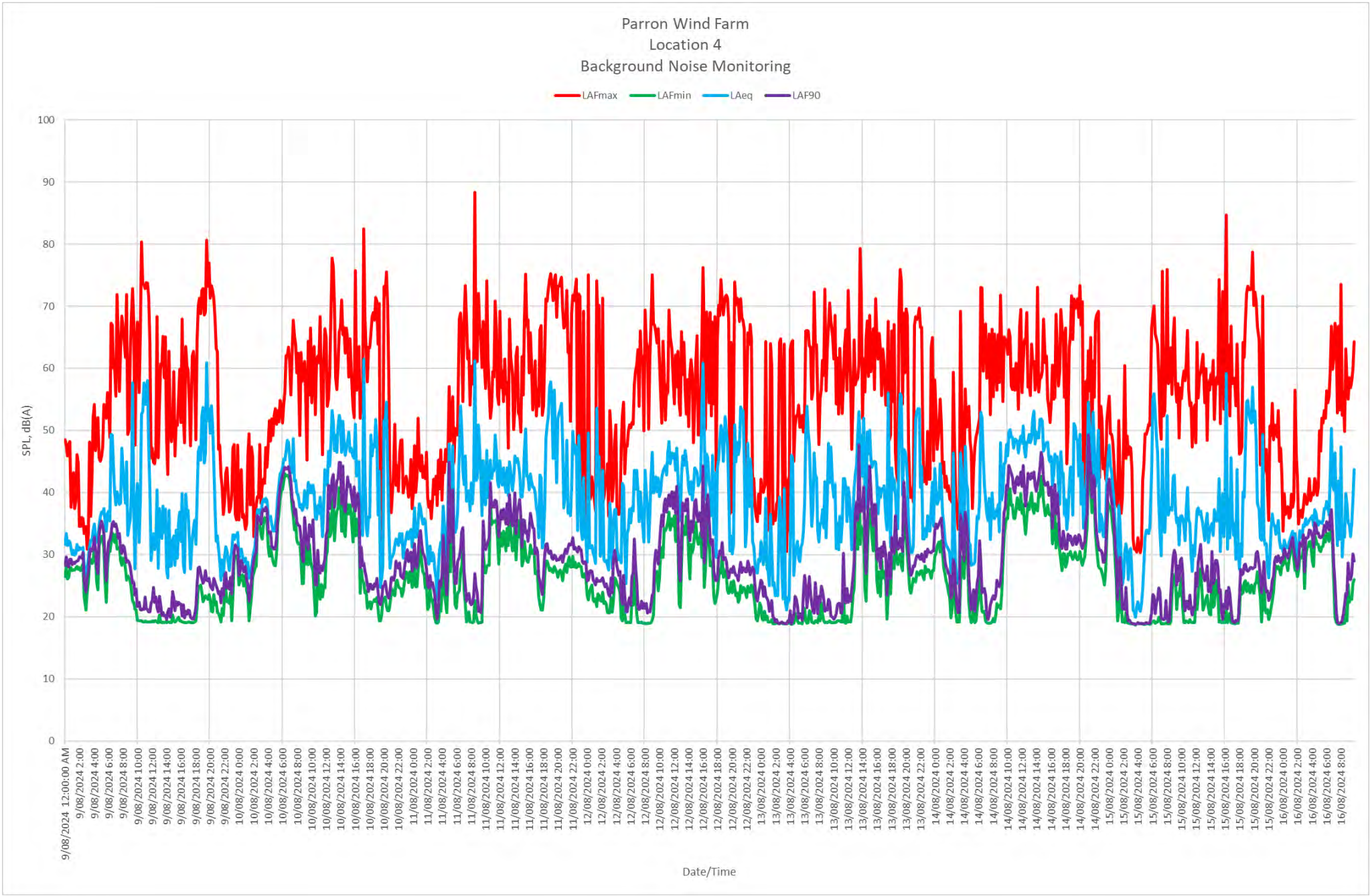

Parron Wind Farm
Location 4
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time


