6. Noise

This chapter summarises the findings of an additional noise impact assessment undertaken in respect of the proposed three additional turbines at the southern end of the approved Woodlawn Wind Farm.

6.1 Introduction

6.1.1 Consent Conditions

Table 6.1 summarises the consent conditions relating to the original Woodlawn Wind Farm Project Approval issued on 5 October 2005 and includes the relevant conditions that have been added as a result of the 2010 SEE and which were included in the Modification Approval issued on 12 May 2010.

Table 6.1 – Woodlawn Wind Farm Consent Conditions relevant to noise impact

Condition	Summary details of condition
19	Construction hours
20 – 22	Blasting and vibration requirements
32A (1)	Construction noise management sub plan required as part of the CEMP
28 (d)	Traffic and Transport Management Plan
42 (c)	Communication and Consultation - information on the development
49 – 52	Operational noise criteria
49A (1)	Operational noise criteria for the substation at Capital Wind Farm
53 – 55	Noise compliance monitoring during operation including compliance assessment plan
56	Noise mitigation for vacant lots in respect of a future dwelling

NOTE (1): From Modification Approval issued on 12 May 2010

As required by Condition 32A, a construction noise management plan is to be prepared by the project contractor and will form part of the project Construction Environmental Management Plan (CEMP). In addition, traffic movements are subject to a traffic management plan that will include consideration of timing of vehicle movements on local roads. Operational noise impacts are addressed by Conditions 49 to 56.

6.1.2 Director Generals Requirements

The Director-General's requirements of 5 July 2010 identified specific aspects to be addressed by the SEE including the following in respect of noise issues:

- a revised noise assessment demonstrating that the proposed modification to the development would be capable of achieving the noise limits set under the conditions of consent for Woodlawn, dated 4 October 2005
- an assessment of the cumulative noise impact of the proposed modification in conjunction with Capital Wind Farm
- details of any further mitigation and management measures, where necessary, to ensure compliance with the noise limits

The supplementary SEE provides a summary of the revised noise assessment undertaken by Vipac Noise Consultants (Vipac, July 2010) in respect of the proposed modification. The Vipac addendum assessment is attached as Appendix E and provides updated details of predicted noise impacts from the modified project in relation to the relevant noise amenity criteria.

The predicted impact from the proposed additional three turbines on the noise issues, outlined in Table 6.1 are addressed in this chapter. This assessment includes consideration of the noise

assessments undertaken for the approved Project and, as relevant, taking into account the cumulative noise impact for Capital Wind Farm.

6.2 Supplementary SEE noise assessment 2010

Vipac Engineers & Scientists (Vipac) was engaged to undertake an additional noise prediction to take into account the proposed construction of the additional three turbines at the southern end of the Woodlawn Wind Farm array. The report is provided as Appendix E of this supplementary SEE.

The addendum noise assessment (Vipac 2010c) identifies the predicted changes to noise impacts previously predicted for the wind farm. The noise assessment report addresses the following aspects:

- identified noise source locations
- noise characteristics of proposed turbines established (106 dB(A))
- residential receiver locations were reviewed in relation to the amended project
- background sound level data at representative residence locations were reviewed
- noise objectives based on existing background sound levels were developed
- sound levels at selected residential receiver locations resulting from the wind farm were predicted using a noise model
- Comparison of predicted sound levels and noise amenity criteria
- Assessment of noise impact of the proposed project variations and identification of any potential exceedances

The South Australian EPA's (SA EPA) Guideline entitled "*Environmental Noise Guidelines: Wind Farms February 2003*" was used in the assessment as this was the reference for the available background monitoring and the 2004 assessment on which the existing consent is based.

In addition to the 2004 Wilkinson Murray noise assessment for Woodlawn Wind Farm, Vipac has also prepared noise assessments for Capital Wind Farm in 2005, 2008 and 2009 as well as the 2010 noise assessment for the Woodlawn Wind Farm SEE (Vipac 2010a).

6.3 Residential receivers

For the purpose of noise impact assessment, residences are classified as follows:

- **Non-relevant receivers (or "wind farmers"):** These are residences on the properties on which the wind farm is located i.e. properties where the landowners have leases or easements for the construction and operation of the wind farm and associated facilities.
- **Relevant receivers (or "non-wind farmers"):** These are residences on the neighbouring properties.

