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Consultant Scientists in Acoustics

Karen Zirkler
Friends of Kentucky Action Group

(by email to: kentuckyactiongroup@gmail.com)
Our Reference: L447/Let1/WLH

20 May 2022

Dear Karen

Re: Thunderbolt Wind Farm Noise Assessment - Review

L Huson & Associates Pty Ltd has been commissioned by the Friends of Kentucky Action Group to review the Thunderbolt Energy Hub – Stage 1 Environmental Impact Statement (EIS) dated March 2022 that was Prepared by Umwelt (Australia) Pty Limited on behalf of Neoen Pty Limited.

This peer review considers the assessment of predicted operational wind farm noise and compliance with the NSW Secretary's Environmental Assessment Requirements (SEAR) for the EIS.

The SEAR lists the following that are relevant to this review:

- an assessment of the likely impacts of all stages of the development (including the cumulative impacts of the development with existing and proposed developments in the New England region, including the Thunderbolt Energy Hub more broadly, New England Solar Farm and the proposed Salisbury Solar Farm and Winterbourne Wind Farm), taking into consideration any relevant State and Commonwealth legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice and including the *NSW Wind Energy Guideline for State Significant Wind Energy Development* (2016);

- a description of the measures that would be implemented to avoid, mitigate and/or offset residual impacts of the development and the likely effectiveness of these measures, including details of consultation with any affected non-associated landowners in relation to the development of mitigation measures, and any negotiated agreements with these landowners.

The NSW Wind Energy Guideline for State Significant Wind Energy Development (2016) refers specifically to a guideline Bulletin, as follows:

> 'To ensure an adequate assessment of potential noise impacts, the Department has developed a Noise Assessment Bulletin' and notes that the EIS must include 'completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin'.

The SEAR specifically references the Noise Assessment Bulletin (Noise Bulletin) and requires that the EIS must; 'assess wind turbine noise in accordance with the NSW Wind Energy: Noise Assessment Bulletin (EPA/DPE, 2016).' The Noise Bulletin, in turn, refers to a South Australia EPA Guideline, as follows:

> 'The NSW Government has adopted the 2009 South Australian document *Wind farms – environmental noise guidelines* (SA 2009)1. SA 2009 will form the basis of the regulatory noise standard and assessment methodology that will apply when SSD wind energy proponents are

> assessed and determined in NSW. Adopting SA 2009 will facilitate increased regulatory consistency between states and result in consistent standards applying to significant areas of Australia with high quality accessible wind resources.'

In summary, an accurate noise impact assessment in accordance with the Noise Bulletin is required for an EIS and detail is required of any negotiated agreements. SA 2009 is the regulatory noise standard and assessment methodology that will apply when SSD wind energy proponents are assessed and determined in NSW. SA 2009 has a section dealing with negotiated agreements with wind farm developers and notes that:

> 'The criteria have been developed to minimise the impact on the amenity of premises that do not have an agreement with wind farm developers.
> Notwithstanding this, the EPA cannot ignore noise impacts on the basis that an agreement has been made between the developer and the landowner. Developers cannot absolve themselves of their obligations under the EP Act by entering into an agreement with a landowner.
> If it is shown that a development is having an 'adverse effect on an amenity value of an area that … unreasonably interferes with the enjoyment of the area', then appropriate action can be taken under the EP Act.'

In a recent decision of the Victorian Supreme Court in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren**) it was found that noise nuisance (unreasonable interference) could still apply even if a wind farm development complied with noise limits imposed through the planning process.

Negotiated Agreements

I have been unable to find any example of negotiated agreements in the EIS that would inform the consideration of adequate noise protection for Hosts and non-associated landowners.

The EIS states that:

> 'In addition to the Neighbour Benefit Sharing Program, Neoen has a number of negotiated agreements in place with neighbouring landowners (identified as 'associated landholders') to address various impacts associated with the Project specific to their dwellings. The agreements were developed in accordance with the Wind Energy Guidelines' and have been signed by Neoen and the relevant landholder. The impacts of the Project on these residences whilst noted in the technical assessments as relevant, are addressed by the agreements in place.'

The EIS does not explain how any adverse noise impacts have been addressed in the agreements or if there is adequate protection from, for example, adverse health effects that can be caused by noise.

