

Post-construction Noise Assessment Audit

CARMs no. 78450-2 Service order: 8006740



Murra Warra Wind Farm

Stage 1, Round 2

Ailsa-Wheat Road, Murra Warra, Victoria 3393



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17 Clowes Street, South Yarra, Victoria 3141

August 10th, 2020

Summary

Stage 1 of the Murra Warra Wind Farm has had its second round of operational turbine noise assessed by Marshall Day Acoustics. Noise sensitive locations, residential receptors, within a predicted 35 dB noise level from the wind farm have been monitored. This compliance monitoring will be concluded with an additional round (Round 3) of noise monitoring as the final noise assessment. This will occur after 12 months of operation of the Murra Warra wind farm Stage 1.

The second round of noise monitoring was conducted from November 20th 2019 to January 16th 2020. The associated noise compliance assessment report was produced on August 4th 2020. Over this period all 61 turbines became operational, but were not necessarily fully engaged due to a number of factors. Therefore a complete assessment of the fully operating wind farm was not possible and compliance could be gauged only for the period of the monitoring.

The assessment found that the wind farm noise was compliant with levels required by the New Zealand Standard NZS 6808: 2010 and the amenity of those occupying the two closest noise sensitive locations monitored (H156 and H161) were not adversely affected by the wind farm noise. The analysis of the wind farm noise at H41 could not be adequately resolved from extraneous noise and was discounted from the analysis. This audit report confirms these findings, but notes that this conclusion is only valid for the monitoring period.

Noise monitoring at the three chosen noise sensitive locations showed a high degree of scatter due to extraneous noise not related to wind speed or the wind farm. This made differentiation of wind farm noise difficult in all noise sensitive locations and not practical at one noise sensitive location (H41). The point scatter rendered the regression analyses at the noise sensitive locations chosen to have a high degree of uncertainty. This was compounded by a wind direction distribution that was atypical of the historical data, further confirming that the assessment is valid only for the monitoring period.

In line with these findings the wind farm operator, RES, and site management reported that there were no noise complaints over this period.

Details of this audit are provided in the following report and appendices.

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Audit report summary

Item	Description
Auditor	John Cumming
Auditor account number	75697
Auditor appointment end date	31/07/2022
Audit type	Section 53v for noise at a wind farm
Date EPA notified of audit	11-07-2020
Audit service order number	8006740 (CARMS 78450-2)
Name of person requesting audit	Stuart Mallinson
Relationship to premise/location	Project Manager, Murra Warra Wind Farm
Date of request	07-07-2020
Completion date of audit	10-08-2020
Reason for audit	Post-construction noise risk audit for Stage 1 Round 2 of the Murra Warra Wind Farm
Audit categorisation	Noise compliance with New Zealand Standard NZS6809:2010 and planning permit noise conditions
Environmental segments	Air (noise) for the noise sensitive locations situated in the locality of the Murra Warra Wind Farm
If the audit was required by an EPA notice or other please provide EPA reference number	Planning permits PA1600127A and PA1600128B issued by Horsham and Yarriambiack councils on November 21, 2016 (amended 11/01/2019)
Current land use zoning	FZ1 Farming
EPA region	North West
Dominant – lot on plan	
Additional - lot on plan	
Site/premise name	
Building/complex sub-unit No.	
Street/lot – Lower no.	
Street/lot – Upper no.	
Street name	Ailsa- Wheat Road
Street type (road,court etc.)	
Street Suffix (north, south etc.)	
Suburb	Murra Warra
Postcode	3393
GIS coordinates of centroid	
Latitude (GDA94)	142.317580
Longitude (GDA94)	-36.432623
Site area (in square meters)	21,000,000
Members and categories of support team members used	Nil
Nature and extent of continuing risk	The noise risk to amenity at noise sensitive locations could only be concluded as a low risk for the monitoring period due to incomplete turbine operations. This was compounded by extraneous noise sources and atypical wind directions over the monitoring period.
Outcome of audit	The following recommendations are provided to ensure compliance can be further assessed for the completed Stage 1 Murra Warra wind farm: <ul style="list-style-type: none"> 1. The stage 1 Murra Warra wind farm needs to have its noise compliance reassessed in accordance with the Standard at a time period in which all turbines are operating and the wind

