

Ryan Corner Development Pty Ltd
Hawkesdale Wind Farm
Pre-construction Environmental
Noise Assessment Audit

277342-10

Final | 1 February 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 27734210

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Appendices

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NZS 6808:2010 Checklist

Distribution

Report,

1 February 2021

Copies	Recipient	Copies	Recipient
1 PDF	Guillermo Alonso Director and Engineering Manager Ryan Corner Development Pty Ltd Suite 4, Level 3, 24 Marcus Clarke Street, Canberra ACT 2601	1 PDF	Manager Environmental Audit Environmental Audit Unit EPA Victoria 200 Victoria Street Carlton Vic 3053
1 PDF	Ms Fiona Koutivos ERM Pty Ltd Level 6/ 99 King Street Melbourne Vic 3000	1 PDF	Arup Project File

Executive Summary

An environmental audit ('the audit') was conducted in accordance with Section 53V of the *Environment Protection Act 1970* (the Act) of the pre-construction noise assessment undertaken by Marshall Day Acoustics Pty Ltd (MDA), of the proposed Hawkesdale Wind Farm to be located near Hawkesdale, Victoria (the site). Hereinafter the wind farm will be referred to as the Wind Energy Facility (WEF) which is consistent with Victorian Government terminology.

Ryan Corner Development Pty Ltd (RCD), a subsidiary of Global Power Generation Australia Pty Ltd (GPG), is proposing to construct a WEF at the site.

The site is located within the Shire of Moyne. The original Planning Permit No 20060221 was issued by the Minister for Planning on 21 August 2008. The Planning Permit was extended on 21 Dec 2017, including an amendment to "increase the height of turbines, reduce the number of turbines, and to modify conditions under the permit" (Planning Permit 20060221-A). This extension of the Planning Permit was due to expire if the works are not completed by 29 August 2020.

A further extension to the Planning Permit was approved by the Department of Environment, Land, Water and Planning (DELWP) on 02 November 2020, and will expire if the development is not completed by 29 August 2023. This application for extension included an audit prepared under Part IXD, Section 53V of the Act by David Spink, an Environmental Auditor appointed under Part IXD of the Act. The audit report comprised an assessment of compliance of the pre-construction (predictive) noise assessment report, demonstrating that the proposal can comply with the *New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise* (Standard) (Report Reference: Pre-construction Environmental Noise Assessment Audit Hawkesdale Wind Farm, Hawkesdale, Victoria 3287, Senversa Project Number M17916. Prepared for Ryan Corner Development Pty Ltd, 28 August 2020, EPA CARMS 78660-1). The audit was largely based on the information provided in a report entitled Marshall Day Acoustics (MDA) – Hawkesdale Wind Farm – NZS 6808:2010 Noise Assessment (Rpt 002 R04 2014362ML, dated 21 April 2017) (2017 Assessment Report). At that stage, the assessment included three turbine options – Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW).

RCD have since nominated a preferred turbine model for the site (Vestas V136-4.2MW) and elected to remove three (3) turbines from the layout considered in the 2017 Assessment Report (ie a reduction from 26 to 23 turbines, with turbines designated A10, A13 and A17 removed). RCD have now prepared their Pre-Construction Noise Assessment for the project (Marshall Day Acoustics – Hawkesdale Wind Farm Pre-Construction Noise Assessment Rp 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report) which includes a noise assessment based on the final wind turbine selection and turbine layout.

RCD intends to submit the 2020 Assessment Report to DELWP, in addition to an application for amendment of the Planning Permit for other proposed changes. The auditor has been advised that the change in turbine type has not triggered the amendment application, rather this is due to proposed changes to the wording of the Planning Permit and conditions which do not relate to the turbines.

DELWP has advised that the 2020 Assessment Report must satisfy the requirements of the *Development of Wind Farm Facilities in Victoria – Policy and Planning Guidelines* (DELWP, March 2019) (DELWP Guideline). Specifically in regard to noise generation, the

submission should include an environmental audit of the 2020 Assessment Report, prepared under Part IXD, Section 53V of the Act by an Environmental Auditor appointed under Part IXD of the Act, comprising an assessment of compliance of the pre-construction (predictive) noise assessment report, demonstrating that the proposal can comply with the Standard. This audit report is a record of the audit required for submission with this current application for amendment of the Planning Permit No. 20060221-A.

EPA Victoria has issued *Wind Energy Facility Noise Auditor Guidelines* (Publication 1692, October 2018) (EPA Guideline) to complement the DELWP Guideline, that sets out the requirements for an audit of pre-construction noise (Section 2.4.1). The EPA Guideline refers to a number of EPA requirements, primarily *Environmental Auditor Guidelines for the Preparation of Environmental Audit Reports on Risk to The Environment* (Publication 952) and *Environmental Auditor Guidelines for Conducting Environmental Audits* (Publication 953)

The audit of the proposed Hawkesdale WEF was consistent with these requirements of the EPA Guideline.

A summary of the audit and its findings are outlined in **Tables 1** and **2** below, consistent with *Environmental Auditor Guidelines - Provision of Environmental Audit Reports, Certificates and Statements* (EPA Publication 1147.2, December 2012).

Table 1: Summary of Audit Information

Summary Information	Details
EPA File Reference No.	CARMS No. 78660-2
Auditor	David Spink
Auditor account number	43572
Auditor appointment end date	24 October 2021
Audit service order number	8006880
Name of person requesting audit	Guillermo Alonso
Relationship of person requesting audit to site	Director and Engineering Manager, Ryan Corner Development Pty Ltd
Name of premises owner	Various, N/A
Date of auditor engagement	11 November 2020
Completion date of audit	01 February 2021
Reason for audit	Audit of pre-construction noise assessment of Hawkesdale Wind Farm
Audit categorisation	Noise compliance with New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise
Environmental segments	Land within the neighbourhood, noise and air

EPA notice, licence or other reference number	N/A
Current land use zoning	FZ - Farming
EPA region	South West
Municipality	Moyne Shire Council
Dominant – Lot on plan	N/A
Additional – Lot on plan	N/A
Site/ premises name	Hawkesdale Wind Farm
Building/complex sub-unit No.	N/A
Street/Lot – Lower No.	
Street/Lot – Upper No.	
Street Name	Woolsthorpe - Heywood
Street Type (road, court, etc)	Road
Suburb	Hawkesdale
Postcode	3287
GIS coordinates of site centroid	
Latitude (GDA94)	142.348
Longitude (GDA94)	-38.13542
Members and categories of support team utilised	Dr Kym Burgemeister Arup Pty Ltd – Principal and Australasian Acoustics Skills Leader Acoustics subject matter expert
Further work or requirements	<ol style="list-style-type: none"> 1. The post-construction noise level monitoring specified under the Noise Compliance Test Plan (NCTP) should be undertaken by an independent acoustic consultant in line with recent recommendations of the Office of the National Wind Farm Commissioner¹. 2. A Noise Management Plan (NMP) should be developed for the operational phase of the WEF, to include measures to manage turbine noise in cases where operational noise non-compliance with the Standard was identified through the Noise Compliance Test Plan (NCTP) and any additional noise monitoring. Given that Planning Permit 20060221-A does not directly require a NMP, it is further recommended that it be included under Conditions 25 and 26 (Environmental Management Plan). 3. Documented evidence of all stakeholder agreements should be required for review as part of the auditor review of the initial NCTP report required by Condition 45 of Planning Permit 20060221-A.

¹ Annual Report to the Parliament of Australia, Office of the National Wind Farm Commissioner, 31 March 2017.

<p>Nature and extent of continuing risk</p>	<p>A risk of noncompliance with the New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (Standard) is taken to be a risk to the beneficial use of the environment, specifically with respect to the amenity of residents in the noise sensitive locations. Based on the predicted sound levels, it is expected that the risk to this beneficial use will be low, due to compliance with the Standard.</p>
<p>Outcome of Audit</p>	<p>The following is a summary of the key findings of the audit.</p> <p>Background Noise Assessment</p> <p>Refer to report entitled Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 20180787, dated 20 August 2020) (Background Monitoring Report).</p> <ol style="list-style-type: none"> 1 The background noise monitoring locations are shown on a site plan in Figure 1 of the Background Monitoring Report. A check was made to compare this noise contour plot based on the Senvion 4.2M140 turbine, with the three turbine options in the 2017 Assessment Report (Appendix E) and the proposed turbine option Vestas V136 4.2MW (2020 Assessment Report, Figure 3). The plots are relatively similar, with potentially the predicted 35 dB(A) contour and other higher noise level contours for the proposed turbine option closer to the windfarm. This indicates that the locations selected for the background monitoring are conservative and are at, or representative of, all the sensitive receivers that are within the predicted 35 dB(A) wind farm sound contour, in accordance with Section 7.1.4 of the Standard. 2 The background noise monitoring undertaken by MDA appropriately considered sensitive receiver locations, including Participant (Stakeholder) and Non-participant Landholders. It is noted that a number of initial sites selected had to be moved to intermediate locations due to permission not been given by the Landholder to place monitoring equipment in the vicinity of the residence. 3 The site inspection by the auditor on 08 April 2020 confirmed that the locations chosen by MDA were appropriate as representative monitoring background locations for sensitive receivers in the area, including the township of Hawkesdale. No significant local topographical features or other additional sensitive receivers were noted that might need to have been considered for inclusion in the background noise monitoring locations selected by MDA, to undertake an appropriate assessment. 4 Background noise monitoring was undertaken by MDA at 7 locations between May and July 2020. The background noise level data has been undertaken over a time period of between 5–7 weeks (depending on location) which is considerably in excess of the minimum recommended requirement of 10 days (1,440 data points). The Background Monitoring Report provides helpful details regarding the individual measurement locations in Appendices G - M, with aerial photography, maps