The EIS also relies upon the Noise and Vibration Assessment (NVA), February 2022 referenced as report S6576.1C10 prepared by Mr Turnbull of Sonus Pty Ltd in regard to negotiated agreements, as follows:

> 'The NVA notes that once the detailed design is complete, a pre-construction noise assessment will be made based on the final WTG model selection, layout, guaranteed sound power levels, consideration of tonality and low frequency noise from the WTGs, and final agreements with landowners. This pre-construction noise assessment will ensure that the noise impacts of the final design comply with the relevant criteria and are generally consistent with or lower than the noise impacts predicted in the NVA.'

It is unusual for an EIS, that *must* include 'completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin', to state that the wind turbine layout, the turbine type, the consideration of other matters such as tonality, low frequency noise and sound power levels can all change and are issues that will be considered *after* approval of the EIS.

In my opinion, an EIS must address all of these possible changes before any EIS is approved. If the changes suggested are not considered in the EIS then the EIS is deficient, incomplete, should be considered premature and must not be approved.

The EIS states:

> Due to the nature of the Project, specific project details will be subject to the detailed design phase and will be influenced by the technology applicable at the time. However, any uncertainty in the data used for the assessment has been appropriately identified, an appropriate assumption has been applied to represent a conservative worst-case analysis and/or sensitivity analysis has been undertaken to assess a range of potential impact scenarios.

I have been unable to find any reference to uncertainty considerations associated with the detailed design changes flagged by this statement in the EIS. For example, there has been no consideration in the NVA for different WTG, layout, possible tonality and low frequency noise.

A full assessment of the effect of all detailed design changes that may be considered by the proponent must be covered in the EIS.

The EIS has identified a shed (ID 30) on the southern side of the New England Highway to the south of WTG T11. There appears to be a residence on this property that has not been identified which is a short distance further south of the shed that could be influenced to the same extent as dwellings 27, 28 and 41.

Peer review by SLR dated 1 Nov 2021 on Sonus report S6576.1C2

Wind Farm noise assessments must be completed as per the SEAR which references the SA 2009 noise guide, which in turn provides two acceptable noise prediction models: CONCAWE and ISO9613-2. Guidelines designed to assist in interpreting the ETSU-R-97 UK planning document for wind farms from 2014 by the UK Institute of Acoustics (IoA) are not described in the SEAR and should not be used.

I disagree with the assertion by SLR that the IoA guidelines are contemporary and should be preferred. The NSW government policy has formally adopted the SA 2009 guidelines in their Bulletin 2016.

The recent Victorian Supreme Court in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren**) was critical of the loose interpretations that the acoustic consultants acting for the wind farm company (Marshall Day Acoustics and Mr Turnbull of Sonus) used in addressing planning permit requirements. A similar criticism could also be levied at SLR when they wish to skew the SEAR to using IoA guidelines rather than SA 2009.

Overall, I find that the SLR peer review is superficial and has not addressed the key problems with the Sonus NVA that will be addressed further in this review. Furthermore, the SLR review is of an earlier Sonus NVA report S6576.1C2 and not the NVA included in the EIS which is report S6576.1C10.

To be an appropriate peer review of the NVA in the EIS there should be a peer review of the report included in the EIS as Appendix 10 to ensure that issues raised in an earlier peer review have been adequately addressed.

In the absence of a contemporary peer review being included in the EIS then this independent peer review may be considered in lieu.

Detailed review of EIS Appendix 10 (Sonus report S6576.1C10)

The body of the EIS suggests that cumulative effects of the Winterbourne Wind Farm have been addressed yet there is no mention in the Sonus report of any cumulative noise impact assessment.

Section 6.3.1.2 states that Table 6.6 shows non-associated dwellings and lists dwelling 270 as such. However, other figures and the EIS body suggest that 270 is an associated dwelling.

Evidence of any negotiated agreement for dwelling 270 should be provided to show how any adverse noise issues have been addressed.

Background Noise Measurements

Wind Speed

Accurate determination of background noise levels is fundamental to setting target noise limits that the developed wind farm must meet.

Background noise measurements must be correlated to wind speed across the wind farm site. SA 2009 notes that wind speed measurement locations must be determined, as follows:

> **Measurement location**
> The same location should be used for measuring wind speed and direction for all of the following procedures:
> • background noise measurements,
> • noise predictions,
> • compliance checking.
>
> Therefore the wind speed measurement location at the wind farm site should not:
> • be significantly affected by the operation of the WTGs in their final location,
> • provide lower wind speed results than other locations on the wind farm site, where those locations will house WTGs that affect the noise level at a relevant receiver.
>
> For large or topographically diverse wind farm sites, the suitability of the wind speed measurement location may need to be confirmed as part of the development assessment process.

