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ACOUSTIC REPORT

Lal Lal Wind Farm Planning Permit SP/05/0461
Amendment Application October 2015

Report Prepared for

Pointon Partners

Instructing Solicitors on behalf of

Lal Lal Environment Protection Association Inc

Prepared by

Raymond Tumney, BEng, MEnvStud
Principal Consultant

2016-002.401.1 Lal Lal Peer Review.Docx**, October 2016**

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30 October 2016

Lal Lal Environment Protection Association Inc
C/- Pointon Partners
Level 14, 565 Bourke Street,
Melbourne, Victoria 3000

Attention: Andrew Cox

ACOUSTIC REPORT
LAL LAL WIND FARM PLANNING PERMIT AMENDEMENT OCTOBER 2015

1 DECLARATION

1. I Raymond Clifford Tumney, of 6 Johnson Street, Kotara NSW. hereby declare that I have been provided with the Planning Panels Victoria | Guide to Expert Evidence, that that I have read the Guide and that this report has been prepared in accordance with that Guide.

2. Pursuant to the Guide, experts are required to include the expert's qualifications. Mr Ray Tumney's qualifications are attached as Appendix A.

3. I am the Principal of Tumney Consulting Pty Ltd which is a company specialising in Environmental Acoustics. I have a total of 30 years' experience as a senior acoustic consultant and an industrial engineer, where I have been responsible for engineering noise control for many types of plant and equipment and for predicting evaluating and managing environmental noise impacts from a wide variety of development types.

4. I have been instructed by my client to prepare a peer review of the noise impact assessment prepared by Marshall Day Acoustics (the MDA Report) for the proposed Planning Permit Amendment documented by Jacobs in this planning matter. In particular, I was requested to address the modelling conducted by MDA in respect of its accuracy and whether or not it correctly indicates the likelihood that the wind farm is likely to achieve compliance with the Planning requirements.

2 REFERENCES

5. In preparing this report I have relied on the following documents:-

   a) Lal Lal Wind farm Noise Assessment Marshall Day Acoustics Report No 001 R01 2007344 5 Feb 2008.

b) Lal Lal Wind Farm NZS6808:2010 Noise Assessment Marshall Day Acoustics Report No 002,

c) Letter Marshall Day Acoustics Lt 001 2010178ML 4 April 2011

d) Letter Marshall Day Acoustics Lt 002 2010178ML 4 April 2011

e) Lal Lal Wind Farm Permit Amendment Application Jacobs 15 August 2016

f) New Zealand Standard NZS 6080-1998 Acoustics- The Assessment and Measurement of Sound from Wind Turbine Generators

g) New Zealand Standard NZS 6080-2010 Acoustics- Wind Farm Noise

h) International Standard ISO 9613-2 Acoustics – Attenuation for Sound During Propagation Outdoors- Part 2 General Method of Calculation.

i) International Standard IEC 61400-11 3rd edition Wind Turbines – Acoustic Noise Measurement Techniques.

j) Evans T and Cooper J, Comparison of Predicted and measured Wind Farm Noise levels and Implications for Assessment of New Wind Farms, Acoustics Australia Vol 40 April 2012 PP 28-36

k) Tickell, C. Ellis, J. Bastasch, M. Wind Turbine Generator Noise Predictions – Comparison of Computer Models. Proceedings of Acoustics 2004, 3-5 November 2004.

l) Summary of Results Extract DNV GL Report GLCH-4286 14 12058 293-S-0002-A.

m) Noise From Industry In Regional Victoria Publication 1411 October 2011 Authorised and published by EPA Victoria, 200 Victoria Street, Carlton

3 INTRODUCTION

6. This report provides my expert opinion into the accuracy and adequacy of the noise assessment prepared by Marshall Day Acoustics (MDA) and whether the report and supplementary information can be considered to demonstrate that the Lal Lal wind farm will comply with the requirements of NZS 6808-2010 and the relevant Victorian Noise guidelines.

7. In making an evaluation of the assessment by MDA there are four main features of the assessment that I will consider:-

    a. Has the background sound level been correctly determined in accordance with the required Standard,

    b. Does the mathematical modelling that has been used in the assessment adequately represent the noise levels that are likely to occur at residences that will be affected by the operation of the wind farm.

    c. Has a sufficient degree of consideration been given to the tolerances and uncertainties within the noise prediction and assessment process to ensure that an adequate level of confidence exists for the protection of the affected noise sensitive receivers,

d. Has adequate and appropriate consideration been given to any 'Special Audible Effects' as defined in the standard that may arise because of the operation of the wind farm.

4 BACKGROUND SOUND LEVELS AND NOISE LIMITS

8. Both NZS 6808 -1998 and NZS 6808 – 2010 require long term measurement of background sound levels referenced to wind speed at the wind farm location and then the use of a regression curve to establish the average background at the receiver locations for a given wind speed at the wind farm.

9. There is a sound logic to this approach because the local wind speed at the receiver points may not be the same as that at the wind farm due to a range of factors that include local topography, wind direction, and local shielding The local wind speed at the receiver will have a significant influence of the background sound level used for the assessment and the local wind speed at the wind farm will have a significant effect of the sound output from the wind turbines.

10. Clause 4.5.5 of NZS 6808-1998 states that:-

> *Background sound levels shall be correlated with the wind speeds at the windfarm of WTG site. A regression curve shall be used to describe the average background sound level vs wind farm speed relationship. It may be necessary to separately correlate background sound levels with wind speed from different directions and different times of day.*

11. Section 7.4 of NZS 6808-2010 adds a number of significant additional requirements over and above those in the 1998 version of the standard.

12. The additional requirements are as follows:-

    a. Measurement of Wind Speed at Hub Height rather than just at the wind farm site,

    b. A requirement for more detailed analysis of the wind data to determine if there are individual data sets that should be considered separately,

    c. A requirement for further investigation of wind speed and sound levels if the regression fit is poor,

    d. A requirement to use the most stringent regression fit (ie that indicating the lowest sound levels) if it is not practical to accommodate the different wind conditions at the wind farm.

13. In their original report (001 R01 2007344) MDA correlated the background sound data with a 10 metre above ground wind speed at the wind farm site. In report 002 2015386ML Sept 2015 MDA have sought to rely on the original data and have not updated the background information to reference the sound levels to the Hub Height wind speed as required by NZS 6808-2010. The failure to update the data means that the regression lines used to determine the average background sound level at the receivers will be incorrect and so the background sound level representative of the wind farm operating speeds will be incorrect.

14. Clause 7.4.3 of NZS 6808-2010 states:-

If there is poor correlation between the wind speed and the sound level, further investigation of wind conditions should be undertaken, possibly indicating wind flow modelling, local knowledge, site observations or local wind monitoring.

15. Comment C7.4.3 of NZS 6808-2010 states:-

A poor correlation between wind speed and sound levels does not necessarily indicate a poor analysis, as under some circumstances the wind conditions at the wind farm may be different from those at the noise sensitive locations. In this case it is possible that Turbine sound is not masked by local wind effects…… However, this conclusion can only be formed after the wind conditions are well understood.

16. In the context of the Standard it is important to appreciate what a good correlation is and what a poor correlation is that would require more work to establish a representative relationship between the Local Background sound at a receiver and the Hub Height wind speed at the wind farm.

17. A regression line is a mathematical representation that may be developed from statistical data to allow engineers and scientists to reliably use a mathematical equation to represent varying physical conditions. The coefficient R^2 is an indicator of how well the mathematical model is likely to represent the physical condition while the Variance or Standard Deviation which are also derived as part of the development of the regression equation give an indication of the likely spread of results calculated using the regression line and are used to develop confidence intervals (ie limits within which predicted values might lie) which provide an indication of the level of accuracy of the model.

18. A good regression fit (ie one that can be relied upon to represent actual conditions when calculated using the derived model) will have an R^2 coefficient value of 0.9 or higher. Lower values of R^2 mean progressively less accuracy in the representation with higher and higher ranges of uncertainty. In my experience (regression fits with R^2 values below about 0.8 are very poor in terms of their ability to accurately predict a data set. Regression line fits with R^2 coefficients of 0.7 or below are not only essentially useless in terms of predicting a data set but are positively misleading.

19. In their assessment under NZS 6808- 2010 MDA seek to rely on the background / wind speed data published in their 2008 report and the data in two letters from 2011. I have reviewed the background noise / wind speed data provided in the MDA information and most of the data has regression coefficient (R^2) near or below 0.5 with only one data set (K34AA2011) showing a value that might make the regression fit a useful tool for establishing background sound levels at turbine operational wind speeds.

20. Under these circumstances NZS 6808-2010 requires further investigation of wind conditions to establish local backgrounds at the receivers and without that information an assessment background sound level for turbine operations cannot be established, the noise level limits for the receivers cannot be set and an assessment of compliance or otherwise cannot be made.

21. NZS 6808-2010 requires the consideration of High Amenity areas based on New Zealand Planning provisions and MDA seeks to interpret that in relation to a Victorian Planning Practice Note dated March 2007. My research has found that the planning note to which MDA appears to refer has been superseded by Planning Practice Note 42 dated June 2015 which contrary to the MDA interpretation states that people within the zone are entitled to have their amenity protected but not to the detriment of the conduct agricultural activities. Since a wind farm does not qualify as an agricultural activity I see no justification in the 2015 Practice Note for not considering high amenity areas as set out in the NZS 68080-2010 Standard.

22. It would be usual to consider high amenity areas as those with little influence from urban and other anthropological noise sources and having background sound levels below 35 dB(A). In my opinion and based on my understanding that the area is predominantly used for grazing then much of the area around Lal Lal Wind Farm would fit the requirement for assessment as a high amenity area.

23. Section 5.3.1 of NZS 6808 sets out the conditions under which a high amenity noise limit would be applied as:-

> *"Ä high amenity noise limit should be considered where a plan promotes a higher degree of protection of amenity related to the sound environment of a particular area, for example where evening and night time noise limits in the plan for general sound sources are more stringent than 40 dB(A)….."*

24. It is significant that NZS 6808 directs the assessor to consider standards outside the Wind Farm guidelines to determine the applicability of a High Amenity acoustic standard and in my opinion this approach is valid in Victoria.