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	<p>direction distribution approximates that of the historical wind direction distribution.</p> <ol style="list-style-type: none"> 2. High amenity can be examined for the receptors inside the 35 dB contour using the analysis in section 5.3.1 of the standard in the subsequent noise compliance assessment. 3. Special audible characteristics of the wind farm noise can be tested upon operation of all 61 turbines in Stage 1, using the test methods provided in Appendix B of the standard. 4. This noise compliance report should be distributed to the stakeholders and be made publicly available.
Historic land use	Farming
Current land use	Farming
Proposed future land use	Farming
Surrounding land use - north	Farming
Surrounding land use - south	Farming
Surrounding land use - east	Farming
Surrounding land use - west	Farming
Proposed land use zoning	FZ1
Nearest surface water receptor - name	N/A
Nearest surface water receptor - direction	N/A
Likely point of groundwater discharge	N/A
Groundwater segment	N/A

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Background:

The Stage 1 Murra Warra Wind Farm is situated at Murra Warra, 25 km north of Horsham. The first turbine became operational on April 9, 2019. At the start of the second round of monitoring 40 turbines were operating and the 61st turbine became operational by mid-January, during the last week of the noise monitoring. This completed construction of stage 1 of the Murra Warra wind farm.

On July 7th, 2020 Stuart Mallinson of the Downer Group requested that Dr John Cumming, Director of Infotech Research, undertake a compliance audit of the Marshall Day Acoustics assessment report. Dr Cumming registered this audit with the EPA on July 11th, 2020. The site was inspected on December 9th, 2019, and again on May 22nd, 2020 at which time all of the turbines were operational.

A check of the Victorian Renewable Energy web site¹ revealed one other approved wind farm north of Horsham, comprising two turbines at Jung off the Henty Highway 10 km north east of Horsham. The Jung Renewable Energy Facility is planned to be located 7 km south east of the Murra Warra wind farm. Another wind farm, the Wimmera Plains Energy Facility, has submitted a planning application. This is to be situated south of the Murra Warra Wind Farm on the Henty Highway.

Examination of the planned turbines does not present a significant impingement of the noise from these planned facilities to that of the Murra Warra Wind Farm.

¹ <https://www.planning.vic.gov.au/permits-and-applications/specific-permit-topics/wind-energy-facilities/wind-energy-projects-planning>