Parron Wind Farm
Location 4
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time


Parron Wind Farm
Location 4
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time


Parron Wind Farm
Location 4
Background Noise Monitoring
Series1
Series2
Series3
Series4
SPL, dB(A)
Date/Time


Parron Wind Farm
Location 4
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time


Parron Wind Farm
Location 4
Background Noise Monitoring
LAFmax
LAFmin
LAeq
LAF90
SPL, dB(A)
Date/Time

APPENDIX E

CALIBRATION CERTIFICATES

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE *SV 307A No. 131821*

with microphone SVANTEK type ST30A_v3 No. 140088

IMEI: 356531110611443

1. CALIBRATION (acoustical)

LEVEL METER function; Reference frequency: 1000Hz; Sound Pressure Level: 114.04 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	114.20	114.08	-0.12
A	114.20	114.08	-0.12
C	114.20	114.08	-0.12

Calibration measured with the microphone SVANTEK type ST30A_v3 No. 140088. Calibration factor: 0.00 dB.

2. LINEARITY TEST (electrical)

LEVEL METER function; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	75.0	85.0
Error [dB]	0.1	0.1	0.1	-0.0	-0.0	0.0

LEVEL METER function; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	115.0	125.0
Error [dB]	0.0	0.0	-0.0	0.0	0.0	0.0

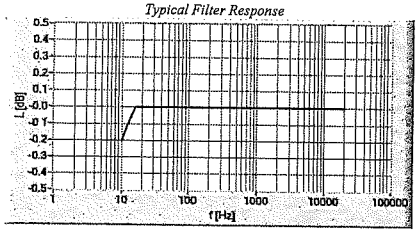
LEVEL METER function; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	114.0	124.0
Error [dB]	0.2	0.1	0.1	-0.0	-0.0	0.0

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: Z; Input signal =122 dB;

Typical Filter Response



Measured Filter Response
(f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-3.3	63	-0.1	4000	0.0
12.5	-2.5	125	-0.0	8000	0.0
16	-1.8	250	-0.0	16000	0.0
20	-1.3	500	0.0	20000	-0.0
25	-0.9	1000	0.0		
31.5	-0.6	2000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

4. FREQUENCY RESPONSE (acoustical)

LEVEL METER function; Characteristic: Z; Input: 90 dB;

Frequency [Hz]	20	31.5	63	125	250	500	800	1000	2000
Pressure Response [dB]	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.5
Free Field Response [dB]	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.1

Frequency [Hz]	3150	4000	5000	6300	8000	10000	12500	16000
Pressure Response [dB]	-0.9	-1.3	-1.8	-2.5	-3.3	-4.0	-4.6	-6.2
Free Field Response [dB]	0.2	0.3	0.5	0.6	0.6	0.4	0.1	-1.4

5. INTERNAL NOISE LEVEL (electrical - compensated)

LEVEL METER function; Calibration factor: 0dB

Characteristic	Z	A	C
Level [dB]	≤32	≤19	≤23

6. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A;

Indication [dB]	≤23

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
22 °C	28%	1018 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	65	Signal generator
2.	SVANTEK	SVAN 979	69475	Sound &Vibration Analyser
3.	RIGOL	DM3068	DM30155100773	Digital multimeter
4.	SVANTEK	SV30A	7449	Acoustic calibrator
5.	G.R.A.S.	51AB	200368	Sound Intensity Calibrator
6.	BRUEL&KJAER	BK4192	3340649	Reference Pressure Microphone
7.	G.R.A.S.	40AN	73421	Reference Free Field Microphone
8.	SVANTEK	SL3071	-	Microphone equivalent electrical impedance

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Ryszard Leoniak ..... Test date: 2023-02-14

5. INTERNAL NOISE LEVEL (electrical - compensated)

LEVEL METER function: Calibration factor: 0dB

Characteristic	Z	A	C
Level [dB]	≤32	≤19	≤23

6. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function: Characteristic: A:

Indication [dB]	≤23

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
26 °C	49%	999 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	127	Signal generator
2.	SVANTEK	SV979	21041	Sound &Vibration Analyser
3.	RIGOL	DM3068	DM30155100773	Digital multimeter
4.	SVANTEK	SV33B	109989	Acoustic calibrator
5.	G.R.A.S.	51AB	200368	Sound Intensity Calibrator
6.	BRUEL&KJAER	BK4192	3340648	Reference Pressure Microphone
7.	G.R.A.S.	40AN	73421	Reference Free Field Microphone
8.	SVANTEK	SL3071	-	Microphone equivalent electrical impedance

CONFORMITY & TEST DECLARATION

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3. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Maria Sawicka ..... Test date: 2023-09-20

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE *SV 307A No. 131848*

with microphone SVANTEK type ST30A_v3 No. 141297

IMEI: 356531110616491

1. CALIBRATION (acoustical)

LEVEL METER function; Reference frequency: 1000Hz; Sound Pressure Level: **114.07** dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.91	113.89	-0.02
A	113.91	113.89	-0.02
C	113.91	113.89	-0.02

Calibration measured with the microphone SVANTEK type ST30A_v3 No. 141297. Calibration factor: 0.00 dB.

2. LINEARITY TEST (electrical)

LEVEL METER function; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	75.0	85.0
Error [dB]	0.1	0.1	0.0	0.0	-0.0	0.0

LEVEL METER function; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	115.0	125.0
Error [dB]	0.1	0.1	0.1	0.0	-0.0	0.0

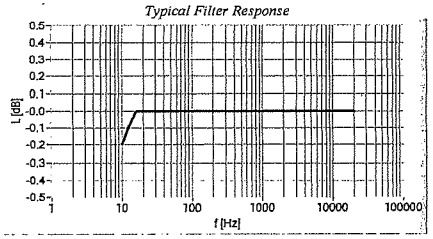
LEVEL METER function; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	114.0	124.0
Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: Z; Input signal =122 dB;

Typical Filter Response



Measured Filter Response
(f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-3.3	63	-0.1	4000	0.0
12.5	-2.5	125	-0.0	8000	0.0
16	-1.8	250	0.0	16000	0.0
20	-1.3	500	0.0	20000	-0.0
25	-0.8	1000	0.0		
31.5	-0.6	2000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

4. FREQUENCY RESPONSE (acoustical)

LEVEL METER function; Characteristic: Z; Input: 90 dB;

Frequency [Hz]	20	31.5	63	125	250	500	800	1000	2000
Pressure Response [dB]	0.1	0.1	0.0	0.1	0.1	0.0	-0.0	-0.2	-0.7
Free Field Response [dB]	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	-0.2

Frequency [Hz]	3150	4000	5000	6300	8000	10000	12500	16000
Pressure Response [dB]	-1.5	-2.2	-3.1	-4.0	-5.1	-6.3	-7.6	-9.4
Free Field Response [dB]	-0.4	-0.6	-0.7	-0.9	-1.1	-1.9	-2.9	-4.7

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM37462

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Svantek		
Type No:	SV307A	**Serial No:**	131847
Mic. Type:	ST30A_V3	**Serial No:**	143473
Pre-Amp. Type:	Internal	**Serial No:**	N/A

Owner: Herring Storer Acoustics
Suite 34, 11 Preston Street
Como, WA 6152

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1002	hPa ±1 hPa	**Date of Receipt :**	21/09/2023
Temperature	23	°C ±1° C	**Date of Calibration :**	21/09/2023
Relative Humidity	36	% ±5%	**Date of Issue :**	21/09/2023

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self-Generated Noise	11.1	Observed
Electrical Noise	11.2	Observed
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Not Available
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

A full technical report is available on request.