25. In Victoria and specifically the area around Lal Lal which, is in Moorabool Shire, the applicable planning document is *Noise From Industry In Regional Victoria*. Table 1 of that document (Appendix E) provides that sound emission from a Faming Zone to all zones other than industrial zones has night time sound level limits between 33dB(A) and 38dB(A) and evening limits for emissions to Rural Living Zones of 38dB(A). This is consistent with the example in NZS 6808 that a high amenity area would be one with noise limits for "general noises" below 40 dB(A).

26. Accordingly, the areas surrounding the Lal Lal Wind Farm would be high amenity areas as intended by the New Zealand Standard. This is consistent with my professional experience in rural areas where ambient levels in the evening and night time are usually well below 30 dB(A).

27. I am of the view that MDA has failed to correctly consider the requirements in NZS 6808 in respect of High Amenity areas and incorrectly discounts the use of "High Amenity Criteria" which should apply to the area. Both "Noise From Industry In Regional Victoria" and "Planning Practice Note 42" require a position different to that adopted by MDA.

28. It is my opinion that this aspect of the MDA assessment is not in accordance with NZS6808-2010 and, therefore, the MDA noise assessment fails to adequately consider the limitations on noise impacts required by the ambient noise climate and does not provide support for the amendment application.

5 PREDICTION OF RECIEVED NOISE LEVELS.

5.1 ACCURACY OF THE PREDICTIVE MODEL

29. Obtaining accurate predictions of expected noise impacts from a wind farm, or any other noise source, a suitable noise modelling algorithm that accurately reflects the behaviour of the sound as it propagates out from the source must be available and must be correctly applied.

30. As a starting point all sound propagation models begin with a basic mathematical equation that describes the attenuation of sound as a result of geometric spreading. Geometric spreading is the application of basic physical equations and considers the reduction in sound intensity only as a function of distance from the source, and in the absence of all other environmental parameters that attenuate sound, such as ground reflections, barriers and atmospheric attenuation.

31. The mathematical sound modelling protocols that are available for use have all been developed from the basic geometric spreading model by adding additional attenuation terms to the mathematical model to account for environmental variables.

32. For each modelling protocol the extra attenuation terms have been developed using empirical measurements, under a defined set of conditions, to provide attenuation parameters that are arithmetically added to the losses determined by the geometric spreading equation. It is the additional attenuation terms that represent the differences between various models and also account for whether a model accurately represents the propagation conditions and the sound source under consideration.

33. Because of the physical difficulties in doing the empirical measurements each of the modelling protocols has been developed within specific constraints relating to a number of variables. The variables include things such as:-

    a. Location of the source and receiver (Particularly the height above ground),

    b. Geometry of the source (whether it has directional characteristics or is too large to be considered a point source),

    c. Distance over which the measurements are made,

    d. Number and types of atmospheric and other conditions that can be tested.

    e. Type of ground over which the test sounds travel,

    f. Local topography,

    g. Accuracy of measurement,

    h. Prevailing weather conditions.

34. Although most models are applicable to many circumstances, each will usually require adjustments to suit the particular conditions under evaluation. Not all models are suitable for all sources and propagation conditions because, the conditions under which a particular model was developed may not adequately represent the sound propagation conditions that are being examined in the given circumstances.

35. Tickell et al [ref k] examined 10 modelling protocols for wind turbine sound propagation and found a spread in predicted results of 30 dB(A) for typical distances of between 800 and 2000 metres from the source. So it is imperative that the correct model is applied and the appropriate corrections and modifications made to the model.

36. To date the most useful study in Australia in respect of modelling sound propagation from wind turbines that I have found is the study by Evans and Cooper [ref i] which compared predicted received sound levels with actual measured levels across a number of wind farm sites and conditions with different topography and with different settings applied to the modelling protocols. The study had a significant focus on the use ISO9613 -2 which is the model applied by MDA in their assessment of Lal Lal Wind Farm.

37. ISO 9613-2 presents a sound prediction model that is intended for typical industrial noise sources and receiver heights above ground and the Standard states that it is applicable over flat or slightly sloping ground. Table 5 of the Standard sets limits for the accuracy of the model for propagation

heights up to 30 metres and for distances between 100 and 1000 metres of +/- 3dB. Outside those parameters the accuracy of the model is not defined. There is also increasing inaccuracy in the model if the ground is not flat or slightly sloping as defined in the standard.

38. The ISO9613 model is based around the assumption that attenuation of the propagated sound due to ground reflections occurs primarily due to reflections of sound from the ground that occurs close to the source and receiver. The standard defines ground reflection zones near the source and receiver that predominantly cause ground attenuation as a function of the source and receiver height. Accordingly, if the propagation height (average height between source and receiver) is significantly larger than set out in the standard and / or the ground is not flat, the ground reflections anticipated by the model do not occur as predicted in the model and the expected attenuation due to interactions between the sound and the ground do not arise. Under those circumstances the model will under estimate the received sound levels.

39. The data provided in Evans and Cooper shows two distinct trends in the use of the ISO 9613 model.

    a. Using a Ground Absorption factor of 0.5 for wind turbines will be accurate over flat ground up to distances of between 500 and 700 metres, however, over that distance it trends to increasing under-prediction as the distance increases.

    b. The use of a Ground Absorption factor of 0.5 where the topography of the ground profile close to the source (within 30 times the source height) is not flat or gently sloping under predicts the received noise level by 3.5 dB at 800 metres increasing to an under-prediction of 5 dB at 3000 metres.

40. Evans and Cooper also showed that using a Ground Absorption Factor of 0 (Zero) under the same conditions over predicts the received noise within 500 – 700 metres from the source when the ground is flat but accurately predicts the received sound levels when the ground is not flat or is concave. They also found that using a Ground Absorption Factor of 0 (Zero) is more accurate than using a Ground Absorption Factor of 0.5 over distances above 800 metres.

41. Hard baked soils without substantial vegetation cover, as tend to occur in summer in Australia, would be regarded as reflective ground conditions and a Ground Absorption Factor of 0 (Zero) should be used under those conditions.

42. I have examined the topography around the Lal Lal Wind Farm and, in many locations, the topography is concave from the wind farm to the receivers. I have included in Appendix B marked up copies of topographic maps obtained from the Victorian Lands Department interactive website showing the locations of wind turbine sources and receivers and the areas where the ground between the two would be considered concave having regard to the wind turbine heights.

43. The sound level predictions made in the MDA report are referenced from the nearest turbine and range between 800 and 1300 metres. The receivers are further away from most of the turbines than the values listed in Appendix B4 of the MDA report and the ISO 9613 model with a Ground Absorption Factor of 0.5 would under predict the noise levels received from most of the individual turbines and the total received noise level would, therefore, also be under predicted.

44. Since most of the receivers are much more than 800 metres from at least some of the turbines and, the topography is concave in many instances, it is my opinion that using a Ground Attenuation Factor of 0.5 in the ISO 9613 model will significantly under predict the received sound levels at most of the receivers that are affected by the Lal Lal Wind Farm. A Ground Absorption Factor of Zero (0) would be more accurate for the conditions at Lal Lal.

45. To obtain an accurate estimate of the actual received noise levels a model would have to be used that applies different Ground Attenuation Factors according to the distance of the receiver from the turbine and the interfacing ground profile. Most commercial sound prediction programs allow for this to be done by defining ground regions with different properties but MDA has apparently not done this in the model they have used.

5.2 CALCULATION TOLERANCES FOR THE ISO 9613 MODEL

46. When assessing the predicted noise levels from a sound modelling application it is normal practice to consider the stated accuracy of the noise model and to seek to ensure that the predicted received noise levels are at least below the target limit by the amount of the uncertainty in the model. In that way compliance with the limits is more certain. The predictive accuracy of ISO 9613 - 2 is stated as +/- 3dB so it would normal practice to seek a target predicted level of 37 dB (A) to meet a limit of 40 dB (A).

47. Based on Table 3 of the MDA 2015 report, 10 of the non-host properties would be likely to exceed the 40 dB limit based only on a consideration of predictive tolerance within the ISO 9613 – 2 Standard.

5.3 OVERALL ACCURACY OF THE PREDICTION

48. The inaccuracies identified by Evans and Cooper would appear to be due to applying the Standard model outside the parameters specified for the accuracy limits in the Standard and may be additional inaccuracies over and above the tolerances set out in the Standard. There is a potential for the two sets of inaccuracies to become additive when the ISO 9613-2 model is used to make a prediction where the precise operating conditions are not known as is the case when an application is being assessed during the planning process.

49. If the predictive inaccuracies identified by Evans and Cooper are added to the predicted levels in Table 3 of the MDA report, then none of the non-host properties would comply with the 40 dB (A) limit.

50. In my opinion it would not be unreasonable to conclude that the values in Table 3 of the MDA report are underpredictions of the A weighted received noise levels by no less than 4 dB(A) and possibly by as much as 6 dB(A) depending on the relational geometry between a given receiver and the turbines in the wind farm.

51. It is my opinion that the MDA report does not adequately demonstrate the ability of the wind farm to comply with the maximum limit in the Standard much less any lower limit that might arise as a result of a correct determination of background sound levels, the application of corrections for special sound characteristics, or the application of a high amenity criteria.

6 CONSIDERATION OF SPECIAL AUDIBLE CHARACTERISTICS

6.1 REQUIREMENTS OF THE STANDARD

52. Section 5.4 of NZS 6808-2010 requires that Wind Farms be designed so as not to have special audible characteristics and requires the addition of an adjustment factor of up to +6dB to the measured (or predicted) sound level at the noise sensitive receiver.

53. Clause 5.4.1 of the Standard recognises that special audible characteristics cannot always be predicted but this is not to say that they are never predictable with an appropriate amount of professional consideration.

54. The special audible sounds that are provided as examples is the NZS 6806-2010 Standard are:-

    a. tonality,

    b. impulsiveness, and

    c. amplitude modulation.

55. The sound characteristics listed above are common characteristics that are associated with many types of industrial noise sources and the corrections applied in NZS 6860 are like those applied for general industrial noise.

56. The characteristics listed in NZS 6808-2010 are not the only special audible characteristics that can occur in industrial sound and excessive low frequency sound is another critical characteristic that is not discussed in the Standard. Never the less the issue of Low Frequency sound remains a subject of concern in many industrial noise situations and its absence from the Standard does not, in my opinion, obviate the need, nor MDA of their professional responsibility, to consider it and make appropriate comment.