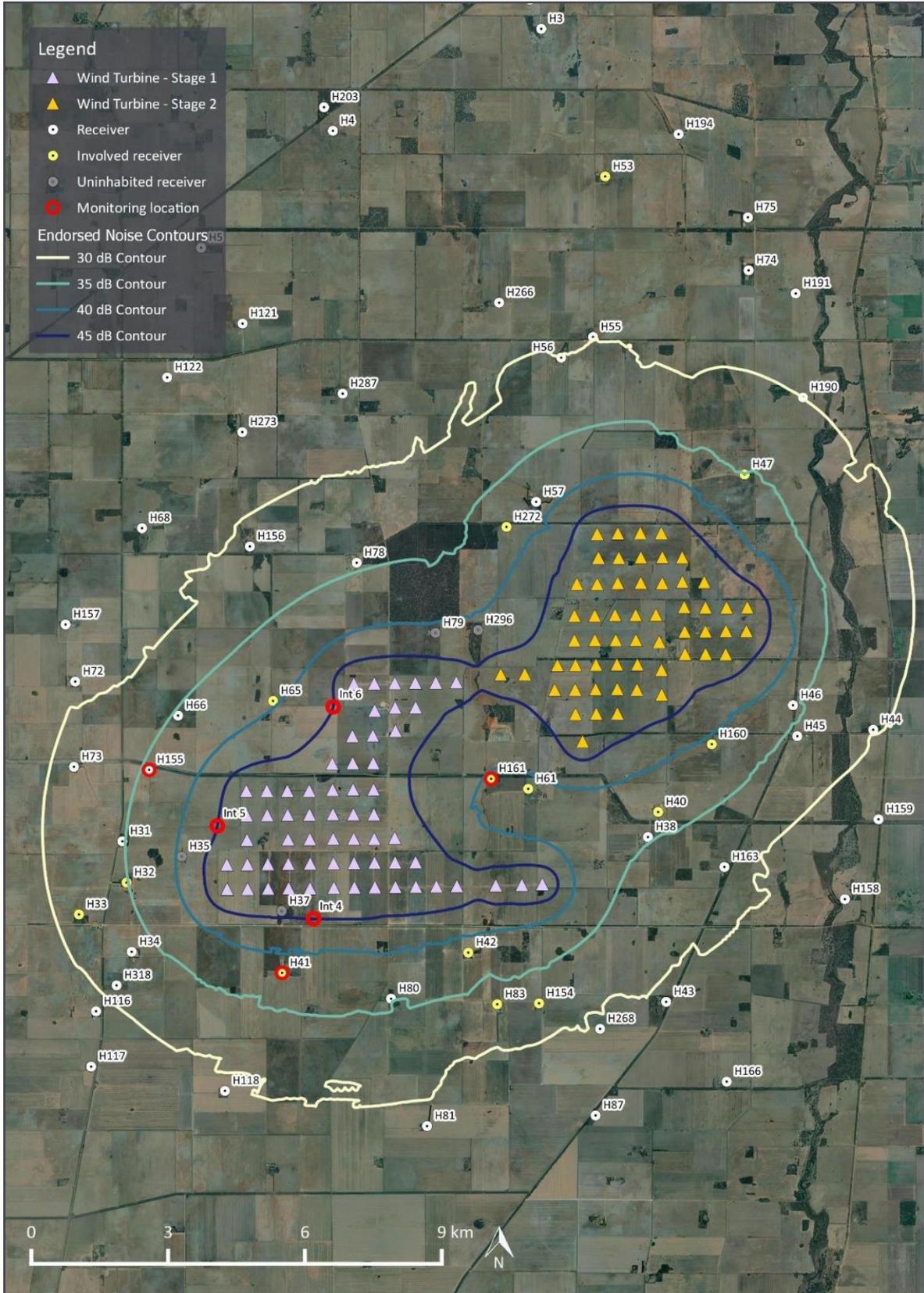


Figure 1. Noise monitoring points for Stage 1 (in red)

Audit objectives

To assess the compliance of the Wind Farm Post-construction Noise Assessment Report for Stage 1 Round 2 of the Murra Warra wind farm, with the requirements set out in:

1. Planning permits nos.PA1600127A and PA1600128B issued by the councils of Horsham and Yarriambiack on November 21, 2016 (amended January 11, 2019).
2. New Zealand Standard: Acoustics – Wind Farm Noise NZS 69808:2010 (The Standard).

And from this compliance assessment to conclude on the risk of amenity impact to the nearby residents, specifically any adverse impacts on the amenity from noise generated by the facility.

Scope:

Activity	Wind energy facility (WEF) - operation
Element	Noise from turbine blades, the generators, gearboxes and hydraulics
Segment	Site environs surrounding the WEF as positioned at Murra Warra, Victoria Centroid Latitude: -36.432623 Longitude: 142.317580 Area of site: 2,100 Ha (Stages 1 and 2) In particular, the noise sensitive locations as defined in the standard: <i>NZS 6808:2010 Acoustics- Wind Farm Noise.</i>
Elements	Air (noise)
Beneficial uses	Of relevance to noise: Human habitation and wellbeing
Risk assessment	Effect on amenity of receptor sites applicable to noise
Time period	November 20, 2020 to January 16, 2020 (the noise monitoring period for Stage 1 Round 2.)
Exclusions	The audit has not considered construction noise, nor noise generated from equipment on site other than that listed. Compliance with anything other than noise requirements of the planning permits was not considered

Table 1. Scope of works

Audit criteria:

The Victorian Policy and Planning Guidelines (October 2018) states:

- Section 5.1.2(a) Noise: that *the facility should comply with the noise limits recommended for dwellings and other noise sensitive locations set out in the New Zealand Standard – NZS 6808:2010 Acoustics- Wind Farm Noise.*
- *Similarly, the Planning Permits state that the noise assessment must be undertaken in compliance with the New Zealand Standard.*
- *the local government Planning Scheme in Clause 52.32-3 that written consent of the owner of a dwelling positioned within one kilometer of the nearest wind turbine is required for planning approval. Evidence of written consent is required.*

NZS 6808:2010 Noise limits

- *Section 5.2 – Acceptable limit (40 dB L_{A90}(10min), or background + 5 dB² if higher)*
- *Section 5.4 - Special Audible Characteristics (tonal, impulsiveness, or amplitude modulation) receive a maximum +6 dB penalty added to the noise level.*
- *Section 5.3 - High Amenity Areas (35 dB L_{A90}(10min), or background + 5 dB if higher) to be considered.*

These noise limits produced in the Standard apply to all times of the day and night.

The EPA released a guidance note for noise in regional areas, Noise from Industry in Regional Victoria (NIRV). This provides recommended maximum noise levels for various receptors of

² The terms dB and dB L_{A90}(10min) are used interchangeably in this report.

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industrial noise outside major urban areas. Using the variations to noise limits for utilities provided in the box on page 10 of the NIRV the limits follow:

- Day 45 dB(A)
- Evening 39 dB(A) and
- Night 34 dB(A).