	<p>and photographs of each site which indicate appropriate positioning of the noise loggers.</p> <p>5 The background measurements have been undertaken using appropriate measurement equipment (including windshields) and include a traceable calibration.</p> <p>6 The background noise level data has been referenced to wind speed measurements undertaken at a meteorological mast installed on the site (HD3). The mast does not include an anemometer at the proposed turbine hub height of 112 m, but does provide 3 individual anemometer heights at 20 m, 40 m and 60 m. These data have been used to calculate a wind shear exponent using a power law, and extrapolate the wind speed at 112 m. This methodology is appropriate.</p> <p>7 The background noise data have been analysed appropriately.</p> <p><u>Pre-construction Noise Assessment</u></p> <p>Refer to report entitled Marshall Day Acoustics – Hawkesdale Wind Farm – Pre-Construction Noise Assessment (Rp 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report).</p> <p>Also note that the 2020 Assessment Report refers on a number of issues to the previous report entitled Marshall Day Acoustics – Hawkesdale Wind Farm – NZS 6808:2010 Noise Assessment (Report 002 R04 2014362ML, dated 21 April 2017) (2017 Assessment Report)</p> <p>8 The pre-construction noise assessment methodology generally complies with the requirements of the Standard. The noise predictions were conducted in accordance with the appropriate standards and guidelines.</p> <p>9 General Noise Limits:</p> <p>a. The approach used in the assessment is to adopt the ‘Base Limit’ criterion of 40 dB(A), at all Non-Participant Landholders up to a background noise level of 35 dB(A). For background noise levels above 35 dB(A), the maximum ‘Background +5 db(A)’ approach has been adopted. This approach is consistent with the Standard, and as also required by Condition 42 of Planning Permit 20060221-A. It is noted that this is a shift from the approach taken in the 2017 Assessment Report, which stated “For the purpose of this assessment, the NZS 6808:2010 base noise limit of 40 dB LA90 at all wind speeds has been used for all noise sensitive locations”.</p> <p>b. The adoption of a limit for Participant Landholders is not strictly considered under the Standard, however, it is agreed that adopting a 45 dB(A) base noise limit for Participant Landholders is reasonable, on the basis of adopting best practice.</p> <p>10 Consideration of High Amenity Noise Limits: MDA does not provide any consideration of the use of a High Amenity Noise Limit in the 2020 Assessment Report. Assessment of noise</p>
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	<p>compliance was against general noise limits only. To provide clarification, the matter was discussed in the 2017 Assessment Report (Section 3.3), and reviewed in the previous audit (CARMS 78660-1). MDA considered the use of a High Amenity Noise Limit in accordance with the Standard, and concluded that a High Amenity Noise Limit should not be applied. The matter was subsequently raised at a Planning Panel² on the proposed amendment to the Planning Permit. The auditor accepts this position (ie a High Amenity Zone does not apply), based on this guidance from the above Panel and from the VCAT determination for the Cherry Tree Wind Farm in relation to High Amenity zonings³.</p> <p>11 Consideration of Special Audible Characteristics (SACs): MDA have assessed the likelihood that the turbines will result in tonal noise emission based on the measured tonal audibility of the selected turbine measured in accordance with IEC 61400-11:2012⁴ and reported by the manufacturer. This data indicates that the tonal audibility level is likely to be below 1.3 dB at all assessed wind speeds, and that tonality is not expected to be a characteristic of the WEF. MDA concludes that it is not necessary to apply a penalty to the predicted noise levels. The auditor accepts this assessment, on the basis that SACs will be assessed through the NCTP, and that a Noise Management Plan will be implemented through the Environmental Management Plan to address any non-compliance and potential associated penalties (Refer to the discussion on the risk assessment, Section 2.3.5).</p> <p>12 Noise Prediction Methodology: The noise level predictions have been undertaken using the ISO 9613-2:1996⁵ noise propagation model. In the opinion of the auditor and his team, the calculation parameters that have been adopted for temperature, humidity and ground absorption are reasonable, and correspond to best practice.</p> <p>13 The predicted noise levels comply with the limits set in the Standard. Specifically:</p> <ol style="list-style-type: none"> a. Table 7 and Appendix G of the 2020 Assessment Report indicates that the predicted wind farm sound levels are predicted to be below 40dB(A). This complies with the criteria at all of the Non-Participant Landholder noise sensitive receivers. b. The assessment also indicates that the wind farm sound levels also comply with the 45 dB(A) noise criterion at the Participant Landholder /Stakeholder residences.
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² Panel Report - Moyne Planning Scheme Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)

³ DELWP Guideline S5.1.2 refers to the Cherry Tree Wind Farm vs Mitchell Shire Council (2013)

⁴ IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurement techniques, International Electrotechnical Commission

⁵ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2)

	<p>14 Potential uncertainty in predicted noise levels: MDA used SoundPlan 8.0 software, utilising the international standard ISO 9613⁶ sound propagation model, in conjunction with the digital terrain model of the site. The ISO 9613 sound propagation model has been demonstrated to generally result in conservative noise predictions. All acoustic measurements and noise predictions are subject to measurement and calculation uncertainty. While MDA's analysis is not subject to a detailed Uncertainty Analysis, it does generally adopt conservative assumptions. We agree with this approach for modelling noise from WEFs.</p> <p>15 Risk Assessment: A risk of noncompliance with the Standard is taken to be a risk to the beneficial use of the environment, specifically with respect to the amenity of residents in the noise sensitive locations. Based on the predicted sound levels, it is expected that the risk to this beneficial use will be low.</p> <p>16 Consideration of Cumulative Impacts: The 2020 Assessment Report provides a summary assessment of the cumulative noise impacts of the Hawkesdale Wind Farm and the nearby Woolsthorpe Wind Farm in Section 5.2 and refers to the 2017 Assessment Report. Based on the conclusion that the predicted noise contour of the proposed turbine (Vestas V136- 42MW) is "no worse" than the noise contours of the three turbine options currently in the approved Planning Permit, the auditor accepts the MDA assessment that 'the cumulative assessment findings remain valid for the updated noise assessment of the Hawkesdale Wind Farm. Accordingly, no further assessments of cumulative noise levels were warranted or undertaken as part of this assessment' (2020 Assessment Report, Section 5.2).</p> <p>17 Additional Auditor Considerations:</p> <ol style="list-style-type: none"> a. Potential Change in Turbine Power Sound Levels: Comparison of provided data indicates that the proposed turbine (Vestas V136-4.2MW) is no noisier than the range approved for the three currently approved options under Planning Permit 20060221-A (Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW), and appears comparable to the quietest option (Senvion M122). b. Potential Change in Predicted Noise Profile of Site: The modelled noise contour maps for the proposed turbine (Vestas V136-4.2MW) (2020 Assessment Report, Figure 3, page 15), and the three approved options (2017 Assessment Report, Appendix E) were reviewed. As a general comment, the contours for the proposed turbine (Vestas V136-4.2MW) in conjunction with removal of three turbines are "no worse" than for the three approved options, and may in fact have decreased, reducing the
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⁶ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2)

	area where sensitive receivers are within the 35 dBA wind farm sound level contour.
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Table 2: Physical Site Information

Historical land use	Farming
Current 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	FZ Farming – no change
Nearest surface water receptor – name	Not relevant for this audit
Nearest surface water receptor – direction	Not relevant for this audit
Groundwater segment	Not relevant for this audit

Signed


David Spink

Environmental Auditor (Industrial Facilities)

Appointed pursuant to the *Environment Protection Act 1970*

List of Acronyms

Acronym	Definition
AGL	Above Ground Level
AS/NZS	Australian and New Zealand Standard
EPA	Environment Protection Authority, Victoria
DELWP	Department of Environment, Land, Water, and Planning (Victoria)
MDA	Marshall Day Acoustics Pty Ltd
NCTP	Noise Compliance Test Plan
NMP	Noise Management Plan
NZS	New Zealand Standard
SAC	Special Audible Characteristic
Standard	NZS 6808:2010 Acoustics – Wind Farm Noise
WEF	Wind Energy Facility

1 Overview of Environmental Audit

1.1 Background

A windfarm has been proposed at Hawkesdale on land generally bounded by the Woolsthorpe -Heywood Road, Pennhurst - Warrnambool Road, Rutledges Roads and Camerons Road. Hereinafter the windfarm will be referred to as the Wind Energy Facility (WEF) which is consistent with Victorian Government terminology.

Ryan Corner Development Pty Ltd (RCD), a subsidiary of Global Power Generation Australia Pty Ltd (GPG), is proposing to construct a WEF at the site.

The site is located within the Shire of Moyne. The original Planning Permit No. 20060221 was issued on 21 August 2008 by the Minister for Planning for the proposed Hawkesdale WEF. The Planning Permit was extended on 21 Dec 2017, including an amendment to “increase the height of turbines, reduce the number of turbines, and to modify conditions under the permit” (Planning Permit 20060221-A). This extension of the Planning Permit was due to expire if the works are not completed by 29 August 2020.

A further extension to the Planning Permit was approved by the Department of Environment, Land, Water and Planning (DELWP) on 02 November 2020, and will expire if the development is not completed by 29 August 2023. This application for extension included an audit prepared under Part IXD, Section 53V of the *Environment Protection Act 1970* (the Act) by David Spink, an Environmental Auditor appointed under Part IXD of the Act. The audit report comprised an assessment of compliance of the pre-construction (predictive) noise assessment report, demonstrating that the proposal can comply with the *New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise* (Standard) (Report Document Reference Pre-construction Environmental Noise Assessment Audit Hawkesdale Wind Farm, Hawkesdale, Victoria 3287, Senversa Project Number M17916, Prepared for: Ryan Corner Development Pty Ltd, 28 August 2020, EPA CARMS 78660-1). The audit was largely based on the information provided in a report entitled Marshall Day Acoustics (MDA) – Hawkesdale Wind Farm 6808:2010 Noise Assessment, (MDA Rp 002 R04 2014362ML, dated 21 April 2017) (2017 Assessment Report). At that stage, the assessment included three turbine options – Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW).

RCD have since nominated a preferred turbine model for the site (Vestas V136-4.2MW) and elected to remove three (3) turbines from the layout considered in the 2017 Assessment Report (ie a reduction from 26 to 23 turbines, with turbines designated A10, A13 and A17 removed). RCD have now prepared their Pre-Construction Noise Assessment for the project (Marshall Day Acoustics – Hawkesdale Wind Farm Pre-Construction Noise Assessment Rp 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report) which includes a noise assessment based on the final wind turbine selection and turbine layout.