In the previous assessment (Vipac 2010a), 33 relevant receivers were identified to be located between 2 km and 5 km from the proposed wind turbine locations. This remains unchanged. There are no relevant or non-relevant receivers located within 2.3 km (2.5 km in 2010 SEE) of a wind turbine and 10 (up from nine in the 2010 SEE) relevant receiver residences are within 3 km of the Woodlawn Wind Farm. The locations of relevant and non-relevant receiver residences are shown in Figure 6.1.

Four non-relevant (wind-farmer) residence locations (Woodlawn Farm, Kalua, Cowley Hills and Pylara) were identified at distances of 2-3 km from Woodlawn Wind Farm. This remains unchanged. It is also noted that lands within the Goulburn Mulwaree Shire close to and including part of the Woodlawn Wind Farm site are zoned industrial and the four residences are within the area subject to industrial zoning.

6.4 Background noise levels

6.4.1 Background noise monitoring sites

Sound levels at four representative residential receiver locations were previously measured by Wilkinson Murray (September 2004) for the Woodlawn Wind Farm noise assessment. Continuous monitoring was carried out over a period of two weeks with wind speed reference data obtained from the Woodlawn Wind Farm site at a former wind monitoring site adjacent to the Turbine 5 site of the original array.

Background noise monitoring was also undertaken for Capital Wind Farm by Vipac in April 2005. Three receiver sites from the Capital Wind Farm investigations were identified as being relevant for assessing noise impacts at receiver locations to the south and west of the Woodlawn Wind Farm. For the purpose of any future compliance assessment these three sites that are closer to Capital Wind Farm are referenced to wind speed measurements at 10 m height at Groses Hill.

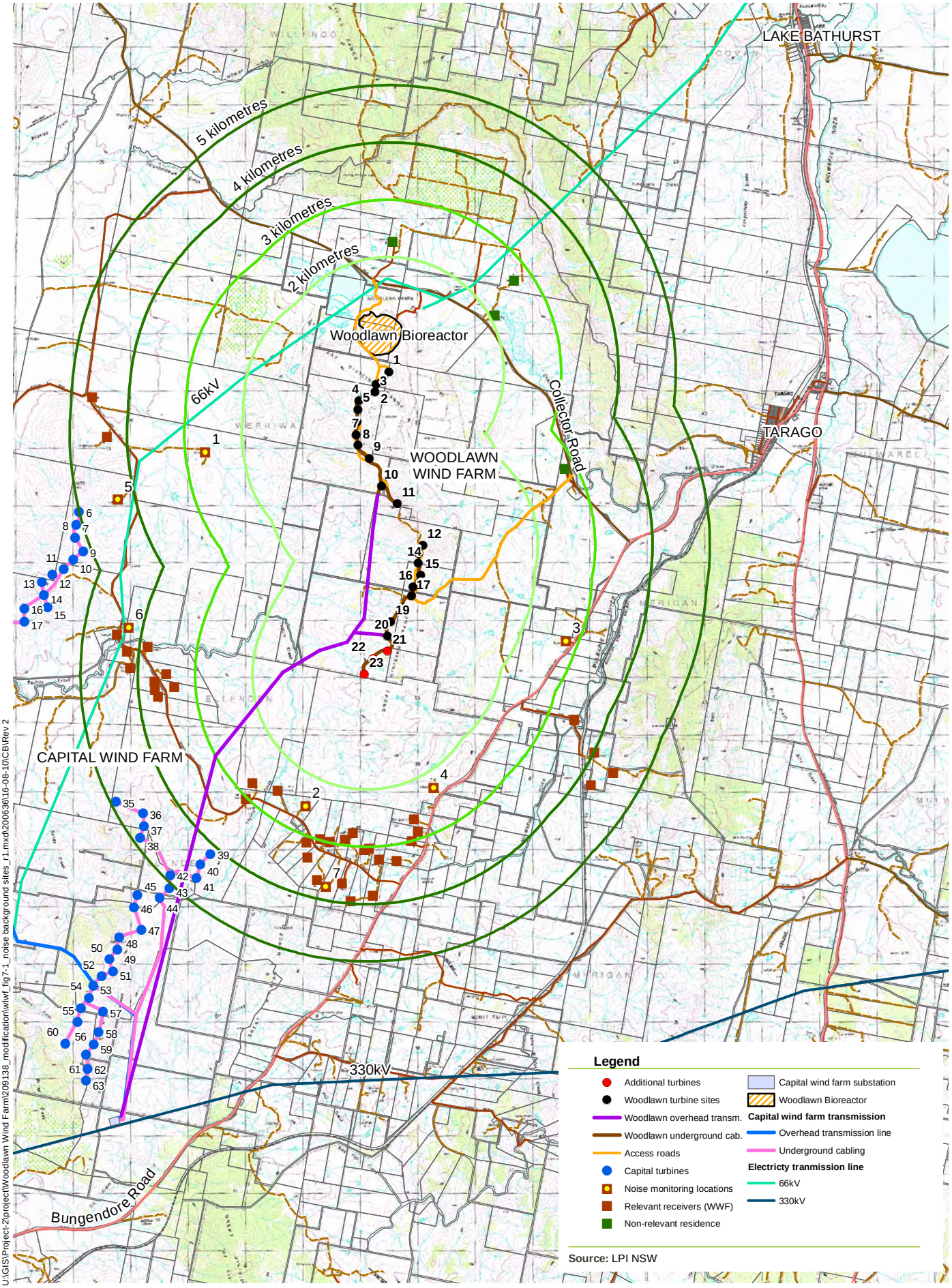
The seven sites previously identified from the 2004 Woodlawn Wind Farm and 2005 Capital Wind Farm noise assessments were considered by Vipac as being suitable for the 2010 assessment. The same seven sites have been therefore been used to assess the noise impact relating to the proposed extension of the Woodlawn Wind Farm. The representative receiver sites are described in Table 6.3 and shown in Figure 6.1.