57. The characteristics listed in the standard are, however, the most likely to occur due to the operation of a wind farm and, in my opinion, there is a reasonable probability of their presence being predicted in advance, once the character of the sound source is determined and the geometric distribution of multiple sources understood. It is, therefore, vitally important that a professional, who assesses the special audible characteristic listed in the standard consider all the relevant factors.

6.2 TONALITY

58. Section 7.1 of the MDA report dismisses the consideration of "Special Audible Characteristics" on the basis of the report that provides A- Weighted Sound Power Level for the Turbine (SD-3.2-WT.PC.00-B-D-EN) and provides a guarantee of absence of tonality in accordance with IEC 61400-11 above a wind speed of 6 m/s at a 10 metre height.

59. I have reviewed data supplied by the applicant in DNV GL Report GLCH-4286 14 12058 293-S-0002-A, which is a sound emission report for the Senvion 3.2M114VG turbine. Page 3 of the report shows that there is a clear tone at 98 Hz under the 8 metre per second wind and 9 metre per second wind speed bins. The sound emission report identifies a tone at 98 Hz that is to be "reported" (meaning that it may be significant) in accordance with the IEC Standard in the 8 metre per second wind speed bin.

60. The IEC Standard states that its purpose is to provide a reliable and repeatable method of collecting and reporting data and states that interpretation and assessment of that data in terms of its effect in the environment is for others.

61. Audibility of a tone under the IEC Standard is defined as a function of the level of the ambient masking sound. At the distance where the assessment of tonality is made (151 metres) the ambient sound signal that masks the tone includes the operating noise signature of the turbine and the local wind conditions at the wind farm. The 98 Hz tone when calculated in accordance with the IEC Standard is identified as being not audible due to masking by the sound from the turbine and the local wind conditions.

62. It is not the case that the turbines and, therefore the wind farm, are guaranteed to be free from tones and this concept, as presented by MDA, is misleading. The assessment under IES 61400 simply means that, when assessed under the IEC Standard, the tones are considered adequately masked by the sound from turbine operation and the wind at the wind farm when measured at the specified test distance.

63. The question that arises and, which has not been addressed by MDA, is whether the tone becomes audible (and annoying or offensive) at greater distances from the turbine because of the change in the masking signature due to changes in local conditions.

64. To provide an answer to that question I have taken the sound emission level from the turbine at 98 Hz and calculated the received sound level from a single turbine at 800 metres using the attenuation conditions from ISO 9613.

65. The calculated un-weighted received sound pressure level at 98Hz, at 800 metres, from a single turbine is 54.4 dB and the A-weighted received level for that tone at the same distance is 38.2 dB.

66. The received sound level from the entire wind farm will be substantially higher than 54.4 dB for the 98 Hz tone and needs to be determined and addressed by MDA. It cannot be dismissed on the basis the DNV GL report.

67. A further matter that is ignored by MDA is whether the tone is audible within a dwelling at night when there is little masking sound.

68. Typical sound level reduction as sound of that frequency travels though building elements into a lightweight dwelling (weatherboard construction) is a loss of about 18 dB which leaves an internal sound pressure level of the tone inside the dwelling of 54 -18 = 36 dB. Again this will be higher from multiple turbines even without harmonic reinforcement or beating.

69. Based on listening tests conducted in accordance with ISO 389 – 7, sound in the 100 Hz 1/3 octave band is audible to 90 percent of the population at any level above 20 dB and so the 98 Hz tone from a single turbine will be audible within dwellings at night. The tone from multiple turbines will be at significantly higher levels and will be clearly audible within a dwelling and will be highly annoying.

70. In my experience the received sound pressure levels I have calculated for the turbine tonal noise at receivers are typical of levels at which people in quiet suburban and rural areas start to observe an adverse reaction to the sound and frequently leads to complaint.

71. It is clear to me that the wind farm will produce special audible characteristics that have not been assessed and which will require the application of adjustments to the predicted sound levels used in the MDA assessments. A reassessment of the noise taking into account the Special Audible Characteristics will lead to a lack of compliance with the target noise goals.

72. MDA makes no attempt to discuss other special audible characteristics which in my opinion and for the reasons outlined in the following paragraphs require consideration.

6.3 Nature And Charrier Of Wind Farms That May Give Rise To Special Audible Characteristics

73. The sound sources that make up a wind farm are generally not like most other industrial noise sources that need to be analysed and their effects predicted.

74. In a wind farm there are many relatively large and essentially identical sound sources spread over large distances. This is unlike most industrial development which, while it may have many sources, they are varied in nature and operating conditions and do not have similar sound output signatures.

75. It is essential to be aware of this phenomenon as industrial noise modelling adds the sound energy impacts of multiple sources together at a receiver location using an inherent assumption of "incoherent" addition. "Incoherent" addition means that the sound levels can be added together without considering the effects of harmonic sound wave reinforcement which, should it occur, can lead to more than a 10dB increase in the received sound level at the frequency that is representative of the sound emission signature of the equipment. If the sound sources are operating at slightly different speeds or are out of phase because of being different distances from the receiver, then amplitude modulation is introduced into the sound as a beat on top of the increase in sound level caused by the harmonic reinforcement. This amplitude modulation is readily detectable and is a highly irritating noise at residential receivers.

76. Harmonic reinforcement and amplitude modulation from industrial sound sources only occurs in a minority of cases in general industry because the presence of highly similar or identical sources is not common in most industrial situations. However, the issue is well known and occurs in enough situations for it to be identified as a matter for review in circumstances where there are multiple similar or identical high power sound sources.

77. Amplitude modulation due to harmonic reinforcement usually only becomes evident at a residential receiver when there is a reasonable amount of sound energy in the frequency bands below 250 Hz. A classic example of its occurrence is where two or more large exhaust fans discharge from an industrial process, and it also occurs with sound from coal washery plant where there are multiple vibrating screens operating simultaneously.

78. The addition of sound levels conducted using a commercial sound modelling package such as Sound Plan assumes incoherent sound addition and does not allow for the possibility of harmonic reinforcement or out of phase beating.

79. In my professional experience, I have dealt with a number cases where harmonic reinforcement of industrial noise has been a significant problem for residences at distances of 1000 metres or more and where the predicted received noise levels using standard methods were below 35 dB(A).

80. A wind farm is a collection of a very large number of identical sound sources operating in identical conditions over a large geographical area and the potential for amplitude modulation due to harmonic reinforcement is very high. Amplitude modulation due to harmonic reinforcement does not occur uniformly in all directions and is a function of the specific geometry of the sound sources.

81. In the case of the turbines proposed for Lal Lal there is a pronounced tone at 98 Hz (See Appendix D) in the sound emission signature and 98 Hz is in the frequency range where harmonic reinforcement regularly occurs and become problematic for nearby receivers. There is also sufficient sound energy in the tone (approximately 106 dB) to enable adverse sound characteristics to be generated.

82. At Lal Lal, West Wind proposes to have many uniform sound sources each providing significant tonal sound energy. It is inconceivable that harmonic reinforcement and beating because of out of phase harmonic interaction would not occur at one or more receiver locations during some operating conditions.

83. In my opinion this wind farm is a classic circumstance where amplitude modulation due to harmonic reinforcement during operation is highly probable if not almost certain and should it not escape the attention of the assessors.

84. In their report MDA make no mention of either Amplitude Modulation or Low frequency sound and in my opinion both should be considered in some detail. Neither of these Special Audible Characteristics can be addressed using an ISO-9613 model in a commercial sound modelling package and further specialist investigation is required.

85. If West Wind is not able to adequately determine the levels of modulation and the amount of time and number of locations where it is likely to occur because of the operation of the wind farm, then in my opinion it would be appropriate to add the 5 dB(A) adjustment specified in Appendix B3 of NZS 6806-2010 to the assessable sound level at each receiver.

86. The addition of the 5 dB adjustment would significantly increase the size of the 35 dB preliminary assessment noise contour and would, therefore, require assessment at many more dwellings than are in the current assessment.

7 CONCLUSION

87. In my opinion the proposed Wind Farm cannot comply with the requirement under NZS 6808 to be free from "Special Audible Characteristics" and requires the addition of an allowance for the presence of both Tonality and Amplitude Modulation.

88. The wind farm is likely to produce offensive noise within dwellings at night and may also cause problems during the day.

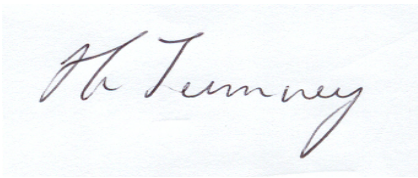
89. The area around Lal Lal is clearly a High Amenity area as set out in NZS 6808 and it is clear that the wind farm could not comply with a High Amenity Limit at nearby Non-Host receivers.

90. Overall I am not satisfied that the information provided by West Wind and MDA demonstrates that the proposed Lal Lal Wind Farm can comply with the noise limits and be operated without special audible characteristics as required by the Standard under which it is to be assessed.

Declaration

'I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been with held from the Panel.'

Tumney Consulting Pty Ltd



Ray Tumney BEng (Mech), MEnv Stud, MIEAust, MAAS.

Principal Acoustic Engineer

8 GLOSSARY

dB(A) Unit of sound pressure level, modified by the A-weighting network to represent the sensitivity of the human ear.

Gradient Wind Gradient wind is the regional wind determined by synoptic factors (high and low-pressure systems), and may originate from any direction.

SPL Sound Pressure Level (SPL), the incremental variation of sound pressure from the reference pressure level, 20 µPa, expressed in decibels.

SWL (L_W) Sound Power Level (SWL) of a noise sources per unit time expressed in decibels from reference level W_O of 10^{-12} W.

L_X Statistical noise descriptor. Where (x) represents the percentage of the time for which the specified noise level is exceeded.

L_{eq} Equivalent continuous noise level averaged over time on an equivalent energy basis.

L_1 Average Peak Noise Level in a measurement period.

L_{10} Average Maximum Noise Level in a measurement period.

L_{90} Average Minimum Noise Level in a measurement period.

L_{max} Maximum Noise Level in a measurement period.

Background Noise Level Noise level determined for planning purposes as the one tenth percentile of the ambient L_{A90} noise levels.