RCD intends to submit the 2020 Assessment Report to DELWP, in addition to an application for amendment of the Planning Permit for other proposed changes. The auditor has been advised that the change in turbine type has not triggered the amendment application, rather this has been triggered by proposed changes to the wording of the Planning Permit and conditions which do not relate to the turbines.

DELWP has advised that the 2020 Assessment Report must satisfy the requirements of the *Development of Wind Farm Facilities in Victoria – Policy and Planning Guidelines* (DELWP, March 2019) (DELWP Guideline). Specifically in regard to noise generation:

The pre-construction (predictive) noise assessment report must be accompanied by an environmental audit prepared under Part IXD, Section 53V of the Environment Protection Act 1970 by an Environmental Auditor appointed under Part IXD of the Environment Protection Act 1970. The environmental audit report must verify that the acoustic assessment undertaken for the pre-construction (predictive) noise assessment report has been conducted in accordance with the New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise.

This audit report is a record of the audit required for submission with this current application for amendment of the Planning Permit No 20060221-A.

It is noted that Condition 42 of the Planning Permit states (in part):

Except as provided below in this condition, the operation of the wind energy facility must comply with New Zealand Standard 6808:2010 Acoustics – Wind Farm Noise in relation to any dwelling existing on land in the vicinity of the wind energy facility as at 28 February 2017, to the satisfaction of the Minister for Planning.

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

The submission is consistent with Section 52.32 of the Victorian Planning Provisions (VC148), and in particular, Sections 52.32-4 and 52.32-5 (24/01/2020, VC160), which explicitly require a mandatory pre-construction (predictive) noise assessment demonstrating that the proposal can comply with the Standard, and an environmental audit report (this report) of the pre-construction (predictive) noise assessment report prepared under Part IXD, Section 53V of the *Environment Protection Act 1970*, verifying that the noise assessment report has been prepared in accordance with the Standard.

EPA Victoria has issued *Wind Energy Facility Noise Auditor Guidelines* (Publication 1692, October 2018) (EPA Guideline) to complement the DELWP Guideline, that sets out the requirements for an audit of pre-construction noise (Section 2.4.1). The EPA Guideline refers to several EPA requirements, primarily:

- *Environmental Auditor Guidelines for the Preparation of Environmental Audit Reports on Risk to The Environment (Publication 952).*
- *Environmental Auditor Guidelines for Conducting Environmental Audits (Publication 953)*

The audit of the Hawkesdale WEF was consistent with these requirements of the EPA Guideline.

Note: Hereinafter the *New Zealand Standard 6808:2010 Acoustics – Wind Farm Noise* will be referred to as the Standard, consistent with the terminology used in EPA Publication 1692 *Wind Energy Facility Noise Auditor Guidelines* (October 2018) (EPA Guideline).

1.2 Audit Objectives

The objective of the audit was to assess compliance of the Hawkesdale WEF Pre-construction Noise Assessment, as provided in the 2020 Assessment Report, with the requirements set out in:

- 1 New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (Standard). Specifically, that
 - a. The assessment has been conducted in accordance with the Standard
 - b. The predicted noise impacts comply with the limits set in the Standard
- 2 Sections 4.3.3 (c) and 5.1.2 (a) of the DELWP Guideline
- 3 Audit requirements of the EPA Guideline

In essence, the audit was to assess the risk of amenity impact to the nearby residents from noise generated from the WEF.

1.3 Audit Scope

The following table directly responds to the additional requirements of the EPA’s Guideline *Preparation of environmental audit reports on risk to the environment* (Publication 952).

Activity undertaken (in respect of which the environmental audit is to be conducted)	Wind Energy Facility (WEF)
Components of the activity to be considered	Noise from turbine blades, generators, gear boxes and hydraulic systems
Segment(s) of the environment to be considered	Hawkesdale environs surrounding the WEF. WEF centred at GPS Coordinates: Latitude: 142.348 Longitude: -38.13542
Element(s) to be considered	Atmosphere/ aesthetics
Beneficial Use(s) to be considered	Residential accommodation, recreation and farming
Risk Assessment	Effect of amenity of receptor sites applicable to operational noise of WEF
Time Period	Indefinite, from commencement of WEF operation
Exclusions	Construction noise Sub-station noise Compliance with other noise requirements of Planning Permit 200602221-A (Moyne Shire Council)

1.4 Audit Criteria

1.4.1 DELWP Guideline

The DELWP Guideline states that the WEF must comply with the noise limits recommended for dwellings and other noise sensitive locations, set out in the Standard.

The noise limits specified in the Standard are:

- Acceptable limit (40 dB $L_{A90(10min)}$, or background + 5 dB - whichever is higher (Section 5.2)

- High Amenity Areas (35 dB $L_{A90(10min)}$, or background + 5 dB - whichever is higher (Section 5.3)
- Special Audible Characteristics (tonal, impulsiveness, or amplitude modulation) receive a penalty between 1–6 dB added to the noise level (Section 5.4.2).

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

1.4.2 EPA Guideline

The EPA Guideline (Publication 1692) includes the following definition:

Risk of harm in relation to WEFs is defined as the potential for noise generated from WEFs to impact upon nearby noise sensitive locations.

Publication 1692 further states that Victoria has adopted ... NZS 6808:2010 (the Standard) ... as the standard which defines the assessment criteria, methodology and noise limits for WEFs.

1.4.3 Planning Guideline

The planning provisions require the noise assessment for wind farm projects to be undertaken in accordance with the Standard (amendment VC78⁷, 15 March 2011).

Condition 42 of Planning Permit 20060221-A specifies the requirements of the Standard, and states that “compliance at night must be separately assessed with regard to night-time data. For these purposes the night is defined as 10.00pm to 7.00am”.

Specific guidelines such as the Standard have been developed to address the unique requirements for the prediction, measurement and assessment of sound from wind farms because the usual measurement and assessment standards adopted in Victoria (such as AS 1055⁸ and SEPP N-1⁹) are unsuitable.

There are other standards and guidelines such as AS4959:2010¹⁰, the draft National Guidelines¹¹, the UK ETSU-R-97¹² and the Annual Report of the National Wind Farm Commissioner¹³ that can provide helpful background information and secondary guidance that can also assist with the assessment of projects where the Standard does not provide detailed or explicit guidance.

In particular, the Standard states that it does not set limits that provide *absolute* protection for residents from audible wind farm sound, but rather provides guidance on noise limits that are

⁷ Advisory Note 35, Amendment VC 78 Wind energy facility provisions – Clause 52.32, March 2011.

⁸ AS 1055.1-1997 Acoustics - Description and measurement of environmental noise - General procedures, Standards Australia, 1997.

⁹ State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1, Victoria Government Gazette No. S31, 1989.

¹⁰ AS4959:2010 Acoustics – Measurement prediction and assessment of noise from wind turbine generators.

¹¹ National Wind Farm Development Guidelines – Draft, Environment Protection and Heritage Council, July 2010.

¹² The Assessment and Rating of Noise from Wind Farms, UK Department of Trade and Industry, ETSU-R-97, September 1996.

¹³ Annual Report to the Parliament of Australia, Office of the National Wind Farm Commissioner, 31 March, 2017.

considered *reasonable* for protecting sleep and amenity from wind farm sound at noise sensitive locations.

1.5 Audit Methodology

The audit methodology was relatively consistent with Section 2.4.1 of the EPA Guideline, and included:

- Inception meeting with RCD management.
- Review of the proposed Hawkesdale WEF development and planned operation.
- Review of relevant documentation (refer to Section 1.6).
- Site inspection of the proposed Hawkesdale WEF project area and the surrounding environment – note that the auditor inspected the site on 06 April 2020, as part of the previous S53V audit (EPA CARMS No. 77774-1). No additional site inspection was deemed necessary. Refer to Section 2.1.
- Assessment of the rigour of the approach to identifying surrounding noise sensitive locations, including background noise assessments.
- Review of the pre-construction noise assessment, including site-specific issues and technical details (overall methodology, baseline noise monitoring equipment, modelling program, alignment with the Standard).
- Review of predicted potential noise impacts, including comparison of the preferred turbine model for the site (Vestas V136-4.2MW) with the turbine options previously approved
- Residual risk assessment, including a qualitative statement on the risk of non-compliance (and operational plans to manage potentially adverse impacts).
- Preparation of the environmental audit report.

1.6 Documents reviewed for the audit

Documents specific to the Hawkesdale Wind Farm:

- Marshall Day Acoustics – Hawkesdale Wind Farm – Pre-Construction Noise Assessment (Report 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report)
- Marshall Day Acoustics – Hawkesdale Wind Farm – NZS 6808:2010 Noise Assessment (Report 002 R04 2014362ML, dated 21 April 2017) (2017 Assessment Report)
- Marshall Day Acoustics - Hawkesdale Background monitoring locations ((Pers Comm C Delaire MDA, email dated 06 April 2020)
- Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 01Draft 20180787, dated 05 August 2020)
- Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 20180787, dated 20 August 2020) (Background Monitoring Report)
- Marshall Day Acoustics - Hawkesdale Wind Farm - Noise Compliance Test Plan (Report v No 001 01draft 20180787, dated 20 August 2018)

- Global Power Generation Australia Pty Ltd - Hawkesdale Wind Farm Development Plan (Reference 31303100040)
- ERM - Ryan Corner Wind Farm Development Plan (Drawing No 0105123_001_HDWF_Layout_201016.mxd)
- Ryan Corner Development Pty Ltd: Drawing No RCWF-DP-02-v10 - Vestas V-136 4.2MW
- Vestas Wind Systems A/S - V136-4.2 MW 50 Hz, PO1, 230933 Results of acoustic noise measurements according to IEC 61400-11 Edition 3.0 (Report No.: 10161571-A-1-A Dated: 09 September 2019)
- Vestas Document no. 0067-7065 V06 2018-05-02 Performance Specification V136-4.0/4.2 MW 50/60 Hz (Dated 03 May 2018)
- Vestas Document no. DMS 0067-4732 V03 V136-4.0/4.2 MW Third octave noise emission
- Hawkesdale Planning Permit No 20060221-A (dated 21 Dec 2017)
- Department of Environment, Land, Water and Planning. Letter to Global Power Generation Australia Pty Ltd, confirming extension of Planning Permit 20060221-A to 29 August 2023 (letter dated 02 November 2020)
- Panel Report - Moyne Planning Scheme Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)
- Infotech Research. Pre-construction Environmental Noise Assessment Audit – Woolsthorpe Wind Farm, dated 28 August 2019. EPA CARMS No 77774-1.

