Chapter 9:Noise Impact Assessment

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Noise Impact Assessment

9. Noise Impact Assessment

An assessment of the predicted noise impacts both during construction and operation of the wind farm has been carried out by Vipac Engineers and Scientists. The full Noise Impact Assessment is provided at Appendix G.

9.1 Methodology

9.1.1 Construction Noise

The assessment of noise predicted to occur during construction of the proposed Keyneton Wind Farm (e.g. construction of turbines, roads and associated infrastructure) was assessed in accordance with the *Environment Protection (Noise) Policy 2007* special noise control provisions for construction noise which states that:

"Construction activity results in noise with an adverse impact on amenity if measurements taken in relation to the noise source and noise-affected premises show-

(a) that the source noise level (Leq) exceeds 45dB(A) at noise-affected premises; or

(b) that the source noise level (Lmax) exceeds 60dB(A) at noise-affected premises."

On-site construction activities will include: site preparation / establishment, earthworks / excavation, foundation works and structural works. The construction noise assessment was carried out based on previously measured (measurements previously made by Vipac) noise levels from typical construction plant and provided indicative short-term noise levels, which may be experienced at varying distances from typical items of equipment used for construction activities.

9.1.2 Operational Noise

The noise assessment was conducted according to the methodology and assessment criteria outlined within the South Australian Environment Protection Authority *Environmental Noise Guidelines: Wind Farms*, July 2009 (EPA Guidelines).

Background noise monitoring was carried out at nine dwellings around the proposed wind farm. Eight of these locations were chosen as representative of the worst-case impact in each direction from the proposed wind farm and one further residence was monitored at the request of the occupant.

The EPA Guidelines state that the background noise monitoring survey should be carried out (for representative sensitive or relevant receivers within 1.5km of the wind farm) over a period of at least 2 weeks to ensure the collection of at least 2000 valid data points. Whilst there are no dwellings within 1.5km of any turbine, the assessment provides rigour with background monitoring undertaken at representative dwellings in a range of directions around the site. All wind speed measurements are to be taken at, or adjusted to, the turbine hub height. For the purposes of this Noise Impact Assessment, a REpower MM92 wind turbine with 98m hub height has been assessed.

Wind speed and direction were monitored at the two meteorological mast stations operated by Pacific Hydro Pty Ltd on the proposed Keyneton Wind Farm site and this data has been utilised to correlate with the background noise monitoring surveys.

9.1.3 Assessment Criteria

The assessment criteria applicable to on-going operations of the wind farm are set out in the EPA guidelines which state:

"The predicted equivalent noise level (LAeq, 10), adjusted for tonality in accordance with these guidelines, should not exceed:

- 35dB(A) at relevant receivers in localities which are primarily intended for rural living, or
- 40dB(A) at relevant receivers in localities in other zones, or
- the background noise level (LA90, 10) by more than 5dB(A),

whichever is the greater, at all relevant receivers for wind speed from cut-in power to rated power of the WTG and each integer wind speed in between."

At all relevant receivers located with the Rural Zone, the EPA has confirmed that the appropriate noise criteria, at the relevant receivers, is the greater of:

- 40dB(A) at relevant receivers, or
- The background noise level ($L_{A90, 10}$) plus 5dB(A).

At all relevant receivers located within the Settlement, Service Centre or Rural Living Zones, the noise criteria applied at the relevant receivers in the greater of

- 35dB(A) at relevant receivers, or
- The background noise level ($L_{A90, 10}$) plus 5dB(A).

In addition, in accordance with the EPA guidelines, an adjustment of 5dB(A) should be added if tonality, impulsiveness or low frequency components are present in the noise generated by the wind farm.

The noise criteria (assessment limits) for the proposed Keyneton Wind Farm receivers were determined from the background noise measurements made at the site. Corrections for the influence of wind-induced background noise were determined from the application of regression techniques described in the EPA guidelines.

For non-relevant receivers (i.e. project stakeholders), the World Health Organisation (WHO) guideline level of 45dB(A) for unreasonable interference or sleep disturbance is applicable[1].

9.1.4 Noise Model

The EPA Guidelines require that noise assessments be conducted based on a nominated model type (in order that the noise characteristics from that turbine can be modelled). For the purposes of this assessment the REpower MM92 wind turbine was nominated as the most appropriate

[1] *Guidelines for Community Noise*, Edited by B. Berglund, T. Lindvall & D. Schwela, World Health Organisation, Geneva (1999)

model. The assessment therefore takes into account 42 MM92 turbines, one substation (two transformers) and the overhead electrical transmission line.

An accurate predictive noise model was constructed using the validated and accepted CONCAWE algorithm for noise propagation in different meteorological conditions. The noise model was constructed using the widely recognised SoundPLAN proprietary software package and was set-up according to the EPA Guidelines.

The algorithms used in the model take into account the likely effects of atmospheric absorption, ground absorption / reflection, diffraction and attenuation by topographic features, screening effect of barriers and the propagation effect of wind speed and direction. Based on experience with past wind farm projects, the accuracy of the noise model is likely to be at least ±2dB(A) and up to the order of ±5dB(A).