P_O Reference Sound Pressure, 20 µPa, for the calculation of SPL in decibels.

W_O Reference Sound Power, 10^{-12} W, for the calculation of SWL in decibels.

Appendix A

R Tumney Qualifications

RAY TUMNEY

Principal Tumney Consulting

ACADEMIC QUALIFICATIONS

Bachelor of Engineering, Queensland University of Technology, 1987.
Master of Environmental Studies, University of Newcastle, 1994.

MEMBERSHIPS

Member - Institution of Engineers Australia
Member - Australian Acoustical Society
Member - Society of Explosive Engineers

EMPLOYMENT

Present	Principal Tumney Consulting Pty Ltd
2010-present	Principal Acoustic Engineer, RCA Australia Pty Limited
2000-2010	Managing Director and Principal, Hunter Acoustics,
1999-2000	Noise Adviser, Hunter Region Office NSW EPA
1998-1999	Manager and Principal Acoustic Engineer, VIPAC Hunter Valley
1994-1998	Engineer, ADI Offshore Mine Hunter Project
1990-1994	Engineer, BHP Wire Division
1987-1990	Research Assistant, QUT Mechanical Engineering Department
1983-1987	Qld Development Manager, Franklins Limited

AREAS OF EXPERTISE

- Acoustic Engineering and Noise Control Design
- Environmental Noise Impact Assessments.
- Ground vibration Analysis and Assessment.
- Blast Impact Monitoring and Assessment.
- Policy and Guideline Development

EXPERIENCE

Over ten years professional construction and industry experience dealing with sound and vibration related issues as part of construction and industrial engineering work. Over 15 years' experience dedicated to professional acoustic consulting involving the preparation of hundreds of environmental noise impact assessments for a range of clients including industry developers and local government. Modelling and assessment of transport noise impacts for rail, road, and aircraft noise. Noise control design for industrial, commercial and transport developments. Policy and guideline development for local government and has acted as an expert witness in a number of and Environment Court Cases.

Has developed and presented training courses in sound and vibration impact assessment for Local Council and has presented a number of technical papers at the AAS technical meetings and conferences.

Industrial Noise

Industrial Noise Impact Assessment and Noise Control Design includes:

- Westfield Shopping Centre Kotara.
- Martins Creek Quarry.
- Armidale Water Treatment Plant.
- Newcastle Airport Terminal Extension and Car Rental Facilities.
- OneSteel (formerly MetalCorp) Recycling Hexham, Chipping Norton and Adelaide.
- Desalination plants for Wyong.
- Apollo Hotel extensions.
- LMCC Materials Recovery Facility.
- Golden Door Health Retreat Pokolbin

Noise Control and Assessment Policy

- Developed the Noise Control Guide for Low Frequency Sound from Music for Newcastle City Council.
- Developed Noise Planning Model for NSW EPA to evaluate the acoustic impacts of the BHP closure.
- Community liaison representative Steel River redevelopment.

Mining

- Mine blast monitoring and impact assessment for Donaldson Coal, Muswellbrook Coal, Liddell Coal, Mt Owen Mine, Howick Coal.
- Specialist studies into blast related building damage claims for Mt Thorley Warkworth, Wambo Coal, Liddell Coal.
- Expert advice to legal practitioners for mining and quarry Impacts.
- Land and Environment Expert Witness Sandstone Quarry Impacts Lismore.

Rail

Rail noise and vibration experience includes:-

- Investigation and noise assessments for loop extensions at Craven.
- Noise complaint investigations and assessment for Minimbah third track post completion
- Rail Noise Impact Review- Signaling Upgrade - Muswellbrook to Ulan.
- Comparison Study rail, sound and Vibration Monitoring - Lochinvar House

- Rail Sound and Vibration Monitoring -track upgrade Maitland.
- Comparison Study Noise Impact and Monitoring, Ardglen loop extension and rail track re-alignment.
- Sound and Vibration Monitoring - Scone Reconfiguration.

Road

Road traffic noise and vibration experience includes:

- Pre and post operational noise monitoring Newcastle Link Road.
- Construction and Operational Noise Impact Assessment for many local road projects including Highway Upgrades at Ourimbah, Erina, Maitland and West Gosford. Local road projects at Warners Bay, Hamilton and Maitland third river crossing.
- Panel member for RMS Noise Abatement Programme.

Aircraft

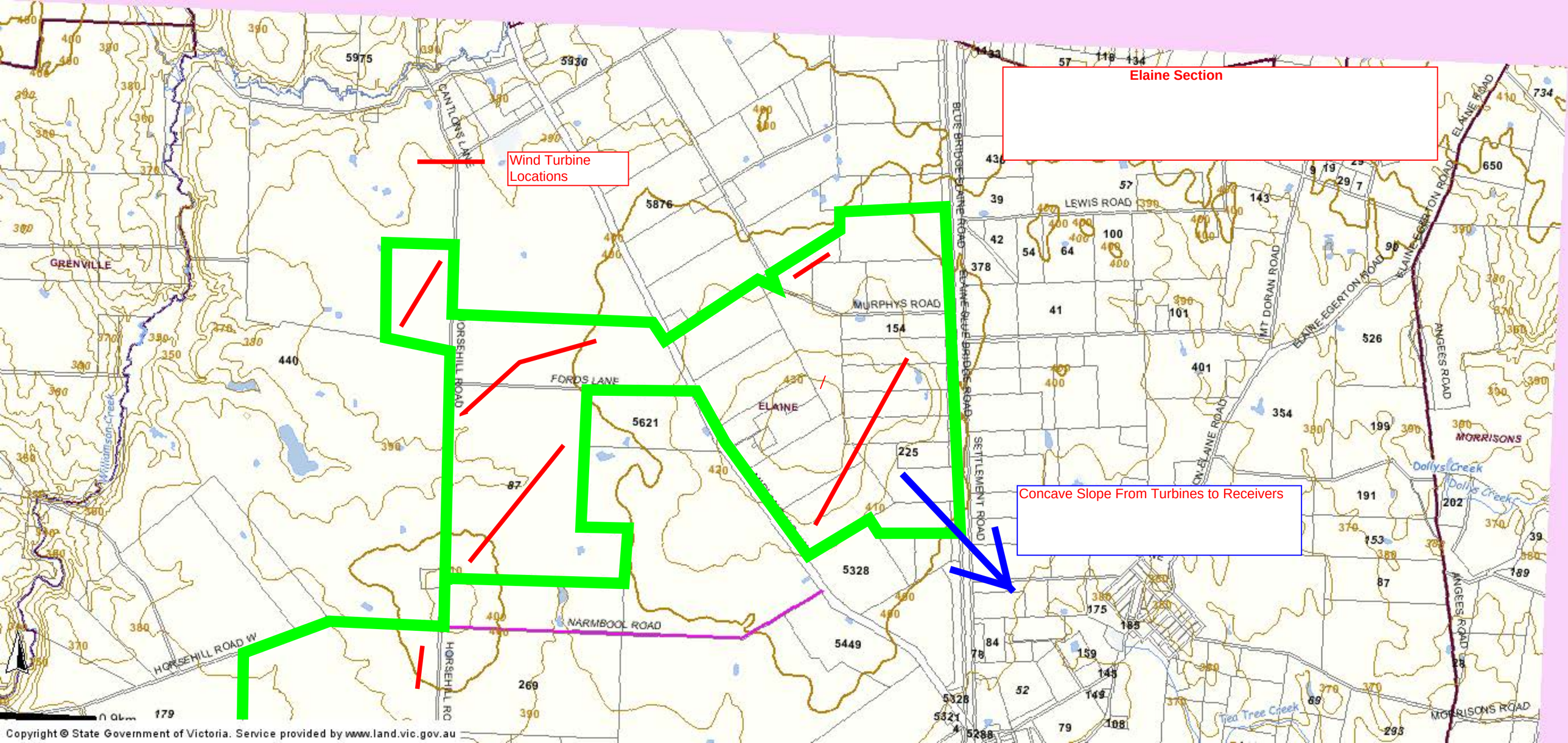
- Noise intrusion control for Defence Department on site facilities RAAF Williamtown.
- Noise Control Design, Department of Defence Housing Estate, Raymond Terrace.

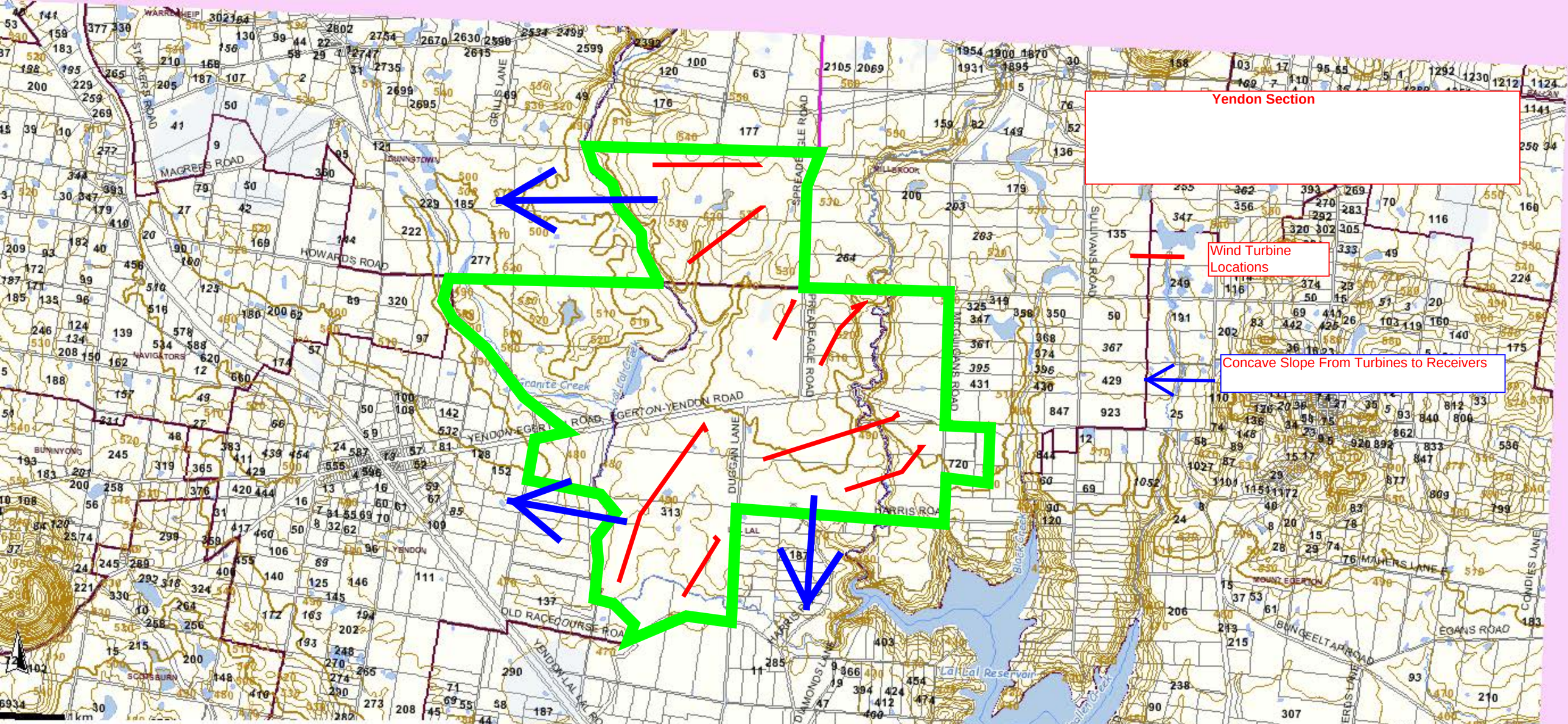
Expert Witness, Land and Environment Court