General references:

- New Zealand Standard NZS6808:2010 Acoustics – Wind Farm Noise
- DELWP - Development of Wind Farm Facilities in Victoria – Policy and Planning Guidelines (March 2019)
- EPA Victoria - Wind Energy Facility Noise Auditor Guidelines (Publication 1692, October 2018)
- EPA Victoria - Environmental Auditor Guidelines for the Preparation of Environmental Audit Reports on Risk to The Environment (Publication 952).
- EPA Victoria - Environmental Auditor Guidelines for Conducting Environmental Audits (Publication 953)
- Victoria Planning Policy (Amendment VC124 – 2015) Clause 52-32-5
- Annual Report to the Parliament of Australia, Office of the National Wind Farm Commissioner, 31 March 2017.

2 Key Audit Findings

The following key audit findings address the objectives of the audit set out in **Section 1.2**. The methodology used was consistent with **Section 1.5**.

2.1 Review of the site

The auditor undertook a site inspection in 2020 as part of the previous independent audit (EPA CARMS No. 78660-1), undertaken to be submitted with the application by RCD for an extension of Planning Permit 20060221-A.

The previous site inspection was preceded by a tele-conference meeting with senior RCD management and MDA technical staff on 01 April 2020 to:

- Confirm of the scope of site access and data requirements.
- Gain an understanding of the process used for selection of background monitoring locations (sensitive receiver sites), including siting alternative locations when agreement was not reached with preferred landholders.

An inspection of the site was held on 06 April 2020. The auditor was accompanied on the site visit by Nathan Micallef, a local employee of the proponent (RCD). Because of the social distancing restrictions in force in Victoria at that time due to the corona virus pandemic, the site visit involved travel in 2 vehicles, with hands free mobile telephone communication and a number of stops to review and discuss local conditions.

One of the key objectives of the site visit was to review the background monitoring locations used by MDA for background monitoring assessment - the table included in Appendix A1. summarises this information.

It was understood that Neighbourhood Stakeholder Agreements (“Participant Landholder”) had been established with some landowners. For clarity, all other residences are considered to be “Non-Participant Landholders”.

In summary, the site inspection confirmed that the locations chosen by MDA were appropriate as representative monitoring background locations for sensitive receivers in the area, including the township of Hawkesdale. No significant local topographical features or other additional sensitive receivers were noted that might need to have been considered for inclusion in the background noise monitoring locations selected by MDA, to undertake an appropriate assessment.

It is a requirement for an auditor to undertake an “inspection of the WEF project site and the surrounding environment” as part of the scope of an audit of pre-construction noise¹⁴. However, MDA advised that the previous background monitoring (including selected monitoring locations) would be used for this current assessment. Given this being the case, and that it was understood that no significant changes to the local sensitive receptors or topographical features had occurred on or near the proposed WEF site since April 2020, it was considered that a further site visit was not warranted. This matter was discussed with EPA, who stated that given that the auditor had previously attended the site earlier in 2020, it was really the responsibility of the auditor “to satisfy yourself that you would be able to defend those measures as fulfilling the requirements, (and) we don’t see that as an issue from

¹⁴ Wind Energy Facility Noise Auditor Guidelines, Publication 1692, Section 2.4.1

our perspective”. (Email from Andrew Lewis, Senior Audit Officer, Environmental Unit, EPA, dated 23 September 2020).

2.2 Background Noise Assessment

This component of the audit is not strictly a condition of the current Planning Permit (or Section 52.32 of the Victorian Planning Provisions); however, the assessment of predicted operational noise levels requires appropriate confidence in the methodology and outcomes of the background noise monitoring which may form the basis of the noise level criteria at individual sensitive receiver locations.

As stated in Section 2.1, MDA proposed that the previous background monitoring (including selected monitoring locations) would still be appropriate for the current assessment.

The background monitoring reviewed in the previous audit (EPA CARMS No. 78660-1) was based on Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 01Draft 20180787, dated 05 August 2020) (Draft Background Monitoring Report).

Since this previous audit, MDA has further updated this report (Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 20180787, dated 20 August 2020)) (Background Monitoring Report). The scope of the audit involved a review of this Background Monitoring Report.

As a preliminary task, a cross check of both reports was undertaken to confirm that the reports were consistent with each other, and that no potentially significant changes in findings had been introduced since the previous audit. In summary, this established that apart from a few insignificant clerical changes, the main change was to rename the substitute monitoring location entitled 53 (proxy) to location 171. Location 171 is situated on the western side of the WEF. As is discussed in Section 3.1 of the Background Monitoring Report, data from Location 171 was subsequently not considered suitable for further assessment.

2.2.1 Background Noise Monitoring Locations

It is understood that the initial background monitoring locations were based on work undertaken by MDA in developing a draft Noise Compliance Test Plan¹⁵ (draft NCTP), as required by Condition 43 of the Planning Permit. The draft NCTP identified a total of 8 sensitive receiver locations that would be monitored for postconstruction noise compliance monitoring, subject to permission being granted by the landholders. The locations were targeted to noise sensitive receivers within the predicted 35 dB(A) wind farm sound contour. The draft NCTP also notes that if permission was not able to be obtained for the monitoring, alternative locations shall be considered. The draft NCTP included a noise contour plot (Figure 1) that includes the currently approved 26 turbines; it was noted that this was based on the Senvion 4.2MW 140 turbine (Appendix B).

The Background Monitoring Report (Section 2.1) has adopted the 8 locations from the draft NCTP, noting that a revised contour plot (Figure 1) now refers to the Senvion 4.2MW 140 turbine. It was also stated that one of these 8 Landholders has not provided permission for noise monitoring to be undertaken. Of the remaining proposed 7 background noise

¹⁵ Marshall Day Acoustics - Hawkesdale Wind Farm - Noise Compliance Test Plan (Report v No 001 01draft 20180787, dated 20 August 2018)

measurement locations, 5 are noise sensitive receiver locations¹⁶, and 2 were at proxy locations between sensitive receiver locations and the WEF. More specifically, since 3 of the residents at the identified locations (53, 58, 89) did not grant permission to undertake the background noise monitoring, intermediate locations (53 (proxy) and 89 (proxy)) were selected instead for these respective sites. Location 53(proxy) has been renamed as location 171 (as discussed above). No substitute location was proposed for location 58, since the draft NCTP includes a number of adjacent sites (170, 59, 60, 62) that MDA considered were sufficient to determine compliance at location 58 – the auditor concurs with this finding noting; however, it does mean that, should issues arise in the future, there are no contemporary recorded background noise levels at this specific sensitive receiver – only representative levels measured at the intermediate locations.

Addressing the issue of generating a contour plot to identify potentially sensitive receivers, the auditor notes that the basis for using the Senvion 4.2MW140 turbine as the basis for generating the contour plot has not been discussed in either the draft NCTP or the Background Monitoring Report. The auditor accepts that using a 4.2MW turbine is an appropriately conservative option for selecting potentially sensitive receiver locations, and certainly preferable for the purposes of this audit to using one of the currently approved options in the Planning Permit as it is a similar power output to the proposed turbine option (Vestas V136 4.2MW).

An initial check was made to compare the noise contour plot in the Background Monitoring Report (Figure 1) based on the Senvion 4.2M140 turbine, with the three turbine options in the 2017 Assessment Report (Appendix E). Whilst there were some differences in the contours, the Senvion 4.2M140 turbine contours were considered to be appropriately conservative compared with the other three plots, to have used these to initially identify sensitive receiver locations.

A check was then undertaken of the noise contour plot for the proposed turbine option Vestas V136 4.2MW (2020 Assessment Report, Figure 3) against the noise contour plot for the Senvion 4.2M140 (Background Monitoring Report, Figure 1). The plots are relatively similar, with potentially the predicted 35 dB(A) noise level contour and other higher noise level contours for the proposed turbine option closer to the windfarm. This indicates that the locations selected for the background monitoring are conservative and are at, or representative of, all the sensitive receivers that are within the predicted 35 dB(A) wind farm sound contour, in accordance with Section 7.1.4 of the Standard.

2.2.2 Background Noise Monitoring

Background noise monitoring was undertaken by MDA at 7 locations between May and July 2020. The background noise level data collection has been undertaken over a time period of between 5–7 weeks (depending on location) which is considerably in excess of the minimum recommended requirement for 10 days (1,440 data points). The background measurements have been undertaken using appropriate measurement equipment (including windshields) and included a traceable calibration. The Background Monitoring Report provides helpful details regarding the individual measurement locations in Appendices G–M, with aerial photography, maps and photographs of each site which indicate appropriate positioning of the noise loggers.

¹⁶ As defined in NZS 6808-2010 as locations of noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site.

Periods with extraneous noise levels, identified in accordance with research by Griffin et al.¹⁷, have been removed from the analysis. While this is not strictly required by the Standard, it is shown to remove data pairs with generally higher noise levels from the regression analysis, and so will result in a conservative assessment of the background noise level.

The background noise level data has been referenced to wind speed measurements undertaken at a meteorological mast installed on the site (HD3). The mast does not include an anemometer at the proposed turbine hub height of 112 m, but does provide 3 individual anemometer heights at 20 m, 40 m and 60 m. These data have been used to calculate a wind shear exponent using a power law, and extrapolate the wind speed at 112 m. This methodology is appropriate.

The background noise level and filtered wind speed data has been analysed using a 3rd order polynomial regression, which is appropriate. Regression analysis was undertaken for both the 24-hour data, and night-period data only, in accordance with the Planning Permit.

The reported square of the correlation coefficient (r^2) is generally 0.23–0.43 considering all time data, and improves to 0.27–0.50 for the night-period data only. This is not particularly high, and is representative of a relatively wide range of results, rather than highly correlated data.