Monitoring of the background sound levels and development of noise amenity criteria are described fully in the 2004 EIS prepared by URS and in the Capital Wind Farm EA (CW PPI, 2006).

Table 6.2 – Location of background noise monitoring sites

Receiver site	Ref no. (Fig 7.1)	Location	Distance to wind turbines
Torokina (1)	1	west / north-west	2.7 – 4.8 km
Bonnie Doon (1)	2	south / south-west	2.5 – 7.7 km
Kildare (1)	3	east / south-east	2.8 – 5.6 km
Glendale (1)	4	south / south-east	2.3 – 5.8 km
Kullingrah (Euroka) (2)	5	west	4.5 km
Sunnybrook (G8) (2)	6	west / south west	4.4 km
Gray (H5) (2)	7	south	3.8 km

Note: (1) Wilkinson Murray (2004) – Reference 10 m height wind speed at Woodlawn Wind Farm site
(2) Vipac (2005) – Reference 10 m height wind speed from Sunnybrook mast on Groses Hill



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SCALE 1:90,000 @ A4

0 1.5 3 km

Projection: MGA

Woodlawn Wind Farm Supplementary Statement of Environmental Effects

FIGURE 6.1: Receiver locations and representative background sites

Based on characteristics of residence locations, degree of exposure, prevailing meteorological conditions and similarities in ambient noise characteristics, Vipac has indicated that the noise levels and associated criteria for the seven representative sites can be applied to the other residences. Table 6.3 shows the representative background sites for the current assessment and residences with similar background noise characteristics.

Table 6.3 – Representative background sites and sites with similar characteristics

Background site	Sites with similar background noise characteristics
Torokina	Bernallah, Willeroo, Somerset
Bonnie Doon	Nardoo, H23, Wroxham, Rosehill, Hilltop Farm, Hamptons, La Lee, Myolena
Kildare	Willandra, Ellareagh, Hollymount, Linden Park
Glendale	Richmond Grove, Bracken Ridge Kandahar, Kalbilli
Sunnybrook (G8)	Sunnybrook (G9), G10, La Granja (G11), Narine Green (G12), G13 to G17
Gray (H5)	McLaughlin, Clear View, Mingary, Ugov
Kullingrah (G7)	Widgemoor

6.4.2 Noise amenity criteria

As described in the previous assessments, the noise amenity criteria at each of the monitored sites and all other remaining sites have been developed based on background noise levels measured and assessed in accordance with the South Australia *"Wind Farms Environmental Noise Guidelines"* 2003. Consideration of wind turbine noise impacts also considers the Industrial Noise Policy (INP) issued by the NSW EPA (DECCW).