The limits do not apply to the wind turbines but may apply to the transformers used in the site substation.

Audit method:

The noise assessment report was examined with reference to the compliance criteria. Explanations were sought from the author of the acoustic compliance report. The proponents of the wind farm were interviewed and provided further documentation to support the proposal.

Plans were checked against maps to confirm dwelling locations.

Task	Comment (ref. to documents / site visit)
1. Confirmation noise outputs of the wind turbines	Refer to Servion 3.7M144 turbine data provided by the Downer Group
2. Confirm the criteria relevant to the NZS 6808: 2010 standard and the EPA noise in regional Victoria guidelines	Refer to Standard NZS 6808:2010 and EPA NIRV Guidelines
3. Site check of the wind turbine and receptor locations and site specific issues relating to noise generation and reception	Site visit was conducted on December 9 th 2019 and a follow up visit was undertaken on May 22 nd 2020.
4. Check the models used and outputs provided in the Marshall Day report	Refer to: Murra Warra Wind Farm – Stage 1 Acoustic Compliance Report – Round 2 August 4 th , 2020 (Rp 005 R01 20181019) Marshall Day Acoustics
5. Review of the background noise assessment and the Noise Compliance Test Plan	Murra Warra Wind Farm Background Noise Monitoring Rp 001 20181019 (November 11 th , 2019) and Stage 1 Noise Compliance Test Plan Rp 003 R01 20181019 (November 21 st , 2019)
6. Risk evaluation and audit report preparation. Submission to the Downer Group and final report registered with the EPA for publication.	Refer to: Wind energy facility noise auditor guidelines (EPA pub. 1692 October 2018) Preparation of Environmental audit reports on risk to the environment (EPA pub. 952.5 December 2015)

Table 2. Task list

Documents examined:

1. Policy and Planning Guidelines for the Development of Wind Energy Facilities in Victoria (the Guidelines) October 2018
2. NZS 6808:2010 Acoustics - Wind Farm Noise
3. Shire of Horsham and Shire of Yarriambiack Planning Permits PA1600127A and PA1600128B issued on November 21, 2016 amended January 11, 2019 (noise conditions)
4. Murra Warra Pre-construction Noise Assessment - Sonus report S4453C25 (August 2017)
5. Murra Warra Wind Farm – Stage 1 Noise Compliance Test Plan -Rp 003 20181019 (November 21st, 2019)
6. Murra Warra Wind Farm Background Noise Monitoring Report -Rp 001 20181019 (November 11th, 2019)
7. Murra Warra Wind Farm – Stage 1 Acoustic Compliance Report Round 2 -Rp 005 R01 20181019 (August 4th, 2020)
8. Preparation of Environmental audit reports on risk to the environment (EPA pub. 952.5 December 2015)
9. Wind energy facility noise auditor guidelines (EPA pub. 1692 October 2018)
10. Murra Warra Wind Farm – Stage 1 Acoustic Compliance Report – Round 1 (Rp001 20181019 November 2019)
11. Post Construction Noise Assessment Audit – Murra Warra Wind Farm Stage 1 Round 1

Audit findings

Construction and commissioning

The Murra Warra Wind Farm uses Senvion3.7M144 wind turbines with a rotor diameter of 144 m. at a hub height of 139 m. above the ground level. The turbines have a rated power wind speed of 12 m/s (cut in wind speed of 3.5 m/s and a cut-out wind speed of 26 m/s).

Construction and commissioning of the total 61 turbines in Stage 1 were completed by mid-January 2020. This coincided with the end of the Round 2 monitoring period. The positions of all 61 Stage 1 turbines are given in Appendix B (Table 13) of the noise compliance report. Turbine positions were confirmed in the Round 1 audit report.

Analysis of the turbine operations during the noise monitoring period from November 20th 2019 to January 16th 2020 revealed that none of the turbines were fully operational over the period. Only 36 turbines were operating normally for more than 50% of the time during the monitoring period.

Cumulative effects

Noise predictions made for the whole project (Stages 1 and 2) indicate that the noise sensitive locations chosen for monitoring fall between the 40 and the 35 dB contours, the other receptors are on or outside the 35 dB contour for both stages.

Additional wind farm noise may be generated from:

1. The approved Jung renewable energy facility that includes two wind turbines, some 7 km to the south east, which is too distant to affect the noise sensitive locations in question.
2. The Wimmera Plains Energy Facility that is under planning application for 54 wind turbines along the Henty Highway directly south of the Murra Warra Wind Farm.