- Sandstone Quarry, Lismore.
- Dog Kennels, Wyee.
- Restaurant Redevelopment, Newcastle.
- Take Away Food Facility, Muswellbrook.

Appendix B

Location of Concave Topography





Appendix C

Planning Note 42

Applying the Rural Zones

Planning Practice Note | 42

JUNE 2015

The purpose of this practice note is to provide guidance to planning authorities about:

- the strategic work required to apply the Farming Zone, Rural Activity Zone, Rural Conservation Zone, Green Wedge Zone, Green Wedge A Zone and Rural Living Zone
- the purposes and features of each zone and where they may be applied.

The practice note seeks to ensure that the most appropriate rural zones are used to achieve a planning authority's rural strategic planning objectives.

The suite of rural zones for Victoria

The rural areas of Victoria accommodate a range of farming, residential and commercial uses and contain many of the state's significant natural resources, such as native vegetation, minerals and water. They also provide important resources for recreation, tourism and timber production.

The suite of rural zones for Victoria:

- recognise the state, regional and local importance of farming as an industry and provide greater protection for productive agricultural land
- provide a wide choice of zones with clear purposes and controls to match
- discourage ad hoc and incompatible use and development
- recognise the changing nature of farming and reduce the potential for conflict between farming and other land uses
- recognise that rural areas are places where people live and work
- recognise and protect rural areas that are environmentally sensitive.

The changing nature of farming

The nature of farming in Victoria is changing in ways that require careful consideration. It is:

- **Becoming more diverse.** Farming in Victoria is constantly changing and expanding in response to changing world and domestic consumption patterns and the need to remain profitable and sustainable.
- **Becoming more industrialised.** Modern farming practices may involve the use of heavy machinery and large scale irrigation and plant equipment, all-hours operation, and the application of chemicals and fertilizers.
- **Intensifying.** Intensive farming enterprises, such as aquaculture, poultry farms and horticulture are growing in numbers and in their contribution to the economy.

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- **Aggregating.** In western Victoria particularly, farms are becoming bigger to achieve the economies of scale for farm investment and to maintain productivity.
- **Undergoing social change.** More farmers are taking on off-farm work, the economic value of off-farm work is increasing, and there is a shift from full-time to part-time farming in some rural areas.

More changes in farming structures and practices are expected due to drier climatic conditions and growing community pressure for more efficient water use by all industries.

At the same time, more people are seeking to live in rural areas for a range of social, environmental and economic reasons. As a result, in some rural areas:

- there is more competition for rural land, which is affecting rural land prices and the capacity of farmers to expand their businesses and maintain productivity
- there is renewed interest in part-time small-scale farming
- more people are living in rural areas for lifestyle reasons not related to farming increasing the potential for land use conflicts because people pursuing a rural lifestyle often have amenity expectations that conflict with modern farming practices
- local rural economies are diversifying, as rural land is used for more diverse purposes (such as tourism or recreation).

Victoria's changing rural landscape requires planning authorities to think strategically about their farming areas and rural settlement patterns, so that sustainable farming is promoted and potential conflicts between farming and other land uses are avoided.

Strategic planning for rural areas

Sound strategic planning for rural areas is essential to ensuring that land use and development achieves the planning authority's vision, objectives and desired outcomes for an area. It can help ensure that:

- use and development in rural areas fits into the overall strategic planning of the municipality
- farmland and farming industries of state, regional or local significance are protected
- housing development in rural areas is consistent with the housing needs and settlement strategy of an area
- future use of existing natural resources, including productive agricultural land, water, and mineral and energy resources, is sustainable
- scarce resources, such as water, are protected
- social networks and infrastructure essential to rural communities are maintained
- existing visual and environmental qualities of rural areas are protected
- conflicts between farming and other land uses are avoided
- the most appropriate planning scheme tools (for example, the right rural zone) are used to achieve strategic planning objectives.

Applying a new rural zone or making adjustments to a schedule to an existing rural zone should be underpinned by clearly expressed planning policies in the planning scheme. If a proposed change is at odds with the existing policy framework, either a different planning tool or approach should be used or the policy framework itself might need re-assessment.

The existing State Planning Policy Framework (SPPF) and Local Planning Policy Framework (LPPF) in the planning scheme should be the starting point for deciding whether the council's strategic objectives are still valid and sound, or whether new strategic work is required. Many councils have already undertaken strategic planning, policies and resource management studies for their rural areas and used this work to articulate rural strategic objectives in their Municipal Strategic Statements (MSS).

New strategic work may not be required if the existing MSS addresses the key rural land use issues and adequately reflects the planning outcomes that the council wants to achieve. The scheme may already contain a sufficient strategic basis for applying a different rural zone or making adjustments to an existing rural zone.

However, if the MSS objectives are no longer relevant, they do not provide clear guidance for decision-making, or there are strategic gaps, new strategic work for a part or parts of the municipality may be required.

Before commencing new strategic work, the council should review the policy components of its planning scheme, past and present council strategic work, relevant studies prepared by government departments and agencies, relevant recommendations of planning panels and past planning scheme review recommendations. This will help to establish whether new strategic work is required, the scope of the strategic work and the main issues to be focussed on.

There is no prescribed content or format for a rural strategy or study, however it should:

- develop a vision, role and purpose for the rural area
- identify the values and features within the rural area
- identify the key opportunities and constraints
- establish a strategic direction for land use and development within the rural area
- articulate how the strategic vision for the rural area is to be implemented through the planning scheme.

The information used to develop the strategy should be tailored to suit the area. In general it should include an assessment of:

- the state, regional and local strategic planning policies and objectives for the area, including relevant regional growth plans or strategies
- the housing needs of the municipality and likely future trends which is particularly relevant if one of the aims of the strategy is to provide for rural living development
- the physical attributes of the land and its capacity to support productive agricultural uses including soil type, climate, vegetation cover, access to water, slope and drainage
- agricultural trends in the area, including agricultural productivity, changes in farming practices and processes, and farm investment patterns
- the natural resources and environmental features in the area and their importance including flora and fauna, significant habitats, wetlands, scenic landscapes and sites of archaeological or cultural significance
- environmental hazards that could affect how the land is used and developed, such as erosion, salinity, flooding and wildfire risk
- the existing lot size and land use patterns
- infrastructure available for agriculture and other relevant land uses
- settlement patterns in the area.

Implementing rural strategic objectives

A planning authority may need to use a number of VPP tools to successfully implement its rural strategic objectives. There are circumstances where a zone and one or more overlays may be needed to deliver the desired outcome. Councils should think laterally about the mix of policies and controls required to achieve their objectives and be prepared to consider using a range of tools to achieve the desired strategic outcomes.

In deciding which rural zone should apply, the following principles should be considered:

- The zone should support and give effect to the SPPF.
- The zone should broadly support all relevant policy areas in the MSS (for example, economic, housing, environment and infrastructure policy).
- The rationale for applying the zone should be clearly discernible in the LPPF.
- Implement the recommendations or actions of any relevant rural strategy or study.
- The zone should be applied in a way that is consistent with its purpose.
- The requirements of any applicable Minister's Direction must be met.

The existing size or pattern of lots in an area should not be the sole basis for deciding to apply a particular zone. For example, it is not appropriate to decide that the Rural Living Zone should be applied to an area simply because it comprises small lots. Traditionally, farms have comprised multiple lots, sometimes contiguous, sometimes in different locations. The fact that an area may comprise many lots does not mean that it cannot be used productively or should not be included in a zone that supports and protects farming. Many factors will determine the suitability of an area for farming, rural living, rural industry, rural conservation or green wedge land.

Local planning policy

Wide discretion is available in the rural zones, particularly the Farming Zone, Rural Activity Zone and Rural Living Zone. To guide the exercise of this discretion and fully implement their strategic objectives, the planning authority should consider whether a Local Planning Policy (LPP) is necessary. An LPP can help to establish realistic expectations about how land in an area may be used and developed, and provide the responsible authority with a sound basis for making consistent, strategic decisions. Refer to *Planning Practice Note 8: Writing a Local Planning Policy* for more guidance on using local planning policies.

The zones in detail

The six zones are summarised as follows:

- **Farming Zone** – a zone that is strongly focussed on protecting and promoting farming and agriculture
- **Rural Activity Zone** – a mixed use rural zone that caters for farming and other compatible land uses
- **Rural Conservation Zone** – a conservation zone that caters for rural areas with special environmental characteristics
- **Green Wedge Zone** – a zone that provides for all agricultural uses and limits non-rural uses to those that either support agriculture or tourism, or that are essential for urban development but cannot locate in urban areas for amenity or other reasons
- **Green Wedge A Zone** – a zone that provides for all agricultural uses and limits non-rural uses to those that support agriculture, tourism, schools, major infrastructure and rural living
- **Rural Living Zone** – a zone that caters for residential use in a rural setting.