The development of noise criteria for the January 2010 assessment used regression analysis of the background monitoring data according to SA EPA guidelines and showed that the criterion ranged from 35 dB(A) at 4 m/s (the cut-in wind speed of the turbine) to over 40 dB(A) at 12 m/s). The criterion for each of the integer wind speeds at the seven relevant representative background monitoring sites is shown in Table 6.4.

Table 6.4 – Noise amenity criteria in dB(A) for each representative background site (SA EPA Guideline 2003)

Wind speed (m/s)	4	5	6	7	8	9	10	11	12
Torokina (1)	35	35	36	37	38	39	40	42	44
Bonnie Doon (1)	35	35	35	37	40	43	46	50	53
Kildare (1)	35	35	36	37	39	40	42	45	47
Glendale (1)	35	35	35	37	39	42	44	47	50
Sunnybrook (G8) (2)	35	35	35	36	37	39	40	42	43
Gray (H5) (2)	35	35	35	35	36	37	39	40	42
Kullingrah (G7) (2)	35	35	35	36	37	38	40	41	43

Note: (1) Vipac (2010) – Reference 10 m height wind speed at Woodlawn Wind Farm site
(2) Vipac (2005) – Reference 10 m height wind speed from Sunnybrook mast on Groses Hill

The data in Table 6.4 shows that criterion values for the seven background noise sites for the reference wind speed of 8 m/s (10 m height) vary from 36 dB(A) to 40 dB(A). The lowest value of 36 dB(A) is for a very sheltered site while the higher values are for more exposed sites or where traffic on Tarago-Bungendore Road may have contributed to the developed criterion.

6.5 Noise model predictions

6.5.1 Methodology

Vipac, 2010a provides a detailed description of the source sound characteristics for Suzlon S88 2.1 MW units, the setup for the noise prediction model and the methodology used to make these predictions.

As part of the current assessment, Vipac reviewed the model run in January 2010. Minor variations to the noise predictions for the residences associated with the Glendale, Sunnybrook and Gray representative sites have been made and the updated results are provided in Appendix E (Vipac, 2010b). To assess the possible impact of the proposed additional three turbines, Vipac re-run updated noise prediction model with the inclusion of three additional turbines. The addendum noise assessment is also provided in Appendix E.

A summary review of the predicted noise impacts at relevant and non relevant receivers is provided in the following sections.

6.5.2 Relevant receivers

Noise levels for the residences located between 2 km and 5 km of Woodlawn Wind Farm have been predicted by Vipac (2010c). It is expected that all residences on neighbouring properties more than 2.5 km from the nearest turbines will have low levels of wind farm noise, in many cases below average background levels. There are no relevant receivers at distances less than 2.3 km from the nearest wind turbine.

Noise predictions for Woodlawn Wind Farm only

Table 6.5 provides the predicted noise levels and noise amenity criteria for the receiver locations less than 5 km from the closest turbine taking into account the noise source of the Woodlawn Wind Farm only. The predictions are for a range of wind speeds from 4 m/s to 12 m/s. As would be expected, there are some increases in the noise levels predicted for some of the residences, particularly those associated with the Glendale and Sunnybrook reference sites as these are the nearest residences to the additional turbines. Despite the increase in noise predictions, the predicted noise levels at surrounding receiver locations are still less than the SA EPA criteria at all winds speeds.