It is noted that the measured noise levels correspond to the noise floor of the measurement equipment at several locations (59, 60, 62, 170), which is likely to influence the regression curve at low wind speeds for these locations. This is of no practical consequence, since the minimum criterion, 40 dB(A), has been adopted at all sensitive receiver locations at lower wind speeds ie up to a hub wind speed of around 10 m/s, regardless of the measured background noise level.

The measurements for location 171 (previously location 53 (proxy)) are noted to be elevated due to an equipment fault resulting in high levels of electrical noise. This is evident in the measurement plots, and the results at this location should be treated with caution.

2.3 Pre-Construction Noise Assessment

MDA has undertaken a preconstruction noise assessment, as provided in the report entitled Marshall Day Acoustics – Hawkesdale Wind Farm – Pre-Construction Noise Assessment (Report 003 R01 20180787, dated 29 October 2020 (2020 Assessment Report)).

It is noted that this is not a stand-alone report, and reference needs to be made for some issues to the previous assessment report that supported the currently approved Planning Permit 20060221-A, entitled Marshall Day Acoustics – Hawkesdale Wind Farm – NZS 6808:2010 Noise Assessment (Report 002 R04 2014362, dated 21 April 2017 (2017 Assessment Report)).

The assessment is generally undertaken in accordance with the Standard. Key findings are discussed below.

¹⁷ Griffin, D., Delaire, C. and Pischedda, P., 2013, *Methods of identifying extraneous noise during unattended noise measurements*, 20th International Congress of Sound & Vibration.

2.3.1 Noise Limits

Consideration of General Noise Limits

Section 5.2 of the Standard defines acceptable noise limits as follows:

As a guide to the limits of acceptability at a noise sensitive location, at any wind speed wind farm sound levels ($L_{A90(10\ min)}$) should not exceed the background sound level by more than 5 dB, or a level of 40 dB $L_{A90(10\ min)}$, whichever is the greater.

While background noise level measurements have been undertaken for the project, as noted above, the approach used in the assessment is to adopt the ‘Base Limit’ criterion of 40 dB(A), at all Non-Participant Landholders up to a background noise level of 35 dB(A). For background noise levels above 35 dB(A), the maximum ‘Background +5 dB’ approach has been adopted. This approach is consistent with the Standard, and as also required by Condition 42 of Planning Permit 20060221-A.

Noise limits based on these criteria and the background monitoring results are presented in both the Background Monitoring Report (Tables 7 & 8) and the 2020 Assessment Report (Tables 3 & 5). Separate noise limits have been developed based on the night-time monitoring data, as required.

It is noted that this is a shift from the approach taken in the 2017 Assessment Report, which stated “For the purpose of this assessment, the NZS 6808:2010 base noise limit of 40 dB L_{A90} at all wind speeds has been used for all noise sensitive locations” (Section 6.3). As will be discussed later, the modelling predicts that this previous limit (40 dB(A)) is likely to be achieved by both the turbine options in the currently approved Planning Permit, and the proposed turbine (Vestas V136-42MW).

Furthermore, the adoption of a limit for Participant Landholders is not strictly considered under the Standard; however, it is discussed in the Working Group on Noise from Wind Turbine recommendations (ETSU-R-97)¹⁸ and the South Australian wind farm environmental guidelines¹⁹. It is therefore concurred that adopting a 45 dB(A) base noise limit for Participating Landholders is reasonable, on the basis of adopting best practice.

Consideration of High Amenity Noise Limit

MDA does not provide any consideration of the use of a High Amenity Noise Limit in the Background Monitoring Report or the 2020 Assessment Report. Assessment of noise compliance was against general noise limits only.

To provide clarification, the matter was discussed in the 2017 Assessment Report (Section 3.3), and reviewed in the previous audit (EPA CARMS 78660-1). MDA considered the use of a High Amenity Noise Limit in accordance with the Standard, and concluded that a High Amenity Noise Limit should not be applied. Based on this finding, MDA therefore assessed noise compliance against the general noise limits only. The matter was subsequently raised at a Planning Panel on the proposed amendment to the Planning Permit²⁰. The Panel accepted the submission made by the Proponent (GPG) that *the Standard and the (DELWP)*

¹⁸ The Assessment and Rating of Noise from Wind Farms, The Working Group on Noise from Wind Turbines, ETSU-R-97, UK Department of Trade and Industry, September 1996.

¹⁹ Wind farms environmental noise guidelines, Environment Protection Authority South Australia, July 2009.

²⁰ Moyne Planning Scheme - Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)

Guidelines reference to the VCAT Cherry Tree Farm decision have been appropriately considered in the current approvals for (the) ... site.

The Panel concluded:

- *There is nothing substantive in the amended proposal .. that affects the Panel's further consideration ofthe Hawkesdale Township Zone... as a "High Amenity Area".*

The auditor accepts this position (ie a High Amenity Zone does not apply), based on this guidance from the above Panel and from the VCAT determination for the Cherry Tree Wind Farm in relation to High Amenity zonings²¹.

Consideration of Special Audible Characteristics (SACs)

Wind farm sound that exhibits special audible characteristics, such as tonality, impulsiveness or amplitude modulation is subject to penalties between 1–6 dB to account for the additional audibility and annoyance caused by sound with these characteristics. However, as noted in Section 5.4 of the Standard, special audible characteristics cannot always be predicted in advance.

Therefore, MDA have assessed the likelihood that the turbines will result in tonal noise emission based on the tonal audibility of the selected turbine measured in accordance with IEC 61400-11:2012²² and reported by the manufacturer. This data indicates that the tonal audibility level is likely to be below 1.3 dB at all assessed wind speeds, and that tonality is not expected to be a characteristic of the WEF. MDA concludes that it is not necessary to apply a penalty to the predicted noise levels.

The auditor accepts this assessment, on the basis that SACs will be assessed through the NCTP, and has also recommended that a Noise Management Plan should be implemented through the Environmental Management Plan to address any non-compliance and potential associated penalties (Refer to the Risk Assessment, Section 2.3.5).

2.3.2 Noise Prediction Methodology

The approach used by MDA has been reviewed, with the following key findings:

- Noise propagation model: MDA used SoundPlan 8.0 software, adopting the international standard ISO 9613-2:1996²³ sound propagation model, which has been shown in national and international studies^{24,25,26,27} to provide reasonable results for wind farm noise level predictions. In the opinion of the auditor and his team, the calculation parameters that

²¹ DELWP Guidelines, S5.1.2 refers to Cherry Tree Wind Farm vs Mitchell Shire Council (2013)

²² IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurement techniques, International Electrotechnical Commission

²³ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation (ISO 9613-2)

²⁴ Bass, J.H., Bullmore, A.J. and Sloth, E. *Development of a Wind Farm Noise Propagation Model*, Final Report for European Commission Contract JOR-3-CT95-0051, 1998.

²⁵ Bullmore, A., Adcock, J., Jiggins, M. and Cand, M., *Wind Farm Noise Predictions and Comparison with Measurements*, Wind Turbine Noise 2009, Aalborg, Denmark, 2009.

²⁶ Delaire, C., Griffin, D. and Walsh, D., Comparison of predicted wind farm noise emission and measured post-construction noise levels at the Portland Wind Energy Project in Victoria, Australia, Proc. 4th International Meeting on Wind Turbine Noise, Rome, Italy, 11-14 April 2011.

²⁷ Evans, T. and Cooper, J., Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms, Proc. Acoustics 2011, Gold Coast, Australia, 2011.

have been adopted for temperature, humidity and ground absorption are reasonable, and correspond to best practice.

- Choice of turbine for assessment – the source levels used in the noise predictions are based on the measured sound power level data and spectral (octave band) data for the selected turbine (Vestas V136 4.2MW) determined in accordance with IEC 61400-11²⁸ as required by Section 6.2.1 of the Standard.
- The noise level predictions have adopted the following conservative assumptions:
 - Barrier effect limited to 2 dB
 - Screening based on turbine tip height, not hub height
 - +3 penalty for ‘concave’ ground topography (‘valley’ effects).

These considerations are not explicitly required by the Standard or implemented in ISO 9613-2:1996²⁹; however, they are commonly adopted as good practice for wind farm noise assessment.

NOTE: Appendix A2 to this report (NZS6808 checklist) shows non-compliance for one aspect of the requirements of the Standard - a requirement to include a topographical map in the assessment report, although the topography of the site was included in the noise propagation model.

2.3.3 Predicted Noise Levels

It is accepted that the pre-construction noise assessment has been generally undertaken in accordance with the requirements of the Standard, and the resulting assessment demonstrates that the predicted noise levels for the WEF will achieve the noise criteria established by the Standard. Specifically:

- Table 7 and Appendix G of the 2020 Assessment Report indicates that the predicted wind farm sound levels are predicted to be below 40 dB(A). This complies with the criteria at all of the Non-Participant Landholder noise sensitive receivers.
- The assessment also indicates that the wind farm sound levels also comply with the 45 dB(A) noise criterion at the Participant Landholder /Stakeholder residences.

The auditor was not provided with documented evidence on these stakeholder agreements during the audit. It is noted that Condition 42 of the Planning Permit requires that “evidence of the agreement must be provided to the satisfaction of the Minister for Planning upon request...”. Ideally, this documentation should be provided for review in this audit process as it relates to applicable noise criteria at Non-Participant Landholder sites. However, it is understood that not all relevant documentation may be in place at this stage of the site development. As a practical approach, it is recommended that relevant documentation be provided for review as part of the auditor review of the initial NCTP report required by Condition 45 of the Planning permit.

²⁸ IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurement techniques, International Electrotechnical Commission

²⁹ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2)

2.3.4 Potential Uncertainty in Predicted Noise levels

As discussed above, MDA used SoundPlan 8.0 software, utilising the international standard ISO 9613 sound propagation model as the method to calculate the level of broadband A-weighted wind farm noise expected to occur at surrounding sensitive receiver locations.

The software in conjunction with the digital terrain model of the site, has been used to evaluate the path between each turbine and receiver pairing, and then subsequently applies the adjustments to each turbine's predicted noise contribution where appropriate. The ISO 9613³⁰ sound propagation model has been demonstrated to generally result in conservative noise predictions.