I note there is a temporary mast next to T31. Wind speed data from this location is unsuitable for background measurement purposes since the location will subsequently be affected by operation of the proposed nearby wind turbine. An alternative temporary mast location should have been chosen that will not be subject to influence from any future turbine.

It is unclear where the wind speed measurements used by Sonus actually come from. The Sonus report references a mast location remote from the wind farm site that is some 48km away to the ESE from the wind farm. Table 6 notes the met mast is at 385152 Easting, 6580287 Northing (WGS84 56J).

SA 2009 states:

> A community concern is that the developer may measure during a limited (minimum two weeks) period that is not representative of the whole year.
> This guideline recommends that compliance checking be repeated at different periods of the year where valid concerns exist.
> The developer must collect representative background noise data.

The NVA has not provided information to demonstrate that background noise data is representative of other times of the year.

Sonus refer to wind speed data that had been corrected to hub height wind speed by Neoen.

SA 2009 states:

> Evidence that the wind speed and direction sensor is certified for the accurate determination of wind parameters is to be supplied as a part of the report. Accuracy of the wind speed measurements should be ±0.5m/s and wind direction measurements ±3º or better.

The location for the met mast supplying data used in the Sonus Background measurements needs to be checked and evidence supplied regarding the accuracy of the measurements, including the uncertainty in the method used to determine hub height wind speeds.

Clarification is required about the suitability of locating the met mast given the proximity of wind turbine T31 that shows probable adverse turbulence influence on the met mast shown in EIS figures.

Explanation is also required that the met mast location meets the SA 2009 requirement that 'the wind speed measurement location at the wind farm site should not .. provide lower wind speed results than other locations on the wind farm site, where those locations will house WTGs that affect the noise level at a relevant receiver.'

Background measurement equipment

SA 2009 states:

> *Equipment*
> Background noise levels should be collected for continuous 10-minute intervals using sound level meters or loggers of at least Class 2 certification in accordance with Standard AS IEC−61672. The lower limit of the instrument measurement range must be chosen to provide accurate measurements which might be limited by the noise floor of the data acquisition device.

Sonus used RION NL-21 sound level meter loggers. The measurement range over which the RION NL-21 complies with AS IEC-61672 is 28 dBA to 138 dBA, as shown in the RION specifications.

Below 28 dBA the NL-21 does not provide accurate results and the levels reported fall outside of the required accuracy for Class 2 equipment according to AS IEC-61672. The effect of this equipment limitation is that if the Background sound levels are shown to be below 28 dBA then the reported measurements will be artificially elevated and the corresponding target noise limits will be too high[1].

Many measurements (estimate >30%) fall below 28 dBA in the results presented for Background measurements in Appendix D of the Sonus NVA report. Because the trend line regression analysis considers dB values without consideration of data point accuracies, this can have a marked effect on the trend line and the validity of the target noise limits proposed in the Sonus report is questionable.

When the base line target noise limit is 35 dBA, or Background plus 5 dB, it is important to recognise that measurement equipment must remain accurate to AS IEC-61672 Class 2 limits below 28 dBA. If such poor low level accuracy equipment is considered then it would be appropriate to adjust the trend line determination lower to compensate.

To meet the requirement of SA 2009 that 'The lower limit of the instrument measurement range must be chosen to provide accurate measurements which might be limited by the noise floor of the data

[1] Huson, W.L.: Constraints imposed by and limitations of IEC 61672 for the measurement of wind farm sound emissions. 6th International Conference on Wind Turbine Noise, Glasgow 2015

acquisition device', then Background noise measurements should be repeated with sound level loggers capable of accurately recording sound levels lower than 28 dBA.

Sound level loggers capable of achieving measured results compliant with Class 2 AS IEC-61672 accuracy limits are readily available down to < 23 dBA. A typical sound level meter from Larson Davis states in its manual:

> The measurement ranges over which the Model 831 meets the standards, which depend upon the selected frequency weighting, as shown in 'Performance Specifications" on page A-4. Measurements which include levels outside this range should not be considered accurate. An overload indication will appear when levels above the range appear.
> However, the user should take care not to rely on measurements whose levels are below the lower limit of the specified range.