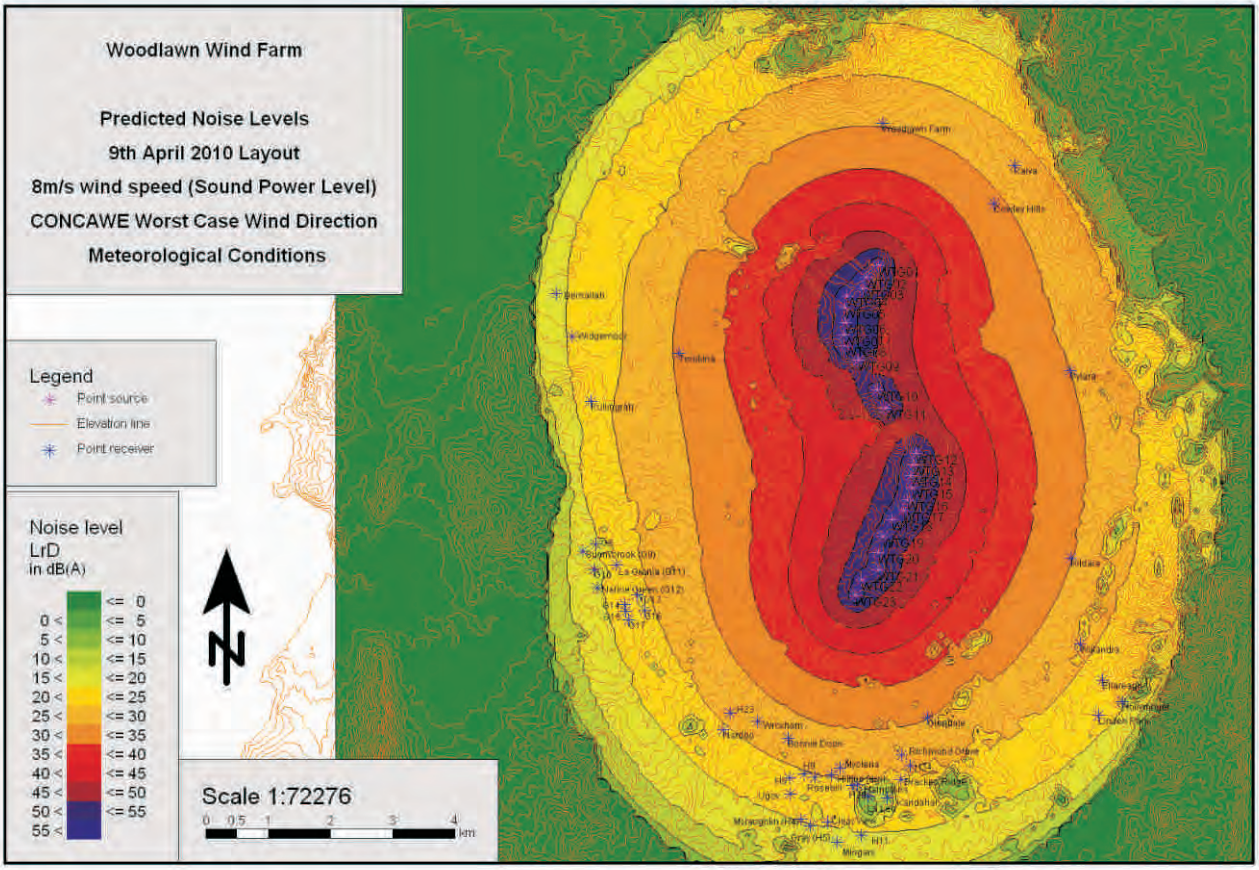
Noise level contours for neutral conditions and worse case conditions using a reference wind speed of 8 m/s are provided in Appendix E and in Figure 6.2.