All acoustic measurements and noise predictions are subject to measurement and calculation uncertainty. While MDA's analysis is not subject to a detailed Uncertainty Analysis, it does generally adopt conservative assumptions. We agree with this approach for modelling noise from WEFs.

2.3.5 Risk Assessment

EPA Publication 1692 requires a risk assessment, including a qualitative statement of the risk of non-compliance.

This audit focussed on risk to sensitive receivers, at locations defined as Participant or Non-Participant Landholders. The criteria applied for Non-Participant Landholders were those specified in the Standard (refer to Section 1.4 of this report).

A risk of noncompliance with the Standard is taken to be a risk to the beneficial use of the environment, specifically with respect to the amenity of residents in the noise sensitive locations. Based on the predicted sound levels, it is expected that the risk to this beneficial use will be low, due to compliance with Standard.

The auditor notes that Conditions 43–45 of the Planning Permit 20060221-A requires an independent post-construction noise monitoring program, “accompanied by a report from an environmental auditor...”. RCD has engaged MDA to prepare a draft Noise Compliance Testing Plan (NCTP)³¹, that is understood to serve the same purpose (refer to discussion on this matter in Section 1.1 of this report). The draft NCTP includes assessment of potential SACs (with potential penalties if assumed tonality is not met) (Section 5.8), and cumulative noise from Hawkesdale and Woolsthorpe WEFs (Section 5.9).

A recommendation is that the post-construction noise level monitoring specified under the NCTP should be undertaken by an independent acoustic consultant in line with recent recommendations of the Office of the National Wind Farm Commissioner³².

In addition, it is noted that Planning Permit 20060221-A does not specify that an Operational Noise Management Plan be developed. Such a plan would include measures to manage turbine noise in cases where operational noise non-compliance with the Standard was identified through the NCTP and any additional noise monitoring. However, Condition 25

³⁰ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2).

³¹ Marshall Day Acoustics - Hawkesdale Wind Farm - Noise Compliance Test Plan (Report v No 001 01draft 20180787, dated 20 August 2018)

³² Annual Report to the Parliament of Australia, Office of the National Wind Farm Commissioner, 31 March 2017.

requires an endorsed Environmental Management Plan (EMP), initially addressing construction issues; however, Condition 26 requires this EMP to “be reviewed and if necessary amended, in relation to matters pertaining to the continued operation of the wind farm facility, in consultation with the Moyne Shire Council and where relevant DELWP Environment Portfolio to the satisfaction of the Minister for Planning every 5 years...”. It is recommended that an Operational Noise Management Plan be developed (that could potentially include the NCTP) and be included in the EMP process required by Condition 25.

2.4 Consideration of Cumulative Noise Impacts

The 2020 Assessment Report provides a summary assessment of the cumulative noise impacts of the Hawkesdale Wind Farm and the nearby Woolsthorpe Wind Farm in Section 5.2, and refers to the 2017 Assessment Report. The closest distance between wind turbines from each wind farm is approximately 1,100 m.

The key outcomes of the cumulative noise impact assessment stated in the 2017 Assessment Report (Section 8 and Appendix F) include:

- The modelling for the combined impact has been undertaken following the same methodology for the noise predictions used for the Hawkesdale wind farm, which is in accordance with the requirements of the Standard. The modelling indicates that the cumulative (additional) impact of the two wind farms on the nearby sensitive receivers is generally insignificant – the additional impact of the second wind farm is more than 10 dB below the impact of one of the wind farms alone.
- There is a small cumulative impact at four receivers near the Woolsthorpe wind farm that have noise levels from that wind farm of 42 dB(A) or more. However, the level from the Hawkesdale wind farm is less than 33 dB(A) at these locations, and only results in a small increase (< 0.4 dB) to the combined level. One Participant Landholder property, 90(S), is expected to experience combined noise levels between 42.6–43 dB(A) depending on the final turbine selection, an increase of between 1.9–2.7 dB. However, this property is a Stakeholder in the Hawkesdale project, and subject to a 45 dB(A) noise limit.
- This previous assessment was based on using the highest sound power level of the three candidate turbine models considered for the Hawkesdale Wind Farm. Overall, based on the assessments provided, this previous assessment considered that the cumulative impact of the two wind farms has been reasonably considered, and is unlikely to have any additional significant impact on sensitive receivers overall.

The question remains as to whether the conclusions reached on potential cumulative impacts provided in the 2017 Assessment Report, and apparently accepted by the Planning Panel at the time (the Panel Report³³ is silent on this matter) remains valid. Based on the conclusion that the predicted noise contour of the proposed turbine (Vestas V136- 42MW) is “no worse” than the noise contours of the three turbine options currently in the approved Planning Permit (Refer to Section 3.2), the auditor accepts the MDA assessment that ‘based on the Woolsthorpe layout considered in the 2017 noise assessment report, the cumulative assessment findings remain valid for the updated noise assessment of the Hawkesdale Wind Farm presented in this (2020 Assessment) report’. Accordingly, no further assessments of

³³ Panel Report - Moyne Planning Scheme Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)

cumulative noise levels were warranted or undertaken as part of this assessment' (Reference: 2020 Assessment Report, Section 5.2).

The report³⁴ of the environmental audit of the pre-construction noise assessment of the Woolsthorpe Wind Farm conducted in accordance with Section 53V of the *Environment Protection Act 1970* was referenced as part of this audit. This audit also considered potential cumulative impacts from the two wind farms, and concluded that the potentially significant impact was limited to one receptor location. The audit report notes that this location is a stakeholder residence for the Hawkesdale Wind Farm (page 6), and with a maximum predicted noise level of 41dB(A) is within the 45dB(A) recommended limit. It is noted that the modelling of potentially cumulative assessments carried out independently for Woolsthorpe (Resonate Acoustics) and Hawkesdale (MDA) both acknowledged a conservative approach – as raised at the Hawkesdale Planning Panel Hearing³⁵, where MDA (Mr C Delaire) stated that "... at intermediate locations in the area between the two WEFs... the locations cannot be simultaneously downwind of each WEF, and the cumulative effects cannot increase the predicted noise levels". The Panel Report makes no further comment on this issue.

Based on the above information, the auditor accepts the findings of the assessment of cumulative impacts from the Hawkesdale and Woolsthorpe WEFs, and considers that no additional assessment is required by RCD for the proposed amendment.

2.5 Additional Auditor Considerations

It is understood that the 2020 Assessment Report and Background Monitoring Report are intended to be submitted as part of the suite of documents concerning an application for further amendment to Planning Permit 20060221-A. The auditor has been advised that the change in turbine type has not triggered the amendment application, rather this is due to proposed changes to the wording of the Planning Permit and conditions which do not relate to the turbines.

The information provided in Section 2 addresses the objectives of the audit, as stated in Section 1.2. Specifically, the audit has identified that the information provided by MDA in the 2020 Assessment Report confirms that:

- The methodology for the pre-construction noise assessment has been generally undertaken in accordance with the Standard.
- The modelling indicates compliance with the applicable noise criteria at all of the Non-Participant Landholder, and Participant Landholder noise sensitive receivers.

However, there are two basic questions concerning the proposed change of turbine (Vestas V136-4.2MW) instead of the turbine options (Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW)), and a slightly reduced array of turbines (26 reduced to 23 units)) from the layout considered in the 2020 Assessment Report;

³⁴ Infotech Research. Pre-construction Environmental Noise Assessment Audit – Woolsthorpe Wind Farm, dated 28 August 2019. EPA CARMS No 77774-1.

³⁵ Panel Report - Moyne Planning Scheme Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)

1. Will the proposed turbine be noisier or quieter than the currently approved turbine options?
2. How will the noise profile of the proposed turbine array compare with the noise profiles of the currently approved turbine options in the Planning Permit?

These two questions concerning the proposed change of turbine are not directly addressed, or are somewhat unclear, in the 2020 Assessment Report - the following comments are provided on these issues by the auditor, as they are likely to arise during the approval process. The following is based on the auditor's review of both the above reports, and additional information provided in the 2017 Assessment Report.

2.5.1 Potential Change in Turbine Power Sound Levels

Will the proposed turbine (Vestas V136-4.2MW) be noisier or quieter than the currently approved turbine options (Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW)?

MDA has provided sound power level data for the turbines as follows:

- Vestas V136-4.2MW – 2020 Assessment Report Figures 1 & 2. The Vestas V136-4.2MW data is based on information provided by Vestas, and sighted during the audit³⁶.
- Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW) – 2017 Assessment Report Figures 1 & 2, and Appendix G. Reference sources for these data are provided in the 2017 Assessment Report, Section 2.2.2.

Comparison of these data indicates that the proposed turbine (Vestas V136-4.2MW) is no noisier than the range approved for the three currently approved options, and appears comparable to the quietest option (Senvion M122). Note that discussion of SACs is provided separately in Section 2.3.1 of this audit report.

2.5.2 Potential Change in Predicted Noise Profile of Site

How will the noise profile of the proposed turbine array compare with the noise profiles of the currently approved turbine options in the Planning Permit?

This question is addressed in the 2020 Assessment Report, Appendix H, where Table 11 provides a summary of comparison of modelling results at sensitive receiver sites. These results indicate that the proposed turbine (Vestas V136-4.2MW) in conjunction with removal of three turbines, has resulted in a reduction in noise levels at these locations, particularly along Cameron's Road adjacent to where the three turbines are proposed to be removed.

As part of the audit, the modelled noise contour maps for the proposed turbine (Vestas V136-4.2MW) (2020 Assessment Report, Figure 3, page 15), and the three approved options (2017 Assessment Report, Appendix E) were reviewed. As a general comment, the contours for the proposed turbine (Vestas V136-4.2MW) in conjunction with removal

³⁶ Vestas doc V136-4.0/4.2 MW Third octave noise emission (Doc no 0067-4732 VO3) and Vestas doc - V136-4.2MW 50Hz, PO1 230933 Results of acoustic noise measurements according to IEC 61400-11 Edition 3.0 (Report No 1061571-A-1-A dated 09 Sep 2019) and Vestas Document no. 0067-7065 V06 2018-05-02 Performance Specification V136-4.0/4.2 MW 50/60 Hz (dated 03 May 2018)

of three turbines are “no worse” than for the three approved options, and may in fact have decreased, reducing the total area where potential sensitive receivers within the 35 dBA are located.