Equipment wind screens

Photographs of the equipment deployed to measure Background levels suggest that the type of wind screen used is the RION WS-15 Outdoor microphone protection system although the wind screen used at Dwelling 270 is not a RION WS-15. The Sonus report does not disclose the type of wind screens used.

SA 2009 states:

> Microphones should be protected with windshields in accordance with the microphone manufacturer's instructions, and the protection should be sufficient to ensure the noise level threshold of the monitoring equipment does not adversely affect the data used in the analysis. If microphones cannot be appropriately protected then affected data should not be collected.
> As part of the development application, developers should confirm that the reported noise levels are not influenced by high wind speed across the microphone, particularly where wind speeds at the noise measurement position are expected to exceed 5 m/s (a high wind speed for the purposes of noise level measurement conditions). It is permitted to report noise measurement data at higher wind speeds if they have been taken with special windshields. The windshield performance should be confirmed by sufficient technical information proving accuracy of such measurements.

RION provide the following for their WS-15 wind shield:

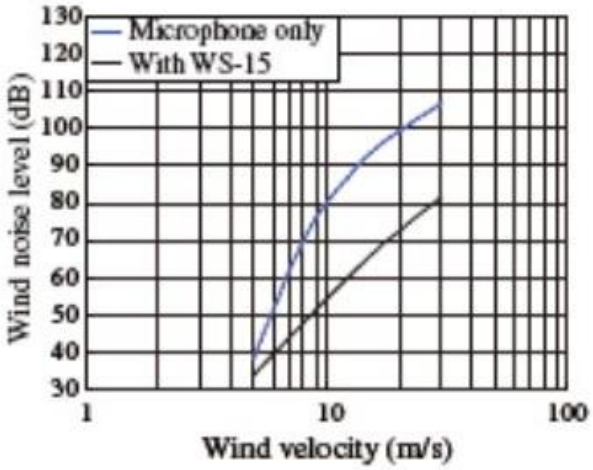

Fig. 12-1 Frequency weighting A

Extrapolating the local wind speed velocity to 4 m/s it is expected that wind generated artificial noise on the microphone is 30 dBA. Such influences on the measured Background noise measurements are required by SA 2009 to be addressed in the development application (EIS).

The Sonus report states that measured sound levels in local wind speed above 5 m/s were discarded but the report does not describe how the wind speed below 5 m/s affects the measured results. For equipment using the WS-15 wind screen it would be appropriate to correct measurements with local wind speeds around 4 m/s generating artificial noise around a level of 30 dBA, as described in SA 2009 as follows:

> If wind data from the single wind speed monitor are not representative for all of the noise monitoring locations, the wind speed should be measured separately at each of the locations. This information would then be compared with both the collected data for that interval and the manufacturer's specifications for the windshield performance under those conditions:
> • Where manufacturers' specifications indicate that wind induced noise on the microphone is 10dB(A) or more below the background noise, the data is acceptable.
> • Where manufacturers' specifications indicate that wind induced noise on the microphone is 10dB(A) to 4dB(A) below the background noise, the affected data may be retained with the wind induced noise subtracted from the measured background.
> • Where manufacturers' specifications indicate that wind-induced noise on the microphone is within 4dB(A) of the affected data, the affected data should be discarded and the data should be re-analysed. If the procedure causes the regression curve to change significantly, then additional data will need to be collected within an improved wind screen.

Data from only two local wind speed measurement locations have been used for the four Background survey locations. No microphone height local wind speed measurements were taken for Background measurements at Dwellings 219 or 270. It is questionable if microphone height wind speeds at Dwellings 6 and 29 are representative of wind speeds across microphones at Dwellings 219 and 270.

Background Data Filtering

The Sonus report explains that Background data has only been presented from cut-in wind speeds at the chosen met mast at hub height at 3 m/s to 12 m/s. The upper limit of 12 m/s has been chosen assuming that the text from SA 2009; 'wind speed of rated power' means the lowest wind speed at which rated power is achieved, not the rated power at which the WTG can operate. The WTG can operate in wind speeds from 3 m/s to cut-out, which is typically around 25 m/s.

The Sonus report puts forward the argument that compliance is only considered over 'at least the range of wind speeds from cut-in to rated power of the WTGs' and interprets that this means the minimum wind speed at which rated power is generated. I disagree. Trend line analyses extending beyond the minimum wind speed at which rated power is achieved is important since higher wind speed data points can significantly influence the trend line. The Sonus report has been selective in not providing reference to the following.