These facilities are yet to be constructed and as such do not need to be considered under the Standard for their cumulative noise impact. Additional noise impacts from these facilities to the subject noise sensitive locations are expected to be negligible in any case.

Background noise monitoring

Background noise monitoring was undertaken by Marshall Day prior to the operational noise assessments. Eleven monitoring sites were chosen including six noise sensitive locations and five intermediate sites. These were chosen to provide a representative array of points to test noise propagation from the wind farm in all directions.

Those of relevance to the Stage 1 turbines are shown in red in Figure 1.

Noise monitoring was conducted for four to six weeks at each site, gathering sufficient data points at the operating range of hub height wind speeds to meet the requirements of the Standard. A regression analysis was performed to characterize the background noise as a function of wind speed. This analysis provided the noise limits for compliance at noise sensitive locations being monitored. This data is provided in the Marshall Day background noise monitoring report (001 20181019 November 11th 2019).

Plots of background noise and wind speed over time correlated in peaks and troughs with the time and there were no clear indications of anomalies of background noise when wind speed was low.

Operational Noise assessment

The noise assessment commenced on November 20, 2019 and finished on January 16, 2020 at the time of the commissioning of the 61st turbine. The positioning of the noise monitoring equipment was the same as for the background and Round 1 monitoring. The monitoring time period of 57 days was well in excess of the minimum time period of ten days required by the Standard.

Wind speed data was determined from mast M220, calculated to the hub height of 139 m. and matched with noise measurements at the receptor locations chosen. The data requirement of a minimum of 1,440 ten minute data points was exceeded at each of the receptors for all time and night time measurements. These measurements gave an adequate coverage of the wind speed range from turbine cut-in wind speed (3m/s) to the rated turbine power wind speed (12m/s). Above 12m/s wind speed the turbines sound power output does not increase.

A regression analysis of the data points (noise vs hub height wind speed) was undertaken at each of the six monitoring locations to obtain the relationship between noise levels at the chosen receptors and the corresponding hub height wind speeds. This showed poor levels of fit of the regression analysis with the data. R^2 values for the goodness of fit varied between 0.1 and 0.36 for noise sensitive locations H155 and H161 (where a perfect fit gives an R^2 value of 1.0). The scatter in points was too great for H41 to determine a regression analysis result.

Using the results of the regression analysis for the receptors neither noise sensitive locations H155 and H161 were found to exceed the compliance level of 40 (or 45) dBL_{A90} . The worst case noise results for the sites monitored in Round 2 are given in Table 3. The monitored receptors H41, H155 and H161 are the closest noise sensitive locations to Stage 1 and are all within the 35 dB contour for the full project (Stage 1 and Stage 2).

Intermediate positions, Int 4., Int. 5, and Int 6., were used at or near the 45 dB contour to give a closer and clearer indication of the contribution of wind farm noise and to match this against the prediction of 45dB at these locations. Again the worst case noise vs hub height wind speed for each of these locations is given in Table 3.

Receptor Site	Highest recorded noise level (dB L_{A90(10 min)})	Noise limit (dB L_{A90(10 min)})	Closest Compliance margin (dB L_{A90(10 min)})	Comment
H41 (south of stage 1 – involved)	N/D (not determined)	40.0	N/D	4.8 km to nearest operating turbines. High noise scatter with extraneous noise preventing determination of wind farm noise levels
H155 (west of stage 1 – uninvolved)	37.5	40.0	2.5	4.0 km to nearest operating turbine. High noise scatter. Noise dominated by background / extraneous noise
H161 (east of stage 1 – involved)	36.3	40.0	3.7	2.1 km to the nearest operating turbines. High noise scatter. Noise dominated by background / extraneous noise
Int. 4 (south of stage 1) – on 45 dB contour	36.0	45.0*	9.0	2.8 km to the nearest operating turbine
Int. 5 (west of stage 1) – on the 45 dB contour	41.1	45.0*	3.9	3.5 km to the nearest operating turbine
Int. 6. (north west of stage 1) – on the 45 dB contour	37.0	45.0*	8.0	0.5 km to the nearest operating turbine

Table 3. Receptor compliance for Stage 1 Round 2- all time

* A compliance noise level of 45dB is assumed in Table 3 for the intermediate locations, which are not noise sensitive locations but simply locations set on the predicted 45 dB contour between the nearest turbines and the noise sensitive locations to enable more accurate assessment of the wind farm noise.

The high level of scatter in the noise vs hub height wind speed plots indicated that background noise was augmented with extraneous noise. This was illustrated in the plots of hub height wind speed and noise at the monitored noise sensitive locations that showed periods where the noise level did not correlate with the wind speed and periods in which the noise level was constant or rose when the wind speed dipped. This extraneous noise was possibly due to mechanical sources such as pumps and tractors.