3 Audit Conclusions and Recommendations

3.1 Conclusions

An environmental audit (‘the audit’) was conducted in accordance with Section 53V of the *Environment Protection Act 1970* of the pre-construction noise assessment undertaken by MDA of the Hawkesdale Wind Farm to be located near Hawkesdale, Victoria (the site). The audit has been completed to assess compliance with the Standard, as required by EPA Guideline 1692.

The following is a summary of the key findings of the audit.

Background Noise Assessment

Refer to report entitled Marshall Day Acoustics – Hawkesdale Wind Farm Background Noise Monitoring (Report 002 20180787, dated 20 August 2020) (Background Monitoring Report).

1. The background noise monitoring locations are shown on a site plan in Figure 1 of the Background Monitoring Report. A check was made to compare this noise contour plot based on the Senvion 4.2M140 turbine, with the three turbine options in the 2017 Assessment Report (Appendix E) and the proposed turbine option Vestas V136 4.2MW (2020 Assessment Report, Figure 3). The plots are relatively similar, with potentially the predicted 35 dBA noise contour and other higher noise level contours for the proposed turbine option closer to the windfarm. This indicates that the locations selected for the background monitoring are conservative and are at, or representative of, all the sensitive receivers that are within the predicted 35 dB(A) wind farm sound contour, in accordance with Section 7.1.4 of the Standard.
2. The background noise monitoring undertaken by MDA appropriately considered sensitive receiver locations, including Participant (Stakeholder) and Non-participant Landholders. It is noted that several of the initial sites selected had to be moved to intermediate locations due to permission not been given by the Landholder to place monitoring equipment in the vicinity of the residence.
3. The site inspection by the auditor on 08 April 2020 confirmed that the locations chosen by MDA were appropriate as representative monitoring background locations for sensitive receivers in the area, including the township of Hawkesdale. No significant local topographical features or other additional sensitive receivers were noted that might need to have been considered for inclusion in the background noise monitoring locations selected by MDA, to undertake an appropriate assessment.
4. Background noise monitoring was undertaken by MDA at 7 locations between May and July 2020. The background noise level data has been undertaken over a time period of between 5–7 weeks (depending on location) which is considerably in excess of the minimum recommended requirement of 10 days (1,440 data points). The Background Monitoring Report provides helpful details regarding the individual measurement locations in Appendices G–M, with aerial photography, maps and photographs of each site which indicate appropriate positioning of the noise loggers.

5. The background measurements have been undertaken using appropriate measurement equipment (including windshields) and include a traceable calibration.
6. The background noise level data has been referenced to wind speed measurements undertaken at a meteorological mast installed on the site (HD3). The mast does not include an anemometer at the proposed turbine hub height of 112 m, but does provide 3 individual anemometer heights at 20 m, 40 m and 60 m. These data have been used to calculate a wind shear exponent using a power law, and extrapolate the wind speed at 112 m. This methodology is appropriate.
7. The background noise data have been analysed appropriately.

Pre-construction Noise Assessment

Refer to report entitled Marshall Day Acoustics – Hawkesdale Wind Farm – Pre-Construction Noise Assessment (Rp 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report).

Also note that the 2020 Assessment Report refers on a number of issues to the previous report entitled Marshall Day Acoustics – Hawkesdale Wind Farm – NZS 6808:2010 Noise Assessment (Report 002 R04 2014362ML, dated 21 April 2017) (2017 Assessment Report)

8. The pre-construction noise assessment methodology generally complies with the requirements of the Standard. The noise predictions were conducted in accordance with the appropriate standards and guidelines.
9. General Noise Limits:
 - a. The approach used in the assessment is to adopt the ‘Base Limit’ criterion of 40 dB(A), at all Non-Participant Landholders up to a background noise level of 35 dB(A). For background noise levels above 35 dB(A), the maximum ‘Background +5 dB’ approach has been adopted. This approach is consistent with the Standard, and as also required by Condition 42 of Planning Permit 20060221-A. It is noted that this is a shift from the approach taken in the 2017 Assessment Report, which stated “For the purpose of this assessment, the NZS 6808:2010 base noise limit of 40 dB LA90 at all wind speeds has been used for all noise sensitive locations”.
 - b. The adoption of a limit for Participant Landholders is not strictly considered under the Standard, however, it is agreed that adopting a 45 dB(A) base noise limit for Participant Landholders is reasonable, on the basis of adopting best practice.
10. Consideration of High Amenity Noise Limits: MDA does not provide any consideration of the use of a High Amenity Noise Limit in the 2020 Assessment Report. Assessment of noise compliance was against general noise limits only. To provide clarification, the matter was discussed in the 2017 Assessment Report (Section 3.3), and reviewed in the previous audit (CARMS 78660-1). MDA considered the use of a High Amenity Noise Limit in accordance with the Standard, and concluded that a High Amenity Noise Limit should not be applied. The matter was subsequently raised at a Planning Panel³⁷ on the proposed amendment to the Planning Permit. The auditor accepts this position (ie a High Amenity Zone does not apply), based on this guidance from the above Panel and from the

³⁷ Panel Report - Moyne Planning Scheme Applications to amend Planning Permits 2006/0221 and 2006/0222 Hawkesdale and Ryan Corner Wind Energy Farms (dated 24 October 2017)

VCAT determination for the Cherry Tree Wind Farm in relation to High Amenity zonings³⁸.

11. Consideration of Special Audible Characteristics (SACs): MDA have assessed the likelihood that the turbines will result in tonal noise emission based on the measured tonal audibility of the selected turbine measured in accordance with IEC 61400-11:2012³⁹ and reported by the manufacturer. This data indicates that the tonal audibility level is likely to be below 1.3 dB at all assessed wind speeds, and that tonality is not expected to be a characteristic of the WEF. MDA concludes that it is not necessary to apply a penalty to the predicted noise levels. The auditor accepts this assessment, on the basis that SACs will be assessed through the NCTP, and that a Noise Management Plan will be implemented through the Environmental Management Plan to address any non-compliance and potential associated penalties (Refer to the discussion on the risk assessment).
12. Noise Prediction Methodology: The noise level predictions have been undertaken using the ISO 9613-2:1996⁴⁰ noise propagation model. In the opinion of the auditor and his team, the calculation parameters that have been adopted for temperature, humidity and ground absorption are reasonable, and correspond to best practice.
13. The predicted noise levels comply with the limits set in the Standard. Specifically:
 - a. Table 7 and Appendix G of the 2020 Assessment Report indicates that the predicted wind farm sound levels are predicted to be below 40 dB(A). This complies with the criteria at all of the Non-Participant Landholder noise sensitive receivers.
 - b. The assessment also indicates that the wind farm sound levels also comply with the 45 dB(A) noise criterion at the Participant Landholder /Stakeholder residences.
14. Potential uncertainty in predicted noise levels: MDA used SoundPlan 8.0 software, adopting the international standard ISO 9613⁴¹ sound propagation model, in conjunction with the digital terrain model of the site. The ISO 9613 sound propagation model has been demonstrated to generally result in conservative noise predictions. All acoustic measurements and noise predictions are subject to measurement and calculation uncertainty. While MDA's analysis is not subject to a detailed Uncertainty Analysis, it does generally adopt conservative assumptions. We agree with this approach for modelling noise from WEFs.
15. Risk Assessment: A risk of noncompliance with the Standard is taken to be a risk to the beneficial use of the environment, specifically with respect to the amenity of residents in the noise sensitive locations. Based on the predicted sound levels, it is expected that the risk to this beneficial use will be low.
16. Consideration of Cumulative Impacts: The 2020 Assessment Report provides a summary assessment of the cumulative noise impacts of the Hawkesdale Wind Farm and the nearby Woolsthorpe Wind Farm in Section 5.2 and refers to the 2017 Assessment Report. Based on the conclusion that the predicted noise contour of the proposed turbine (Vestas V136-42MW) is "no worse" than the noise contours of the three turbine options currently in the

³⁸ DELWP Guideline S5.1.2 refers to the Cherry Tree Wind Farm vs Mitchell Shire Council (2013)

³⁹ IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurement techniques, International Electrotechnical Commission

⁴⁰ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2)

⁴¹ International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613-2)

approved Planning Permit, the auditor accepts the MDA assessment that ‘the cumulative assessment findings remain valid for the updated noise assessment of the Hawkesdale Wind Farm. Accordingly, no further assessments of cumulative noise levels were warranted or undertaken as part of this assessment’ (2020 Assessment Report, Section 5.2).

17. Additional Auditor Considerations:

- a. Potential Change in Turbine Power Sound Levels: Comparison of provided data indicates that the proposed turbine (Vestas V136-4.2MW) is no noisier than the range approved for the three currently approved options under Planning Permit 20060221-A (Vestas V126 (3.3MW), Senvion M122 (3.0MW) and GE 3.2-130 (3.2MW), and appears comparable to the quietest option (Senvion M122).
- b. Potential Change in Predicted Noise Profile of Site: The modelled noise contour maps for the proposed turbine (Vestas V136-4.2MW) (2020 Assessment Report, Figure 3, page 15), and the three approved options (2017 Assessment Report, Appendix E) were reviewed. As a general comment, the contours for the proposed turbine (Vestas V136-4.2MW) in conjunction with removal of three turbines are “no worse” than for the three approved options, and may in fact have decreased, reducing the area where sensitive receivers are within the 35 dBA noise level contour.

3.2 Recommendations

1. The post-construction noise level monitoring specified under the Noise Compliance Test Plan (NCTP) should be undertaken by an independent acoustic consultant in line with recent recommendations of the Office of the National Wind Farm Commissioner⁴².
2. A Noise Management Plan (NMP) should be developed for the operational phase of the WEF, to include measures to manage turbine noise in cases where operational noise non-compliance with the Standard was identified through the NCTP and any additional noise monitoring. Given that the Planning Permit does not directly require a NMP, it is further recommended that it be included under Conditions 25 and 26 (Environmental Management Plan).
3. Documented evidence of all stakeholder agreements should be required for review as part of the auditor review of the initial NCTP report required by Condition 45 of Planning Permit 20060221-A.