In South Australia and elsewhere, the use of the CONCAWE model has been validated for its application to wind farms. Post-compliance data and information suggests that the model provides reasonably accurate (and slightly conservative) predictions of wind farm noise levels.
Vipac consider the CONCAWE model, with the setup parameters that are used, incorporates sufficient built-in conservatism to account for any possible minor inaccuracies.

9.1.5 Turbine Noise Characteristics

In the near vicinity of a turbine there is a slight swish-like modulation resulting from the rotor blade passing through the air and past the support tower in addition to a slight hum emanating from the generator. These normal effects diminish rapidly over distance and, for an array of WTGs, are randomly mixed to form low-level background noise beyond about 1km, which can be just perceptible beyond this distance at times depending on wind and atmospheric conditions.

REpower warrants that there is no tonal audibility greater than 0dB. The highest impact sound power levels for the installed turbines (i.e. the standard setting) has been assumed. If an alternate turbine is proposed which displays any tonality or other special noise characteristics, remodelling will be required and the noise impact re-assessed. Based on the REpower turbine, the noise predictions made provide a conservative estimate.

Modern wind turbines do not generate significant amounts of Low Frequency Noise (LFN) below 100 Hz. Over substantial distances atmospheric absorption is greater in the mid to high frequencies, and therefore the low frequency content is more easily perceived. Infrasound from wind turbines (inaudible range < 20 Hz) is most unlikely to occur at levels that are detectable by humans, from the evidence in the literature (Turnbull et al 2010/2012, Madsen & Pedersen 2011, Ochiai et al 2011, Parnell 2012). It is noted that infrasound is naturally occurring in the environment, due to a large variety of natural and man-made sources such as wind noise, coastal waves, storms, ground vibrations, motor vehicles, etc. Measured levels of infrasound at some distance (e.g. – beyond about 400m) from modern wind farms are well below (typically 20 to 30 dB or more below), the most sensitive human threshold of hearing/audibility or perception. In addition, from the peer-reviewed literature to date, there is no evidence of direct health effects arising from low frequency noise or infrasound from wind farms. [Ref: Leventhall 2003/2006, Bellhouse 2004, Pederson & Waye 2005, Jakobsen 2005, BWEA 2005, HayesMckenzie/DTI 2006, Howe 2006, Rogers 2006, UnivSalford/DEFRA 2007, Moorhouse et al 2007, Turnbull et al 2010/2012, Draft National Wind Farm Development Guidelines 2010, Madsen & Pedersen 2011, Lindkvist & Almgren 2011, Richarz 2011, Ochiai et al 2011, Bowdler 2012, Tickell 2012, Parnell 2012].

Amplitude modulation (AM) is the modulation or cyclic variation (over blade pass cycles of once per second or so) in the amplitude or level of the broadband aerodynamic noise from the turbine blades. AM is a naturally occurring part of turbine noise (usually at low levels, i.e. swish) but can be increased at times in certain conditions producing a greater noise level variation every second or so (enhanced AM). However, enhanced AM typically dissipates with distance, occurs extremely rarely and requires the alignment of a number of causal factors simultaneously.

9.2 Results

The nearest non-stakeholder dwelling is approximately 1,560m away from the nearest turbine.

9.2.1 Construction Noise

Construction activities will vary in intensity both across time and geographically across the site, therefore noise impacts will not impact any one dwelling for the full length of the construction period. The extent of construction and associated noise sources at any one receiver area is likely to occur only when the construction and preparation work is occurring near that receiver.

Based on previously measured emissions from typical construction plant and as distances from the nearest turbine to each residence are greater than 1,500 metres, the continuous noise criterion of 45dB(A) for construction noise is likely to be achieved at all residences.

With respect to traffic noise, existing roads will be used to access the site, minimising the time and cost of constructing additional infrastructure and avoiding the impact of temporary road construction on residential receivers. The short-term increase in heavy vehicle movement may be noticeable to residences along the existing roads utilised during construction. Traffic associated with construction will be managed and controlled in accordance with a traffic management plan (to be approved by Transport SA, Mid-Murray and Barossa Councils) and will limit the times that deliveries occur. The number of Concrete Mixer Trucks movements on local roads will be reduced in the event of use of an on-site batching plant.

9.2.2 Operation

Background noise monitoring measurements were used to develop environmental noise criteria applicable at a range of wind speeds for the nearest receivers to the wind farm. A predictive noise model has been developed and the noise levels assessed against the criteria developed.

The predicted LAeq noise levels, for worst case wind conditions range up to 36.1dB(A) at the nearest relevant receivers (R117). The predicted levels at maximum turbine power setting meet the appropriate criteria, developed in accordance with the EPA Guidelines for all receivers, and readily meet the WHO recommended noise levels for project stakeholder receivers. No mitigation measures were proposed by Vipac to achieve compliance with the noise criteria.

Despite the above, post-construction noise monitoring will be carried out at dwellings close to the site. The duration and locations of the compliance monitoring regime will be agreed with the EPA and are expected to be a condition of the development consent.