Compliance was more difficult to gauge for the full set of 61 Stage 1 turbines, as previously mentioned, were not all operating over the monitoring period. The compliance of the fully operating Stage 1 wind farm cannot therefore be gauged by this analysis.

Wind directions were determined over the monitoring period to be predominantly from the north west to north east, while historical data over five years shows predominantly the winds are from the south west to the south east at this location. This will also affect the wind farm noise levels experienced at the noise sensitive locations and places the compliance determination for “normal conditions” in further doubt.

It can still be concluded from this analysis that neither of the two noise sensitive locations, H155 and H161 were modelled by the regression analysis above 40 dB L_{A90(10 min)}. In addition the intermediate monitoring locations where wind farm noise was more readily detected were under the assumed limit of 45 dB for the period of monitoring.

High Amenity Areas

If a site is classified as a high amenity area under the New Zealand standard a +5 dB penalty applies. The land is zoned for farming (FZ1) in all directions including the properties that the wind farm is on.

No sites were identified as having a high amenity, and none were referenced in the planning permit or the pre-construction noise assessment. Regression analysis of the background noise levels at noise sensitive locations H41, H155 and H161 are not expected to be 8dB or more below the wind farm noise at low wind speeds of 4 to 6 m/s as required by the Standard to consider high amenity (Sec 5.3.1 of the New Zealand Standard NZS 6808:2010).

Special Audible Characteristics (SACs)

The New Zealand standard requires a noise penalty for noise containing tonality likely to be audible at the noise sensitive locations. Impulsivity and amplitude modulation may also contribute to audible noise and attract a penalty.

Marshall Day personnel attended the site on January 6, and 16, 2020 and again on February 4, 2020. On two of these occasions 50 or more of the turbines were operating and wind farm noise was audible at the noise sensitive locations. However, Marshall Day Acoustics reported that no SACs were observed at the noise sensitive locations. Tonality was observed at one of the intermediate locations (Int4.) when 50 turbines were operating with down/cross wind conditions at a hub height wind speed of 7.5 m/s. The tonality was identified at mid to high frequency that was unlikely to be related to operation of the turbines.

Consequently tonality was discounted from the wind farm at the noise sensitive locations and the possibility of special audible characteristics penalties was also discounted.

This set of observations provides sufficient evidence of compliance with the Standard during this intermediate round of monitoring especially as the operation of all 61 turbines seldom if ever occurred over the monitoring period. This assessment of SACs should be further undertaken at the next and final noise compliance monitoring for the Stage 1 wind farm operation.

Noise from substations

No compliance of the proposed operations with the noise requirements in the EPA (Victoria) Guidelines – Noise from Industry in Regional Victoria (Publication 1411 – October 2011) was given in the Marshall Day Acoustics report. Consideration of substation noise is not a strict requirement of the Standard.

The noise limits required by the NIRV Guidelines for utilities in farming zones are:

Day < 45 dB(A) Evening < 39 dB(A) and Night 34 dB(A)

These limits do not apply to the wind turbines but apply to industrial noise and in this case the noise from the transformers.

The substation has been established off Ailsa-Wheat Road with a 450 MW capacity. The nearest receptor for noise is H161 which is approximately 1,000 m. south. The preliminary environmental noise assessment report (Sonus S4453C13 May 2016) estimated a noise at the receptor to be < 29 dB(A) achieving compliance with NIRV limits for night-time.

At the time of inspection no noticeable noise was evident when walking past the substation and noise from it was not detected during the inspection of H161. A subsequent noise measurement by Downer Group for occupational safety and health reasons indicated that substation was within the industrial noise limits for operational personnel³.

³ Personal communication with Stuart Mallinson (Downer Group) July 22, 2020 indicating that the noise level from the transformers outside the structures housing the transformers was less than 83 dB(A).

Error analysis

The Class 1 microphones were again used to monitor the noise at the noise sensitive locations and intermediate sites. These had all been calibrated within two years of the monitoring program. The maximum calibration drift was 0.68 dB.

Assuming a ± 3 dB error in wind farm noise at the sensitive noise locations, the compliance margins of receptors H155 and H161 of 2.5 and 3.7 dB present a high probability of compliance with the Standard. No SACs and high amenity area penalties were observed that may affect this compliance.

Errors in background noise measurements are expected to be ± 1 dB and will have little impact on noise compliance.