⁴² Annual Report to the Parliament of Australia, Office of the National Wind Farm Commissioner, 31 March 2017.

Appendices

A1 Hawkesdale Site Visit

Date of site visit: 08 April 2020

Introduction

As noted in Section 2.1, it is a requirement for an auditor to undertake an “inspection of the WEF project site and the surrounding environment” as part of the scope of an audit of pre-construction noise⁴³. The auditor had visited this site on 08 April 2020, as part of the previous environmental audit.

MDA advised that the background monitoring (including selected monitoring locations) conducted between May and July 2020, as documented in the Background Monitoring Report, had also been used for this current assessment. Given this being the case, and that it was understood that no significant changes to the local sensitive receptors or topographical features had occurred on or near the proposed WEF site since April 2020, it was considered that a further site visit was not warranted.

This matter was also discussed with EPA, who stated that given that the auditor had previously attended the site earlier in 2020, it was really the responsibility of the auditor “to satisfy yourself that you would be able to defend those measures as fulfilling the requirements, (and) we don’t see that as an issue from our perspective”. (Email from Andrew Lewis, Senior Audit Officer, Environmental Unit, EPA, dated 23 September 2020).

The following is a summary of the site visit held 08 April 2020.

General comments

The proposed site of the Hawkesdale Wind Farm is generally an undulating site. The general area on and adjacent to the proposed site is used for the most part for farming activities, with well-established farmhouses and associated outbuildings.

The auditor was accompanied on the site visit by Nathan Micallef, a local employee of the proponent Ryan Corner Development Pty Ltd (RCD), a subsidiary of Global Power Generation Australia Pty Ltd (GPG). Because of the distance restrictions in force in Victoria due to the corona virus pandemic, the site visit involved travel in 2 vehicles, with hands free mobile telephone communication and a number of stops to review and discuss local conditions.

The general route initially involved a drive on local roads near the perimeter of the proposed windfarm.

All the proposed turbine locations (total 26) are situated within an area of cleared land.

All monitoring sites proposed by MDA for the background monitoring were inspected from the road. No residents were contacted during the site inspection.

The appropriateness of these sites was discussed with MDA before the site inspection. The proposed monitoring locations were selected on the basis of identifying sites with predicted noise levels greater than 35dB, as required by NZS 6808:010.

⁴³ Wind Energy Facility Noise Auditor Guidelines, Publication 1692, Section 2.4.1

The background monitoring was a repeat of an earlier monitoring program (circa 2006), that the auditor and MDA considered should be reviewed to check whether local conditions had changed (eg trees grown).

A further discussion was held with GPG and Marshall Day after completion of the site visit to confirm a number of issues identified.

Summary of Observations

Receptor Site No	Stakeholder?	Sensitivity	Comment on Proposed Background Monitoring Location
58, 59, 60, 62	No	Occupied residences	<p>All residences are located along Cameron's Road, on the eastern side of the proposed site.</p> <p>These residences are all located close to the road, and all have varying degrees of vegetation on the residential blocks.</p> <p>These residences will have varying line of site visibility to various turbines across a reasonably flat terrain on this side of the proposed site.</p> <p>It is noted that:</p> <p>Residence 58 – owner declined request to place background monitor at this location. No alternative site was identified by Marshall Day</p> <p>there are 2 closer stakeholder sites on this road (Sites 61 & 90); both are understood to have stakeholder agreements with RCD.</p>
170	No	Occupied residence	The overall site is more open, with less trees than the residences mentioned above
169	No	Occupied residence	The closest residence on the western side of the proposed windfarm, taken as representative of baseline at township of Hawkesdale
53	No	Occupied residence	Indicative of western side of proposed windfarm. Quite an open farmland area with few trees
89	No	Occupied residence	<p>This residence is located on the south side of Woolsthorpe – Heywood Road, on the southern side of the proposed site.</p> <p>There is significant vegetation on the residential block.</p>

Appendix 2

NZS 6808:2010 Checklist

A2 New Zealand Standard Acoustics – Wind Farm Noise NZS 6808:2010 Checklist

Information Source:

Marshall Day Acoustics – Hawkesdale Wind Farm – Pre-Construction Noise Assessment
(Report 003 R01 20180787, dated 29 October 2020) (2020 Assessment Report)

NZS 6808:2010 Acoustics – Wind Farm Noise - Section/Clause	NZS 6808:2010 Acoustics – Wind Farm Noise Requirement	Reference from Information Source (2020 Assessment Report)	Assessment	Compliance
S3.1.3	Adopt A-frequency weighted L90 percentile level for wind farm sound	S2.2.2, Figure 1 and Figure 2	LAeq adopted for source levels. LAeq levels will result in conservative predictions compared to L90 level.	Comply
S5.2	Adopt an outdoor limit of background + 5dB, or a level of 40 dBLA90(10min), whichever is the greater	S3.2	Noise limit of 40 dB(A) adopted at all non-participant receivers to 35db(A), and background plus 5 dB beyond	Comply
S5.3	Consider a High Amenity noise limit where a plan promotes a higher degree of protection.	2020 Assessment Report does not specifically consider a High Amenity noise limit	The issue of a High Amenity Noise Limit was raised at a Planning Panel on the previous amendment to the Planning Permit. The Panel accepted the submission made by the Proponent (GPG) that <i>the Standard and the (DELWP) Guidelines reference to the VCAT Cherry Tree Wind Farm decision have been appropriately considered in the current approvals for (the)... site.</i> The auditor accepts this position..	Comply
S5.4	Design the wind farm so that wind farm sound does not have Special Audible Characteristics.	S2.3	MDA have assessed the likelihood that the turbines will result in tonal noise emission based on the measured tonal audibility of the selected turbine measured in accordance with IEC 61400-11:2012 ⁴⁴ and reported by the manufacturer. This data	Comply

⁴⁴ IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurement techniques, International Electrotechnical Commission

			indicates that the tonal audibility level is likely to be below 1.3 dB at all assessed wind speeds, and that tonality is not expected to be a characteristic of the WEF. MDA concludes that it is not necessary to apply a penalty to the predicted noise levels.	
S5.5	Other factors, including ultrasound, infrasound, low frequency sound and vibration and ground-borne vibration are not required to be assessed.	-	Factors not required to be assessed	Comply
S5.6	Apply limits to the cumulative sound level of all wind farms affecting any noise sensitive location.	S5.2	Cumulative impact of Woolsthorpe Wind Farm has been considered. Referral to findings of previous MDA assessment (2017 Assessment Report)	Comply
S5.7	Uncertainty.	S2.3	+1 dB adjustment adopted to account for typical values of test uncertainty	Comply
S6.1.1	Undertake predictions to determine environmental noise impact before installation takes place	2020 Assessment Report	-	Comply
S6.1.2	Predictions to take into account <ul style="list-style-type: none"> a. Sound power levels and positions of wind turbines b. Directivity of propagation c. Meteorological conditions d. Attenuation due to geometric spreading e. Attenuation due to atmospheric absorption f. Ground attenuation g. Miscellaneous attenuation h. Barrier and terrain screening 	S2.3 Fig 1 & 2 Appendix F Assumed Omni S4.0 and Appendix F S4.0 and Appendix F S4.0 and Appendix F S4.0 and Appendix F S4.0 and Appendix F S4.0 and Appendix F	Appropriate modelling, propagation and attenuation parameters have been adopted	Comply
S6.1.3	Use an appropriate sound propagation calculation method applicable to wind turbines.	S4.0 and Appendix F	ISO 9613-2:1996 used with the adoption of appropriate modelling parameters	Comply
S6.1.4	Wind farm sound levels determined by calculating in	S2.3 Figure 2 and S4.0, Appendix F.	Octave bands from 63Hz–4kHz have been adopted for the noise modelling.	Comply

	octave-bands from at least 63 Hz to 4kHz			
S6.1.5	Predict levels covering the hub-height wind speed range for which power data is available from the manufacturer (including corresponding to the highest sound level generated by the turbine)	S2.3 Figure 1	Sound power at 9 m/s adopted for prediction and assessment, representing the maximum noise level emission of the turbine.	Comply
S6.1.6	Levels predicted for wind speed corresponding to 95% rated power for determining 35 and 40 dB sound level contours	S4.0	Predictions based on highest source level corresponding to 100% rated power and maximum sound power output.	Comply
S6.2.1	Sound power levels used for predictions obtained from the wind turbine manufacturer determined in accordance with IEC 61400-11 unless otherwise stated	S2.3 Figure 1	-	Comply
S6.2.2	Use sound power levels based on hub-height wind speeds.	S2.3 Figure 1	Hub-height wind speed sound power data adopted	Comply
S8.1	Report of wind farm sound level predictions shall provide <ul style="list-style-type: none"> a. A map showing topography in the vicinity of the wind farm, the position of the wind turbines , and noise sensitive locations b. Noise sensitive locations for which wind farm sound levels are calculated c. Wind turbine sound power levels d. The make and model of the wind turbines e. The hub height of the wind turbines f. Distance of noise sensitive locations from the wind turbines g. Calculation procedure used h. Meteorological conditions assumed i. Air absorption parameters used 	Appendix D Appendix D S2.3. Figures 1 & 2 S2.2 Table 1 S2.2 Table 1 Appendix C S4.0, Appendix F S4.0, Appendix F S7.0 Appendix D	No topographic map is included in the Information Source. However: RCD has subsequently provided the auditor with a topographical map, and this will be included in the submission to DELWP	Strictly does not comply. No topographic map is included in the Information Source. However, the auditor and his team are aware that MDA utilised topographical data within the SoundPlan assessment.

	<p>j. Ground attenuation parameters used</p> <p>k. Topography/screening assumed</p> <p>l. Predicted far-field wind farm sound levels</p>	<p>MDA S7.0, Appendix D</p> <p>MDA S7.0, Appendix D</p> <p>MDA S5.1 Table 3, MDA S7.0, Tables 4, 5 & 6, Appendix E</p>		
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