The zone purposes

All of the zones provide for the use of land for agriculture; however while it is implicit in the purpose of the Farming Zone, Rural Activity Zone, Green Wedge Zone and Green Wedge A Zone that farming will be a primary land use activity, in the Rural Conservation Zone and Rural Living Zone, farming is subordinate to other land uses or the environmental values of the land.

Farming Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To provide for the use of land for agriculture.
- To encourage the retention of productive agricultural land.
- To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.
- To encourage the retention of employment and population to support rural communities.
- To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.

Rural Activity Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To provide for the use of land for agriculture.
- To provide for other uses and development, in appropriate locations, which are compatible with agriculture and the environmental and landscape characteristics of the area.
- To ensure that use and development does not adversely affect surrounding land uses.
- To provide for the use and development of land for the specific purposes identified in a schedule to this zone.
- To protect and enhance natural resources and the biodiversity of the area.
- To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.

Green Wedge Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To provide for the use of land for agriculture.
- To recognise, protect and conserve green wedge land for its agricultural, environmental, historic, landscape, recreational and tourism opportunities, and mineral and stone resources.

- To encourage use and development that is consistent with sustainable land management practices.
- To encourage sustainable farming activities and provide opportunity for a variety of productive agricultural uses.
- To protect, conserve and enhance the cultural heritage significance and the character of open rural and scenic non-urban landscapes.
- To protect and enhance the biodiversity of the area.

Green Wedge A Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To provide for the use of land for agriculture.
- To protect, conserve and enhance the biodiversity, natural resources, scenic landscapes and heritage values of the area.
- To ensure that use and development promotes sustainable land management practices and infrastructure provision.
- To protect, conserve and enhance the cultural heritage significance and the character of rural and scenic non-urban landscapes.
- To recognise and protect the amenity of existing rural living areas.

Rural Conservation Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To conserve the values specified in a schedule to the zone.
- To protect and enhance the natural environment and natural processes for their historic, archaeological and scientific interest, landscape, faunal habitat and cultural values.
- To protect and enhance natural resources and the biodiversity of the area.
- To encourage development and use of land which is consistent with sustainable land management and land capability practices, and which takes into account the conservation values and environmental sensitivity of the locality.
- To provide for agricultural use consistent with the conservation of environmental and landscape values of the area.
- To conserve and enhance the cultural significance and character of open rural and scenic non urban landscapes.

Rural Living Zone Purpose

- To implement the SPPF and the LPPF, including the MSS and local planning policies.
- To provide for residential use in a rural environment.
- To provide for agricultural uses which do not adversely affect the amenity of surrounding land uses.
- To protect and enhance the natural resources, biodiversity and landscape and heritage values of the area.
- To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.

What are the main features of each zone?

Farming Zone

The Farming Zone is primarily concerned with keeping land in agricultural production and avoiding land uses that could limit future farming or constrain agricultural activities. In this zone:

- farming is the dominant land use and all other land uses are subordinate to farming
- farming uses are encouraged to establish and expand with as little restriction as possible, subject to proper safeguards for the environment
- non-farm dwellings and land uses not related to farming may be considered but should not limit the operation and expansion of agricultural uses
- farm-related tourism and retailing uses may be considered
- uses that could lead to the loss or fragmentation of productive agricultural land, or which could be adversely affected by farming activities, are prohibited
- land subdivision that could take farmland out of production or limit future farming productivity is discouraged
- the minimum lot size for subdivision may be tailored to suit the farming practices and productivity of the land.

This zone provides a minimum lot size of 40 hectares unless an alternative is specified in a schedule to the zone. The creation of smaller lots is prohibited unless the subdivision is for an existing dwelling, is the re-subdivision of existing lots or the creation of a small lot for a utility installation.

Productive agricultural land

Productive agricultural land generally has one or more of the following characteristics:

- suitable soil type
- suitable climatic conditions
- suitable agricultural infrastructure, in particular irrigation and drainage systems
- a present pattern of subdivision favourable for sustainable agricultural production.

The basic physical characteristics of the land, such as soil type and climate, access to water, and infrastructure are critical to determining the agricultural use of land and whether agricultural productivity can be sustained in the future. However, productivity is also affected by many other factors, including market demand, access to suitable storage and transport facilities, access to efficient processing and value adding capability, availability of technology, the skills of the farmer, research and development, access to capital, marketing, effective industry support, availability of land for expansion and farm labour costs.

Productive agricultural land is a finite resource that makes a significant contribution to the economy of the state and individual municipalities. Its significance is recognised in the SPPF.

Productive agricultural land should be clearly identified and protected in the planning scheme. If the protection and retention of this land for agricultural production is of primary strategic importance, then it should be included in the Farming Zone.

The Farming Zone is designed to encourage diverse farming practices, some of which can have significant off-site impacts. For this reason, the level of amenity that can be expected in this zone will usually not be compatible with sensitive uses, particularly housing.

Decision guidelines

In reaching a decision on a proposal in this zone, the responsible authority must give significant weight to the farming productivity of the land and the relevance of the proposal to farming. There is an expectation that decisions will be made in favour of protecting and supporting farming. In relation to agricultural issues, the responsible authority must consider:

- whether the use or development will support and enhance agricultural production
- whether the use or development will permanently remove land from agricultural production
- the potential for the use or development to limit the operation and expansion of adjoining and nearby agricultural uses
- the capacity of the site to sustain the agricultural use
- the agricultural qualities of the land, such as soil quality, access to water and access to rural infrastructure
- any integrated land management plan prepared for the site.

In relation to dwellings, the responsible authority must also consider:

- whether the dwelling will result in the loss or fragmentation of productive agricultural land
- whether the dwelling will be adversely affected by agricultural activities on adjacent and nearby land due to dust, noise, odour, use of chemicals and farm machinery, traffic and hours of operation
- whether the dwelling will adversely affect the operation and expansion of adjoining and nearby agricultural uses
- the potential for the proposal to lead to a concentration or proliferation of dwellings in the area and the impact of this on the use of the land for agriculture.

The zone's focus on farming does not mean that there should be little or no consideration of the impact of farming on the environment. The zone encourages farming based on comprehensive and sustainable land management practices and a planning permit is required to establish or expand certain farming enterprises. However, in these cases, the focus of the responsible authority's decision will usually be on whether off-site impacts that may result from the proposal are reasonable for a farming area.

Rural Activity Zone

The main feature of the Rural Activity Zone is the flexibility that it provides for farming and other land uses to co-exist. In this zone:

- the purpose and provisions support the continuation and growth of farming but provide the opportunity for non-farming uses to be considered in appropriate locations
- a wide range of tourism, commercial and retail uses are supported
- farming uses are encouraged to establish and expand, subject to proper safeguards for the environment and amenity considerations
- a planning permit is always required to use land for a dwelling.

Because the mix of uses that is supported in the Rural Activity Zone is wide-ranging, the planning scheme should be clear about:

- what the planning authority wants to achieve in the area where the zone is to be applied
- how discretion in the zone will be exercised.

This can be done by:

- setting out clear objectives for the zone and explaining how discretion in the zone will be exercised in the LPPF, or
- including a purpose statement in the schedule to the zone. If this option is chosen, the statement should be inserted above the table setting out minimum and maximum areas, it should not repeat or contradict the SPPF and LPPF, and it should be more specific than the zone purpose.

If the planning scheme is clear about what is to be achieved in the zone, this will enable the responsible authority to make decisions on a consistent, strategic basis and avoid land use conflicts in the future.

A purpose statement in the schedule to the zone may describe:

- desired or preferred mix of land uses
- desired or preferred locations for particular land uses
- preferred approaches for managing off-site land use impacts
- a specific need that a proposal should meet.

A good purpose statement should reference local conditions, be grounded in reality, and help the responsible authority to make planning decisions, for example:

> *To achieve a mix of nature-based recreation facilities and tourist accommodation that complements the wilderness values of Gumnut National Park and is compatible with organic food production activities in the area.*

The mix of uses that a planning authority may want to encourage in the zone could include:

- farming, rural industry and associated agribusiness
- farming and tourist facilities
- intensive animal husbandry and associated rural processing industries
- nature-based tourism and recreation facilities
- agricultural and environmental education and research facilities.

The application of the Rural Activity Zone does not mean that protecting or maintaining farming activities will be of low importance. The zone caters for a wide range of farming activities, including intensive animal husbandry, rural processing industries and timber production, and a planning authority may want to apply the zone to encourage a particular mix of farming and non-farming activities. However, the needs of farmers will need to be balanced with the council's other planning objectives for the area.

The mix of uses that is encouraged in the zone should complement the environmental and landscape values of the land, and support the council's overall urban and rural settlement strategies. It would be inappropriate to apply the zone to encourage a rural mixed use area if the land is required for urban development in the future, or if the particular uses would be better located in an existing town, where there is access to a wider range of urban services and infrastructure.

The zone should not be mistaken for a quasi rural residential zone. Housing is only one of a number of uses that may be considered in the zone, and, in some circumstances, it may be incompatible with the particular mix of uses that the planning authority is seeking to achieve.

Tourism

Rural Victoria is home to many trails, transport routes and nature-based attractions that have strong tourist appeal and create demand for recreation and tourism facilities and services. Tourism can promote and facilitate economic activity that supports aspects of regional and rural life. For example, farm stays, cellar door sales and the sales of local produce support agriculture.

A range of farming-related tourism uses may be considered in the Farming Zone (such as farm stays, group accommodation, market, residential hotel, restaurants, and primary produce sales). However, if a planning authority is keen to facilitate the establishment of larger scale tourism uses or a more diverse mix of tourism and recreation uses, the Rural Activity Zone may be a more appropriate zone to apply as hotel and tavern are permit required uses.

In deciding to apply the Rural Activity Zone to facilitate tourism in an area, matters to be considered include:

- the need to protect the agricultural, environmental and cultural values of the area
- the scale and mix of tourism and recreation uses to be encouraged
- whether there are opportunities to build alliances between tourism business operators, farmers, food and wine producers and trail network managers
- the product and infrastructure needs of tourists and the local community
- requirements for the siting, planning and design of tourism facilities.