It should be pointed out that this analysis is based on regression noise analyses that had a poor correlation with wind hub height speed due to high point scatter of noise to wind speed plots at each receptor. Interference from extraneous noise and atypical wind direction distribution over the monitoring period (November 20, 2019 to January 16, 2020) indicate further constraints on the noise analysis over this period.

Risk to the environment

The assessment of risk to the environment relies on criteria given in the standard NZS6808:2010 Acoustics – Wind Farm Noise. As such, the risk of noncompliance with the standard is taken as equivalent to a risk to the environment. The risk level determined for compliance is equivalent to that determined for the environment. A risk that is not acceptable i.e. Is medium or high.

A limit of 40 dB is considered by the adopted New Zealand Standard (NZS 6808:2010 Acoustics – Wind Farm Noise) to not adversely affect amenity for occupants of noise sensitive locations. The noise regression analyses did not rise above 40 dB consequently compliance with the Standard is concluded and the risk to amenity for occupants at the nearest noise sensitive locations is considered to be low.

The resultant noise risk is considered to be low from Stage 1 Round 2 monitoring, but this can only be concluded as applying over the monitoring period during which the Stage 1 turbines were not fully operating.

Conclusions

The Murra Warra wind farm Stage 1 was fully operational in the final week of this noise monitoring compliance report. The noise monitoring has been confirmed to comply with the requirements of the New Zealand standard (See Appendix 1).

The lack of full operation during the Round 2 monitoring has meant that the monitored noise compliance can only be confirmed for the monitoring period from November 20, 2019 to January 16, 2020.

The wind farm operator, RES and site management reported that no noise complaints were received over this operating period.

Noise monitoring at the noise sensitive locations showed significant scatter that could not be attributed to wind dependent background or variable noise from the wind farm. This extraneous noise was not identified by Marshall Day Acoustics, but may be due to seasonal factors as the monitoring period was six weeks over summer.

Recommendations

The following recommendations are provided to ensure compliance can be further assessed for the completed Stage 1 Murra Warra wind farm:

5. The stage 1 Murra Warra wind farm needs to have its noise compliance reassessed in accordance with the Standard at a time period in which all turbines are operating and the wind direction distribution approximates that of the historical wind direction distribution.
6. High amenity be examined for the receptors inside the 35 dB contour using the analysis in section 5.3.1 of the standard in the subsequent noise compliance assessment.
7. Special audible characteristics of the wind farm noise be tested upon operation of all 61 turbines in Stage 1, using the test methods provided in Appendix B of the standard.
8. This noise compliance report should be distributed to the stakeholders and be made publicly available.

Details of the compliance of the Marshall Day Acoustics report with the specific noise requirements of the planning permit and New Zealand standard are given in Appendix 1.

Appendix 1

Post-construction Noise Assessment

Murra Warra Wind Farm

Wind farm noise assessment	Review of assessment document				
	Condition	Reference document	Noise assessment report	Comment	Rectification required
Planning Scheme (Victoria)					
	Planning condition VC124 Planning amendment (noise sensitive locations within 1 km of wind turbines have written agreement)			This is not strictly a requirement of a noise assessment report	
Planning Scheme	Conformance to the Victorian Guidelines and NZS 6808:2010				
Policy and Planning Guidelines for Developments of Wind Energy Facilities in Victoria (Oct 2018)	Written consent of owners of dwellings within 1 km of any turbine	VPP Sec. 2.1.6		Assumed to be satisfied as a function of the planning permits	
	Not in an urban growth zone or within 5 km of major regional cities	VPP Sec. 2.1.5		The nearest urban area is that of Horsham which is 25 km to the south	
	An Environmental Effects Statement is either completed or not required	VPP Sec.3.3.1		Not required by the planning permits	
	Approval under the EPBC Act has been given has been given or is not required	VPP Sec.3.3.2		Not required by the planning permits	

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	Condition	Reference document	Noise assessment report	Comment	Rectification required
	15a. Acoustic compliance report for the proposed wind energy facility is prepared by a suitably qualified and experienced acoustics engineer	VPP Sec.4.3.3		A. Dundon and J. Adcock are qualified acoustics engineers	
	15b. Noise assessment positions located according to the standard and shown on a map		Figure 2.	All noise sensitive locations assessed by monitoring of noise were within the predicted 35 dB contour	
	15e. Compliance reports are to be publicly available			This is a function of the audit reporting system where reports are published on the EPA web site	
	Sec. 5.1.2a requires compliance with noise limits for dwellings and other noise sensitive locations stated in NZS 6808:2010	VPP Sec.5.1.2a	Sec. 5.3	Noise limits were assessed for the monitored receptors at operational hub height wind speeds	
Local Government		Horsham and Yarriambiack			
Planning Permits conditions	Compliance with NZS 6808:2010 noise levels	Clause 12	Sec. 5	Adequately assessed within the Acoustic Compliance Report	
The planning permits are identical	Preparation of a pre-construction noise assessment	Clause 11		Sonus report: S4453C25 (August 2017)	
	Preparation of a compliant Noise Management Plan			Murra Warra Wind Farm – Stage 1 Noise Compliance Test Plan -Rp 003 20181019 (November 21 st , 2019)	