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE *SV 307A No. 131860*

with microphone SVANTEK type ST30A_v3 No. 140060

IMEI: 356531110881384

1. CALIBRATION (acoustical)

LEVEL METER function; Reference frequency: 1000Hz; Sound Pressure Level: **114.07** dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.91	113.93	0.02
A	113.91	113.93	0.02
C	113.91	113.93	0.02

Calibration measured with the microphone SVANTEK type ST30A_v3 No. 140060. Calibration factor: 0.00 dB.

2. LINEARITY TEST (electrical)

LEVEL METER function; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	75.0	85.0
Error [dB]	0.2	0.2	0.1	0.0	-0.0	0.0

LEVEL METER function; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	115.0	125.0
Error [dB]	0.3	0.1	0.1	0.0	0.0	0.0

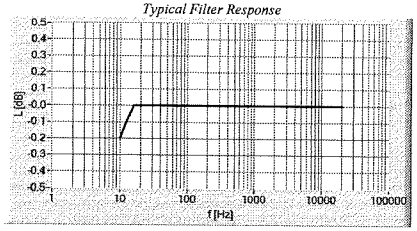
LEVEL METER function; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	114.0	124.0
Error [dB]	0.1	0.1	0.0	-0.0	0.0	0.0

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: Z; Input signal =122 dB;

Typical Filter Response



Measured Filter Response (f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-3.2	63	-0.1	4000	0.0
12.5	-2.4	125	-0.0	8000	0.0
16	-1.7	250	0.0	16000	0.0
20	-1.2	500	0.0	20000	-0.0
25	-0.8	1000	0.0		
31.5	-0.5	2000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

4. FREQUENCY RESPONSE (acoustical)

LEVEL METER function; Characteristic: Z; Input: 90 dB;

Frequency [Hz]	20	31.5	63	125	250	500	800	1000	2000
Pressure Response [dB]	-0.0	-0.0	-0.1	-0.1	-0.0	-0.1	-0.1	-0.2	-0.5
Free Field Response [dB]	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.0	-0.0	-0.0

Frequency [Hz]	3150	4000	5000	6300	8000	10000	12500	16000
Pressure Response [dB]	-1.1	-1.6	-2.2	-3.0	-3.9	-4.8	-5.9	-7.6
Free Field Response [dB]	0.1	0.0	0.2	0.1	-0.0	-0.4	-1.2	-2.8

5. INTERNAL NOISE LEVEL (electrical - compensated)

LEVEL METER function; Calibration factor: 0dB

Characteristic	Z	A	C
Level [dB]	≤32	≤19	≤23

6. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A;

Indication [dB]	≤23

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
23 °C	26%	1007 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	100	Signal generator
2.	SVANTEK	SVAN 912A	4369	Sound &Vibration Analyser
3.	RIGOL	DM3068	DM30155100773	Digital multimeter
4.	SVANTEK	SV33B	93171	Acoustic calibrator
5.	G.R.A.S.	51AB	200368	Sound Intensity Calibrator
6.	BRUEL&KJAER	BK4192	3340650	Reference Pressure Microphone
7.	G.R.A.S.	40AN	73421	Reference Free Field Microphone
8.	SVANTEK	SL3071	-	Microphone equivalent electrical impedance

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Cezary Dardziński .....

Test date: 2023-02-16

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE *SV 307A No. 131856*

with microphone SVANTEK type ST30A_v3 No. 140070

IMEI: 356531110611609

1. CALIBRATION (acoustical)

LEVEL METER function; Reference frequency: 1000Hz; Sound Pressure Level: **114.04** dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.88	113.94	0.06
A	113.88	113.94	0.06
C	113.88	113.94	0.06

Calibration measured with the microphone SVANTEK type ST30A_v3 No. 140070. Calibration factor: 0.00 dB.