In reaching a decision on proposals in the Rural Activity Zone, the responsible authority must consider whether the use or development will support and enhance agricultural production and other matters relating to protecting and enhancing farming. However, the weight that is given to these considerations will need to be balanced with other social, environmental or economic objectives and policies identified for the land in the scheme.

The schedule to the Rural Activity Zone requires the planning authority to nominate an appropriate minimum lot size and subdivision of land must be at least the area specified in the schedule to the zone (subject to certain exceptions). This will vary depending on the physical attributes of the land, the type of agricultural activities being encouraged and the mix of non-farming land uses being sought.

The minimum lot size should promote effective land management practices and infrastructure provision and could be large or small.

Rural Conservation Zone

The Rural Conservation Zone is primarily concerned with protecting and conserving rural land for its environmental features or attributes. The conservation values of the land must be identified in the schedule to the zone and could be historic, archaeological, landscape, ecological, cultural or scientific values. In this zone:

- all uses are subordinate to the environmental values of the land
- farming is allowed provided that it is consistent with the environmental values of the area
- the minimum lot size for subdivision is tailored to suit the environmental features and values of the land.

Land use and development is controlled in the zone to safeguard the natural environment and conserve the identified environmental qualities of the land. Most agricultural uses require a planning permit. In general, there is an expectation that a proposal will only be permitted if it conserves the values identified for the land, the site is environmentally capable of sustaining the proposal, and it is compatible with surrounding land uses.

The zone provides a minimum lot size of 40 hectares unless an alternative is specified in a schedule to the zone. The creation of smaller lots is prohibited unless the subdivision is the re-subdivision of existing lots or the creation of a smaller lot for a utility installation.

A permit is required to lease or license a portion of a lot for a period of more than 10 years for the purpose of Accommodation and must be on land of at least 40 hectares in area or as specified in a schedule to the zone.

Industrial uses other than Rural industry, Warehouse uses other than Rural store, most types of Retail premises, and Intensive animal husbandry are prohibited in the zone.

Green Wedge Zone

The Green Wedge Zone is primarily concerned with protecting and conserving non-urban land outside of the Urban Growth Boundary (UGB) for its agricultural, environmental, historic, landscape, or recreational values, or mineral and stone resource attributes.

The zone provides opportunity for all agricultural uses and most farming uses and limits non-rural uses to those that either support agriculture or tourism, or that are essential for urban development but cannot locate in urban areas for amenity and other reasons (such as airports, schools, waste treatment plants, land fills and reservoirs). A dwelling requires a permit and is restricted to one dwelling per lot.

The zone provides a minimum lot size of 40 hectares unless an alternative is specified in a schedule to the zone. The creation of smaller lots is prohibited unless the subdivision is the re-subdivision of existing lots or the creation of a small lot for a utility installation.

A permit is required to lease or license a portion of land for a period of more than 10 years for the purpose of Accommodation and must be on land of at least 40 hectares in area or as apecified in a schedule to the zone.

Industrial uses other than Rural industry, Warehouse uses (except Rural store), and most types of Retail premises are prohibited in the zone.

Green Wedge A Zone

The Green Wedge A Zone is primarily concerned with protecting and conserving non-urban land outside of the Urban Growth Boundary (UGB) for its agricultural, environmental, historic, landscape, infrastructure, natural resource or rural living attributes.

The zone provides opportunity for all agricultural uses and limits non-rural uses to those that either support agriculture or tourism, schools, major infrastructure and rural living. A dwelling requires a permit and is restricted to one dwelling per lot.

The zone provides a minimum lot size of eight hectares unless an alternative is specified in a schedule to the zone. The creation of smaller lots is prohibited unless the subdivision is the re-subdivision of existing lots or the creation of a small lot for a utility installation.

A permit is required to lease or license a portion of a lot for a period of more than 10 years for the purpose of accommodation and must be on land of at least 8 hectares in area or as specified in a schedule to the zone.

Industrial uses other than Rural industry (except for Abattoir and Sawmill), Warehouse uses (except Rural store), most types of Retail premises, and Intensive animal husbandry are prohibited in the zone.

Rural Living Zone

This zone provides for residential use in a rural environment. It is designed to cater for lots in a rural setting that are large enough to accommodate a dwelling and a farming use. The farming use is likely to be carried on for reasons other than the need to provide a significant source of household income.

In this zone:

- it is not essential that a dwelling be genuinely associated with a farming use of the land
- some farming may take place on the land, however this will not always be the case
- residents have a reasonable expectation that their amenity will be protected
- a wider range of tourism, commercial and retail uses may be considered in the zone.

Although the Rural Living Zone is catering primarily for residential use, the allotment size and subdivision layout should provide the opportunity for farming activities to occur, without adversely affecting the natural environment or the amenity of surrounding land uses. This means that the minimum lot size could be quite large.

The zone provides a minimum lot size of 2 hectares unless an alternative is specified in a schedule to the zone. The creation of smaller lots is prohibited unless the subdivision is the re-subdivision of existing lots, creating lot sizes consistent with the schedule or the creation of a smaller lot for a utility installation.

If the planning authority's objective is to encourage rural residential development at densities that are defacto large residential lots or which would preclude farming activities, then it should consider applying the Low Density Residential Zone.

Because of the zone's primarily residential function, a planning authority must be able to show that using the Rural Living Zone is part of its strategy to provide appropriate housing diversity and choice to meet housing needs.

In the Rural Living Zone, development must be provided with certain community infrastructure and services normally expected for residential areas. This is why land uses that are normally located in urban areas may be considered in the zone. These uses need to be considered carefully, to ensure that the zone does not become an unplanned urban area and farming on adjacent land is not compromised.

For more information about the key strategic and land capability requirements that a proposed Rural Living rezoning must meet refer to *Planning Practice Note 37: Rural Residential Development*

Potable water supply catchment areas

A potable water supply catchment provides water resources to a reservoir used primarily for domestic water supply purposes. Special water supply catchment areas are listed in Schedule 5 of the *Catchment and Land Protection Act 1994*.

There are two types of potable water supply catchments. An 'open' catchment is where part or all of the catchment area is in private ownership and access to the catchment is unrestricted. A 'closed' catchment means that the whole of the catchment area is publicly owned and public access is prohibited.

Water authorities do not have direct control over land use and development in open, potable water supply catchments. However because of the risks to public health, all use and development should be sited and managed to protect the quality of water collected from the catchment. Residential development and agriculture particularly have the potential to impact adversely on water quality through the discharge of contaminated runoff and wastes, nutrient contributions or sediment to waterways.

To protect water quality in open, potable water supply catchments, the preferred approach is to apply the Rural Conservation Zone. However, in deciding to apply this zone to these areas, a planning authority should carefully consider the type and extent of development expected in the area, the potential sources of pollutants, and the conditions or standards that new use and development would be required to meet to maintain an acceptable water quality. For further information about potable water supply catchments, refer to the *Guidelines for Planning Permits in Open, Potable Water Supply Catchment Areas*.

Where should the zones be applied?

Each zone's purpose and provisions determine where the zone should be applied. Examples of candidate areas for each zone are provided below, however these are indicative only. The decision about which zone is applied should be driven by the strategic objectives in the scheme.

The **Farming Zone** is designed to be applied to rural areas where:

- farmers require certainty about undertaking normal farming practices and need the flexibility to change farming practices in the future
- farming is the principal activity in the area and the protection of productive farmland is of primary strategic importance
- the farmland is of state, regional or local significance in terms of agricultural production or employment
- the farmland has physical attributes that are scarce or essential to sustaining particular agricultural activities
- pressures to use and develop land for non-farming purposes pose a significant threat to the supply and productivity of farmland in the area
- the scale, nature and intensity of farming uses in the area have the potential to significantly impact upon sensitive land uses, such as housing
- the efficient and effective use of agricultural infrastructure will be maximised.

Possible Farming Zone areas include:

- horticulture areas
- intensive animal husbandry areas
- irrigated areas
- dairying areas
- forestry plantation areas
- other broad hectare cropping areas
- areas where the consolidation, intensification or aggregation of farming activities is encouraged
- areas where non-farming uses and development need to be strictly controlled so that potential land use conflicts can be avoided.

The **Rural Activity Zone** is designed to be applied to rural areas where:

- farming is an important activity in the area but the planning objectives identified for the land support the establishment of other land uses
- a mixed-use function would support farming activities in the area, assist in preventing the unplanned loss of productive agricultural land elsewhere, or allow for the logical and efficient provision of infrastructure
- the use of land in the area for non-farming purposes would not compromise the long term productivity of surrounding farmland
- appropriate buffers can be provided between different land uses so that land use conflicts are avoided
- the planning authority has developed a clear policy about how discretion in the zone will be exercised.

Possible Rural Activity Zone areas include:

- an existing mixed use rural area where the mix of uses complements the agricultural, environmental and landscape values of the area and supports the council's urban settlement objectives
- rural areas where commercial, tourism or recreational development will complement and benefit the particular agricultural pursuits, landscape features or natural attractions of the area
- farming areas where complementary rural industry, intensive animal husbandry, agribusiness uses, and rural research facilities are encouraged.

The **Rural Conservation Zone** is designed to be applied to rural areas where:

- the protection of the environmental features of the land is of primary strategic importance including, for example, native vegetation, flora and fauna, significant habitats, or they could relate to the visual qualities of the land
- the environmental features of the land are scarce and strict controls are required to prevent the further loss or decline of those features
- land use and development could directly or indirectly threaten the environmental values of the land and strict controls are required to manage this.

If the environmental or landscape features cover a large rural area, the Rural Conservation Zone is likely to be suitable. However, if the features are widely dispersed or fragmented and the surrounding land has been substantially altered (for example, broadacre farming areas with wildlife corridors), the other rural zones may be more appropriate supplemented with overlays.

Possible Rural Conservation Zone areas include:

- relatively intact natural areas where land use and development could result in the loss of important environmental features or values
- areas of biodiversity or ecological significance
- rural areas that contain threatened species habitat, such as wetlands, water catchments and grasslands
- rural areas of high scenic or landscape value
- environmentally degraded areas where a cautious approach to land use and development is required to avoid further environmental damage
- rural areas that are unstable or prone to erosion or salinity
- open, potable water supply catchment areas.