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	Condition	Reference document	Noise assessment report	Comment	Rectification required
NZS 6808:2010 Acoustics - Wind Farm Noise					
Compliance assessment	A 40 dB limit is applied for noise sensitive locations with allowance for background noise 35 dB + background	5.1	Sec. 3.0	Noise criteria were assessed using background noise assessment	
	High amenity receptors are considered	5.3.1	Sec. 3.0 Sonus report Sec. 3.3		
	Special audible characteristics are considered	5.4	Sec. 5.2 Sonus report Sec. 3.2	SACs were assessed on three occasions with attended observations	SACs can be considered in future noise compliance assessment reports
	Uncertainty of measurements / calculations is considered	5.7		An error analysis was considered unnecessary due to the limited operation of the wind farm during the monitoring	Consideration of errors would assist third party evaluations
	Prediction of the 35 dB wind farm sound contour mapped	7.6.1	Figure 2.	The full wind farm predicted noise contours were mapped	

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	Condition	Reference document	Noise assessment report	Comment	Rectification required
	Prediction of sound levels for all noise sensitive locations inside the 35 dB contour	7.6.1	Background Noise Report 2019	Reproduced in Figure 2. of the Compliance Assessment report	
	Regression analysis of monitoring results to determine compliance	7.6.2	Appendices G to L	Points and regression analysis shown along with compliance levels in a graphical form for each receptor	
Report requirements	Specs of the sound monitoring equipment	8.3(a)	Appendix D	All class 1 equipment with calibrations recorded including drift	
	Statement regarding the use of (A) frequency weighting	8.3(b)	Section 4.2		
	Map showing the location of the sound monitoring positions	8.3('c')	Figure 2. Appendices G to L		
	Description of anemometry equipment plus height AGL	8.3(d)	Appendix E	Three met masts were used M220, M85 and M145	
	Map showing position of wind speed measurements	8.3('e')	Appendix E2	Frequency and direction were mapped from historical data	
	Make and model of wind turbines	8.3(f)	Section 2.0	Senvion 3.7M144 wind turbines	
	Number of turbines	8.3(g)	Section 2.0	61 turbines were assessed in Round 2 although these were not all operating through the monitoring period	
	Monitoring period details	8.3(h)	Section 4.2 Table 7.		

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	Averaging period for sound and wind speed measurements	8.3(i)	Section 4.2	10 minutes as per the standard	
	Atmospheric conditions	8.3(j)	Appendices E and G to L		
	Number of data pairs measured	8.3(k)	Appendices G to L	Total data points recorded, points removed and points retained were provided for all time and night-time	
	Description of regression analysis	8.3(l)	Appendix F	Regression equation coefficients and R ² values were tabulated	
	Graphical plots of points and regression line	8.3(m)	Appendices G to L		
	Graphical plots showing background and wind farm operation	8.3(n)	Appendices G to L		
	Assessment of special audible characteristics	8.3(o)	Section 5.2 And Table 12.	Attended observations on three separate occasions	
	Statement of compliance	8.3(p)	Section 6.0		

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Electrical Sub station	Condition	EPA (Vic) NIRV Guideline	Noise report	Comment	Rectification required
Victoria EPA Guidelines Noise from Industry in Regional Victoria	Substation location			Location not provided in reports	
	Substation sound power levels and dB(A)				
	Maximum Noise levels (Day , Evening, Night) at nearest receptor	Step 2 & 3 variations for utilities	Sonus report S4453C13 (May 2016)	Transformer noise at closest receptor determined at <29 dB(A)	
	Compliance with limits provided				

Legend

Fully compliant		Partially compliant		Not compliant	
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This audit report has been prepared for The Downer Group. for the Murra Warra Wind Farm Stage 1 Round 2 development and assumes that the data provided is correct.

A handwritten signature in blue ink, appearing to read 'John Cumming', with a stylized flourish at the end.

John Cumming
Auditor pursuant to the Environment Protection Act (1970)
August 10th 2020

End