SA 2009 states (my underlining):

> Background noise is measured at relevant receiver locations at continuous 10-minute intervals and particularly over the range of wind speeds at which the WTGs operate.

The Victorian Supreme Court case in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren)** decision recognised the approach suggested by Sonus as being inappropriate noting that limiting the higher wind speed data is unnecessary since the same elevated Background data at higher wind speed is effectively considered in the Background plus 5 dB method used in setting noise limits.

Noise model predictions

SA 2009 states:

> Noise Model
> A conservative approach should be used for predicting wind farm noise by calculating noise levels in octave bands from at least 63 to 4,000Hz to determine an overall predicted level and using the following inputs:
> - atmospheric conditions at 10ºC and 80% humidity,
> - weather category 6 (if CONCAWE method is utilised),
> - hard ground (zero ground factor).

The NVA has not used all of these input parameters. In a recent decision of the Victorian Supreme Court (**Uren**) relating to wind turbine noise the expert representing the wind farm (Mr Turnbull of Sonus Pty Ltd) incorrectly interpreted "the method for assessing wind farm noise prescribed" and the interpretation was accordingly not accepted by Judge Richards. It would be inappropriate for the Sonus NVA noise model to use input parameters other than those required in the SA 2009 guidelines.

Noise models produce sound pressure level output predictions based upon sound power levels (SWL) input to the noise model and various factors that address sound propagation from each sound source (WTG at hub height) to receiver dwellings. SA 2009 requires weather category 6 to be used in CONCAWE with particular atmospheric conditions and a parameter defining reflections from the ground (zero ground factor which means the ground is fully reflective of sound).

Sound predictions can also be penalised if dB(C) predicted levels exceed 60 dB(C) or if tones are observed in measured test data.

Sound Power Level (SWL)

SA 2009 states:

> The sound power level data at wind speeds from cut-in speed to the speed of rated power and each integer speed in between should be specified in the development application as determined in accordance with International Electrotechnical Standard IEC 61400−11. The sound power level determined in accordance with other relevant standard or procedure might be acceptable for the purpose of the guidelines.
> At the time of development application, the contractual arrangements for a particular WTG model may not have been finalised between the developer and WTG supplier. If the WTG model to be installed differs from that indicated at the time of development application, the developer should assess and discuss the effect on the propagation model with the EPA.

The last sentence from the extract above can be problematic if the applicant Neoen plans to change the candidate WTG for final construction. If Neoen are considering alternative WTGs then they should include those in the EIS NVA. Neoen should have sufficient experience to firm up on their WTG choice and understand the extent of altered layout that may be required. Each of the alternative 'final design' parameters should be included in a NVA report.

The SWL data included in the NVA has not been referenced to come from any IEC61400-11 independent measurements. The NVA states that IEC61400-11 test report tonality data was unavailable for the Vestas V162 6MW WTG. To consider the validity of the SWL data listed in the NVA it is a requirement that an alternative measurement standard or procedure should be offered for consideration in the EIS. This has not been done.

Tonality

No predictive correction penalty has been applied to the SWL of the candidate WTG for tonality. However, recent Vestas installations of their WTGs has demonstrated tonal noise emissions, as measured by Sonus at the Salt Creek Wind Farm for the Vestas V126 3.6MW turbines using the 1/3 octave band assessment method used in this EIS, that were not considered in earlier predictions for development approval.

The tones were identified in hub height wind speeds between 3 m/s and 7 m/s which are below the minimum wind speed of rated power. The Vestas V126 and V162 share the same proven underlying mechanical platform development. The Vestas website:
https://www.vestas.com/en/products/enventus-platform/v162-6-2-mw
describes the sound power level for the V162 6.2 MW turbine as:
"With a standard Sound Power Level of 104.8dB(A) and up to 30 percent higher energy production than the V150-4.2 MW™, the V162-6.2 MW™ establishes a new benchmark in competitiveness."

This is 0.5 dB higher than the data used by Sonus in the NVA.

It is of interest to note that there is no V162 6MW WTG listed as a current product on the Vestas website so that could explain the lack of an independent IEC61400-11 test report. V162 6MW WTGs are being installed currently in Finland but the current offering from Vestas is the 6.2MW WTG.