The **Green Wedge Zone** is designed to be applied to green wedge land where:

- agriculture and farming is an important activity in the area, complemented by other land uses
- a mixed-use function would support farming activities in the area, assist in preventing the unplanned loss of productive agricultural land elsewhere, or allow for the logical and efficient provision of infrastructure to service urban areas
- the use of land in the area for non-farming purposes, such as tourism uses, would support the long term productivity of surrounding farmland
- the protection of the environmental features of the land is important including, for example, native vegetation, flora and fauna, cultural heritage, significant habitats, or they could relate to the landscape and visual qualities of the land
- significant mineral and stone resources are located in the area.

Possible Green Wedge Zone areas include:

- rural land defined as green wedge land
- areas of agricultural and farming land
- relatively intact natural areas where land use and development could result in the loss of important environmental features or values
- areas of biodiversity significance
- rural areas more remote from townships and township areas supporting a variety of land uses and lot sizes of around 40 hectares or greater
- rural areas of high scenic or landscape value
- areas for infrastructure provision or stone and mineral resources.

The **Green Wedge A Zone** is designed to be applied to green wedge land where:

- agriculture and farming is an important activity in the area but the planning objectives identified for the land support the establishment of other land uses
- a mixed-use function would support farming and tourism activities in the area, assist in preventing the unplanned loss of productive agricultural land elsewhere, or allow for the logical and efficient provision of infrastructure to service urban areas
- the use of land in the area for non-farming purposes, such as tourism uses, would support the long term productivity of surrounding farmland
- the protection of the environmental features of the land is important including, for example, native vegetation, flora and fauna, cultural heritage, significant habitats, or they could relate to the landscape and visual qualities of the land
- significant natural resources are located in the area
- rural living areas with lot sizes of around eight hectares or greater located on the periphery of, or between, townships.

Possible Green Wedge A Zone areas include:

- rural land defined as green wedge land
- relatively intact natural areas where land use and development could result in the loss of important environmental features or values
- areas of biodiversity significance
- rural areas surrounding townships supporting a variety of land uses with lot sizes of around eight hectares or greater
- rural areas of high scenic or landscape value
- areas with significant natural resources.

The **Rural Living Zone** is designed to be applied to areas where:

- the rural land has a mainly residential function
- farming may take place on the land but this is subordinate to the residential use
- residents require certainty about the residential amenity of the area and are protected from potentially incompatible land uses
- farming is of a nature or scale that will not conflict with housing
- residents will have access to most of the normal services and infrastructure provided in urban areas.

Possible Rural Living Zone areas include:

- rural areas that have been substantially subdivided and developed for dwellings in proximity to an urban area or township with a range of urban services and infrastructure.

Further information

More information is available on the department's website at www.delwp.vic.gov.au/planning

Other planning practice notes:

- *PPN62: Green Wedge Planning Provisions*
- *PPN31: Preparing a Green Wedge Management Plan*
- *PPN37: Rural Residential Development*
- *PPN55: Planning in Open Drinking Water Catchments*

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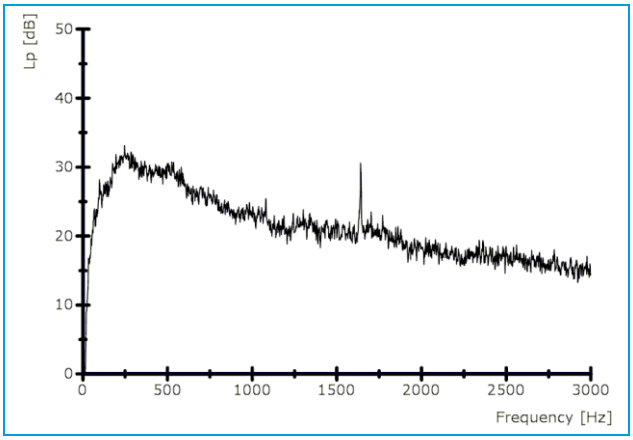
Appendix D

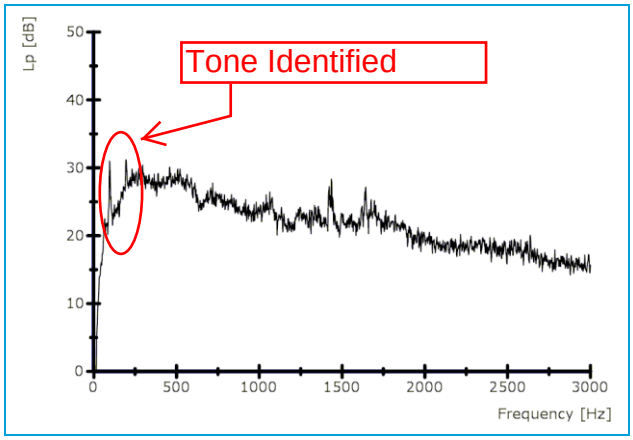
Extract from DNV Report

Summary of results of a noise emission measurement in accordance with IEC 61400-11 Ed. 2.1

Tonality according to IEC 61400-11/Ed.2.1:

Representative FFT - Spectra (left 6 m/s and right 8 m/s at a height of 10 m):





WS in 10 m height [m/s]	5.0	6.0	7.0	8.0	9.0
Freq. of most prevalent tone, f [Hz]	180	1640	1440	98	98
Tonality, ΔL_k [dB]	-9.11	-12.96	-11.38	-4.84	-5.70
Audibility, $\Delta L_{a,k}$ [dB]	-7.08	-9.66	-8.20	-2.83	-3.69

Remarks: This report deviates from IEC 61400-11 Ed. 2.1 as the measured wind speed range does not cover the 10 m/s BIN. All turbine data (power output, generator rpm and nacelle anemometer) have been taken from the turbine controller. Although the correlation coefficient is below 0.8 a fourth order regression was chosen to have the possibility to calculate sound power levels at different hub height. Additionaly a BIN analysis was performed to verify the results of the fourth order regression. The resulting sound power levels are nearly identical for both regression methods. Details are shown in the annex of the source report.

Kaiser-Wilhelm-Koog, 2014-11-11

Checked **Checked**

Dipl.-Ing. (FH) Ulf Kock

Dipl.-Ing. (FH) Philip Schmiedel

Deutsche Akkreditierungsstelle
D-PL-11134-01-00

Appendix E

Table 1 Noise From Industry In Regional Victoria

Table 1: Zone Levels – must only be applied in conjunction with steps 2 to 5

Planning zone for noise-receiving location

Planning zone for noise-generating use (Generating Zone ↓)	Receiving zone → ❑ Green Wedge A GWAZ ❑ Rural Conservation RCZ ❑ Rural Living RLZ	❑ Low Density Residential LDRZ ❑ Public Conservation and Resource PCRZ ❑ Public Park and Recreation PPRZ ❑ Public Use 2,5 PUZ ❑ Urban Floodway UFZ	❑ Farming FZ† ❑ Green Wedge GWZ ❑ Residential 1 R1Z ❑ Residential 2 R2Z ❑ Residential 3 R3Z ❑ Rural Activity RAZ ❑ Township TZ ❑ Urban Growth UGZ‡	❑ Business 1 B1Z ❑ Business 2 B2Z ❑ Business 5 B5Z ❑ Comprehensive Development CDZ‡ ❑ Mixed Use MUZ ❑ Priority Development PDZ‡ ❑ Public Use 1,3,4,6,7 PUZ ❑ Road RDZ	❑ Industrial 3 IN3Z ❑ Special Use SUZ‡	❑ Business 3 B3Z ❑ Business 4 B4Z	❑ Industrial 1 IN1Z ❑ Industrial 2 IN2Z
▸ Low Density Residential LDRZ ▸ Public Conservation and Resource PCRZ ▸ Public Park and Recreation PPRZ ▸ Residential 1 R1Z ▸ Residential 2 R2Z ▸ Residential 3 R3Z ▸ Urban Floodway UFZ	Day: 45 Evening: 37 Night: 32	Day: 45 Evening: 39 Night: 34	Day: 45 Evening: 40 Night: 35	Day: 47 Evening: 42 Night: 37	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 53 Evening: 48 Night: 43
▸ Business 5 B5Z ▸ Farming FZ† ▸ Green Wedge GWZ ▸ Green Wedge A GWAZ ▸ Public Use 2,5 PUZ ▸ Rural Activity RAZ ▸ Rural Conservation RCZ ▸ Rural Living RLZ ▸ Urban Growth UGZ‡	Day: 45 Evening: 38 Night: 33	Day: 45 Evening: 40 Night: 35	Day: 46 Evening: 41 Night: 36	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 54 Evening: 49 Night: 44
▸ Business 1 B1Z ▸ Business 2 B2Z ▸ Comprehensive Development CDZ‡ ▸ Mixed Use MUZ ▸ Priority Development PDZ‡ ▸ Public Use 1,3,4,6,7 PUZ ▸ Road RDZ ▸ Township TZ	Day: 45 Evening: 40 Night: 35	Day: 47 Evening: 42 Night: 37	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45
▸ Industrial 3 IN3Z ▸ Special Use SUZ‡	Day: 46 Evening: 41 Night: 36	Day: 49 Evening: 44 Night: 39	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46
▸ Business 3 B3Z ▸ Business 4 B4Z	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 54 Evening: 49 Night: 44	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46	Day: 57 Evening: 52 Night: 47
▸ Industrial 1 IN1Z ▸ Industrial 2 IN2Z	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46	Day: 57 Evening: 52 Night: 47	Day: 58 Evening: 53 Night: 48

† In the Farming Zone, where the noise-emitting subject agricultural activity is 'intensive', then an adjustment of +3 dB should be applied to the determined Zone Levels to reflect amenity expectations of locally intense farming activities. Intensive farming activities are agricultural activities under the planning scheme (Clause 74), including horticulture and timber production, but not:

- 'extensive animal husbandry'
- 'apiculture'
- other 'crop raising'.

‡ For Special Use, Comprehensive Development and Priority Development, see notes in previous page.

Note: The UGZ designation should be used prior to incorporation of the Precinct Structure Plan (PSP) for the zone. When incorporated, the PSP will outline the different land uses planned for the zone. It should be used for determining Zone Levels.

Note: The public-use zones are grouped into two categories and include: Service & Utility (PUZ1), Health & Community (PUZ3), Transport (PUZ4), Local Government (PUZ6), Other Public Use (PUZ7), Education (PUZ 2), Cemetery/Crematorium (PUZ 5).