2. LINEARITY TEST (electrical)

LEVEL METER function; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	75.0	85.0
Error [dB]	0.2	0.2	0.1	-0.0	-0.0	0.0

LEVEL METER function; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	115.0	125.0
Error [dB]	0.1	0.1	0.1	-0.1	-0.0	0.0

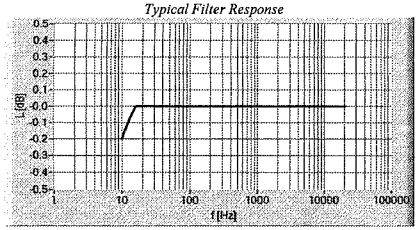
LEVEL METER function; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	30.0	31.0	32.0	40.0	114.0	124.0
Error [dB]	0.2	0.2	0.1	-0.0	-0.0	0.0

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: Z; Input signal =122 dB;

Typical Filter Response



Measured Filter Response
(f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-3.3	63	-0.1	4000	0.0
12.5	-2.5	125	-0.0	8000	0.0
16	-1.8	250	-0.0	16000	0.0
20	-1.3	500	0.0	20000	-0.0
25	-0.9	1000	0.0		
31.5	-0.6	2000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

4. FREQUENCY RESPONSE (acoustical)

LEVEL METER function; Characteristic: Z; Input: 90 dB;

Frequency [Hz]	20	31.5	63	125	250	500	800	1000	2000
Pressure Response [dB]	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.4
Free Field Response [dB]	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.0	0.1

Frequency [Hz]	3150	4000	5000	6300	8000	10000	12500	16000
Pressure Response [dB]	-0.8	-1.1	-1.5	-2.1	-2.8	-3.3	-3.7	-3.9
Free Field Response [dB]	0.4	0.5	0.9	1.0	1.2	1.1	1.0	0.9

5. INTERNAL NOISE LEVEL (electrical - compensated)

LEVEL METER function; Calibration factor: 0dB

Characteristic	Z	A	C
Level [dB]	≤32	≤19	≤23

6. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A;

Indication [dB]	≤23

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
23 °C	26%	1007 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	65	Signal generator
2.	SVANTEK	SVAN 979	69475	Sound &Vibration Analyser
3.	RIGOL	DM3068	DM30155100773	Digital multimeter
4.	SVANTEK	SV30A	7449	Acoustic calibrator
5.	G.R.A.S.	51AB	200368	Sound Intensity Calibrator
6.	BRUEL&KJAER	BK4192	3340649	Reference Pressure Microphone
7.	G.R.A.S.	40AN	73421	Reference Free Field Microphone
8.	SVANTEK	SL3071	-	Microphone equivalent electrical impedance

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
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4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Ryszard Leoniak ..... Test date: 2023-02-16

NVMS

Certificate of Calibration

Certificate No:	CAL/23/02/001	**Calibration Date:**	01/02/2023

Client:	Herring Storer Acoustics		
Address:	Po Box 219, Como WA 6952		
Description:	Acoustic Calibrator	**Specified Sound**	
Manufacturer:	Brüel & Kjær	**Pressure Levels:**	94, 114 dB
Model:	4231		
Serial:	2464046	**Specified Frequencies:**	1000 Hz
Adaptors:	½ inch		

Tests performed The sound pressure level(s), frequency(ies) and total distortion of the calibrator have been checked against the requirements of AS IEC 60942 - 2004 Annex B

Test Results

Parameter	**Measured Value**	**Expanded Measurement Uncertainty** †	
Sound Pressure Level 1	**93.99**	0.14 dB	**Complied Class 1**
Sound Pressure Level 2	**114.00**	0.14 dB	**Complied Class 1**
Frequency	**999.9**	0.015 Hz	**Complied Class 1**
THD + N @ SPL 1	**0.6**	0.07 %	**Complied Class 1**
THD + N @ SPL 2	**0.3**	0.07 %	**Complied Class 1**

(Sound Pressure Levels are referred to a pressure of 20 micro-pascals)

† Measurement uncertainties are stated at the 95% confidence level, and have been calculated in accordance with the principles in the ISO Guide to the Expression of Uncertainty in Measurement. A coverage factor of 2 applies.

Ambient Conditions

Temperature:	24
Relative Humidity:	46%
Atmospheric Pressure:	1009

Authorised Signatory

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.

Accreditation No. 12604.

Checked By

1/2/23
Date of issue

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