If tonality has been demonstrated to be a problem below rated power output of Vestas WTGs then it would be appropriate to insist on a proper IEC61400-11 test report to be provided with this application.

If tonality is demonstrated just below the wind speed of rated power then a 5 dB penalty would be applicable to predicted sound levels.

If an IEC61400-11 test is unavailable for the proposed WTG then an alternative that has such a test should be offered as candidate. It is not uncommon for a WTG manufacturer to offer predicted SWL data rather than measured SWL data but in such circumstances it would be appropriate to add some measure of uncertainty in the predictions.

The Vestas V162-6.2MW WTG has yet to be installed at any wind farm. The first installation is due to commence in the second quarter of 2022 in Finland:
https://www.globalenergyworld.com/news/sustainable-energy/2021/07/02/vestas-wins-192-mw-order-finland-increases-rating-v16260-mw-enventus-turbine-62-mw

The V162 6.2MW WTG is as yet unproven. The V162 6.0 MW WTG will probably see commercial operation at a wind farm in Finland by the end of the first quarter of 2022:
https://www.globalenergyworld.com/news/sustainable-energy/2020/12/08/vestas-debuts-new-v16260-mw-turbine-winning-74-mw-order-two-projects-finland

Without an IEC61400-11 test report it is not possible to evaluate tonality or provide confidence to predicted sound power levels.

From the Bulletin:

SA 2009 requires that development applications for wind energy projects report the following:

> "To help determine whether there is tonality, the method and results of testing (such as in accordance with IEC 61400−11) carried out on the proposed WTG model to determine the presence of tonality should also be specified in the development application."

In NSW, in addition to the SA 2009 requirements, for both environmental assessment and compliance purposes, the presence of excessive tonality (a special noise characteristic) shall be consistent with the methodology described in ISO 1996.2: 2007 Acoustics - Description, measurement and assessment of environmental noise – Determination of environmental noise levels (Annex D – Objective method for assessing the audibility of tones in noise – Simplified method). Tonality is defined as when the level of one-third octave band* exceeds the level of the adjacent bands on both sides by:

5 dB or more if the centre frequency of the band containing the tone is in the range 500 Hz to 10,000 Hz;

8 dB or more if the centre frequency of the band containing the tone is in the range 160 Hz to 400 Hz; and/or

15 dB or more if the centre frequency of the band containing the tone is in the range 25 Hz to 125 Hz.

Sonus only used the 1/3 octave band method, not that of IEC61400-11preferred by SA 2009.

Ground Effect

The Sonus NVA has use *soft ground* as an input parameter in the CONCAWE noise model.

An example prediction at a range of 500m is shown in CONCAWE. With hard ground the predicted sound level can be >10dB higher than if soft ground is used. An example calculation from CONCAWE is shown below (worked example 1 from section 5.3 in CONCAWE).

The Ground Effect correction factor K3 is determined from a set of equations or from a chart in Figure 1 in CONCAWE. If hard ground is used then K3= -3.

The predicted sound level is determined by subtracting different factors K1 to K6 from the WTG sound power levels. The effect of using hard ground compared to soft ground is to increase the predicted sound level in octave bands by values of + 3dB to +14 dB in this example, depending upon the octave band chosen.

For the most influential octave band of 500 Hz for wind turbine sound emission and propagation we see that at 500m the use of soft ground compared to hard ground is to change the predicted sound level by 11 dB (8 dB reduction to 3 dB increase). For 500 Hz the same attenuation value (K3) for soft ground also extends out to 2000m.

DESCRIPTION			dB(A)	Octave Band Centre Frequency, Hz						
				63	125	250	500	1k	2k	4k
Plant Sound Power Level		L_W	118	127	123	120	113	111	112	108
Directivity	(Omnidirectional source)	D		0	0	0	0	0	0	0
Geometrical Spreading	(d = 500 m)	K_1		65	65	65	65	65	65	65
Atmospheric Attenuation	(Temperature = 10 deg C, Humidity = 75%)	K_2		0	0	0	1	2	3	10
Ground Effects	(Figure 1)	K_3		0	5.5	11	8	4.5	2.5	1.5
Meteorological Correction	(Vector wind speed + 2 m/s Pasquill Stability Factor D, Category 5)	K_4		−1	−2.5	−3.5	−4	−4.5	−3	−4
Source Height Correction	(Source at 1.5m)	K_5		0	0	0	0	0	0	0
Barrier Attenuation	(3m high wall, 10m from source)	K_6		5	6	7	10	11	14	17
		ΣK		69	74	79.5	80	78	81.5	89.5
		L_P	40	58	49	40.5	33	33	30.5	18.5

Worked example 1 from section 5.3 in CONCAWE

CONCAWE is an empirical noise model and predicted results can be overly optimistic if soft ground is used to represent the K3 correction factor, as has been done in the Sonus NVA noise model.
The NVA incorrectly used soft ground in the noise model, contrary to the requirements of SA 2009.

In summary, the CONCAWE noise model must be recalculated using 'hard ground' as required in SA 2009 before a valid assessment can be made of the noise impact of this development.

Low frequency noise
A noise model re-calculation will also affect the low frequency noise assessment in terms of dB(C). Predicted dB(C) levels are dominated by sound power levels in the 250 Hz octave band. From the example shown in CONCAWE at 500m above, in this 250 Hz octave band the predicted dB(C) level will increase from an attenuation of 11 dB with soft ground to an increase in level of 3 dB with hard ground. Thus, the predicted dB(C), with a change from soft ground to hard ground in the CONCAWE example above, is an increase of 14 dB.

The margin of compliance in the Sonus NVA is only 10 dB for non-associated dwelling 29.

For distances representative of dwellings to the proposed WTGs the 250 Hz ground effect value K3 for soft ground increases to 15 dB (at 2000m) from 11 dB (at 500m), which would change the predicted dB(C) level by +18 dB compared to that listed in the NVA. This will demonstrate non-compliance with the low frequency limits imposed in the Bulletin that then requires a 5 dB penalty to predicted noise levels in the NVA.

Summary

General
The EIS has stated that "once the detailed design is complete, a pre-construction noise assessment will be made based on the final WTG model selection, layout, guaranteed sound power levels, consideration of tonality and low frequency noise from the WTGs, and final agreements with landowners." The EIS has not considered the effect of different layouts or details for the current or other wind turbine candidates. Also, there seems to be an additional property to the south of shed ID30 that needs to be considered.

In my opinion, an EIS must address all of these possible changes before any EIS is approved. If the changes suggested are not considered in the EIS then the EIS is deficient, incomplete, should be considered premature and must not be approved.

Technical consideration of the cumulative effect of the Winterbourne wind farm should be included in the NVA, as required in the SEAR.

Background Noise Measurements
For the reasons identified and detailed in this review there are concerns over wind speed measurements used in the Background noise scatter charts and the adequacy of sound level measurement equipment used (poor sound level meter low level performance and corrections required for wind noise caused by the wind screens below 5 m/s). Derived target noise limits are artificially elevated due to the poor performance of the equipment used and the scatter charts have been incorrectly limited to a maximum wind speed of 12 m/s.

In my opinion the Background sound levels need to be repeated with improved sound level meters that must have a wind speed measurement near to each microphone location. The wind speed measurements representing wind across the proposed wind farm should be located where there is no potential influence from subsequently constructed wind turbines that can cause errors due to wake effects.

The wind speed measurements must comply with the uncertainty requirements of SA 2009 at hub height.

The location of the wind met mast used to provide data in the NVA needs to be checked.

The NVA has not provided information to demonstrate that background noise data is representative of other times of the year.

Noise Model

I have detailed the deficiencies of the CONCAWE noise model input parameters used in the Sonus NVA.

The deficiencies relate to unverified sound power levels and the incorrect application of the Ground Effect term in the recognised CONCAWE noise model, as specified in SA 2009.

The NVA significantly underestimates the noise impact in the community surrounding the proposed wind farm.

The noise model should be re-calculated with the correct 'hard ground' term K3 set to -3.

In addition, a sensitivity analysis is required of any alternative layout and different candidate wind turbine generator (WTG) using test results rather than predictions.

The predicted dB(C) levels should also be reviewed together with possible tonal qualities of the candidate WTG.

The EIS should confirm the availability of the candidate WTG. The currently available 6.2MW Vestas V162 has a published sound power higher than that used in the NVA.

Negotiated Agreements

Evidence of any negotiated agreement for dwelling 270 and others should be provided to show how any adverse noise issues have been addressed.

Yours sincerely,

W Les Huson BSc(Hons) MSc CPhys MInstP MIoA MAAS MEIANZ

Referenced paper attached.