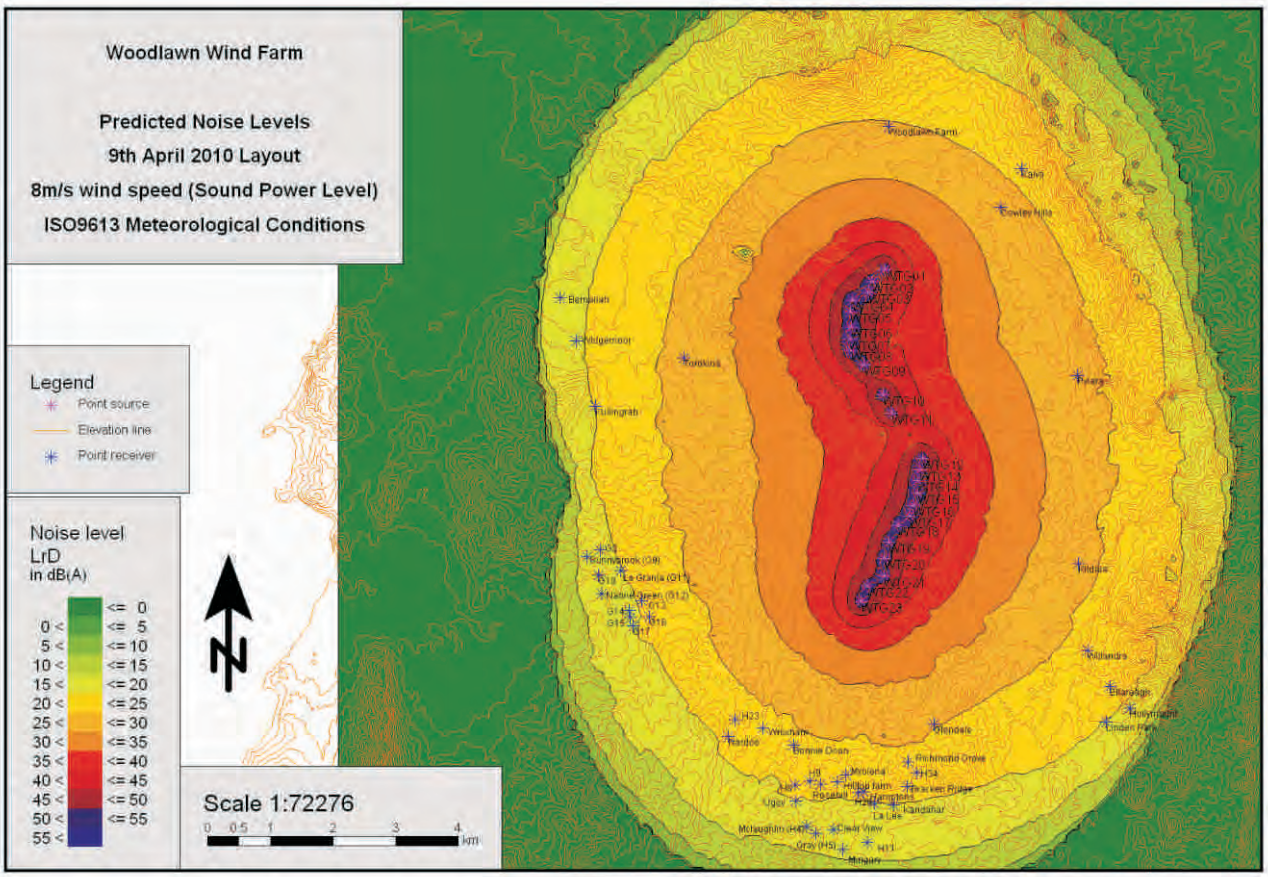
Table 6.5 – Predicted noise levels (L_{Aeq}) for the receiver locations at integral wind speeds (m/s) (Vipac, 2010b)

Receiver locations	Predicted noise levels $_{(LAeq)}$ - Woodlawn Wind Farm only *								
	4	5	6	7	8	9	10	11	12
Criteria dB(A) Torokina [1]	35	35	36	37	38	39	40	42	44
Torokina	27.5	28.5	30	30	30	31	31	31	31
Bernallah	16	17	18.5	19	19.5	19.5	19.5	19.5	19.5
Criteria dB(A) Bonnie Doon [1]	35	35	35	37	40	43	46	50	53
Bonnie Doon	24.5	25.5	26.5	27	27.5	27.5	27.5	27.5	27.5
Nardoo	21.5	22.5	23.5	24	24.5	24.5	24.5	24.5	24.5
Wroxham	24.5	25	26.5	27	27	27.5	27.5	27.5	27.5
Rosehill	21.5	22.5	24	24	24.5	25	25	25	25
Hilltop Farm	22.5	23	24.5	25	25.5	25.5	25.5	25.5	25.5
Hamptons	21.5	22.5	24	24	24.5	24.5	25	25	24.5
Myolena	23	24	25.5	25.5	26	26.5	26.5	26.5	26.5
Criteria dB(A) Kildare [1]	35	35	36	37	39	40	42	45	47
Kildare	27.5	28	29.5	29.5	30	30.5	30.5	30.5	30.5
Willandra	23	24	25.5	25.5	26	26.5	26.5	26.5	26.5
Ellareagh	20	21	22.5	22.5	23	23.5	23.5	23.5	23.5
Hollymount	17.5	18.5	20	20	20.5	21	21	21	21
Linden Park	18.5	19	20.5	21	21.5	21.5	21.5	21.5	21.5
Criteria dB(A) Glendale [1]	35	35	35	37	39	42	44	47	50
Glendale	27.5	28	29.5	29.5	30	30.5	30.5	30.5	30.5
Richmond Grove	24.5	25	26.5	27	27.5	27.5	27.5	27.5	27.5
Bracken Ridge	22	23	24.5	24.5	25	25	25.5	25.5	25.5
Criteria dB(A) Sunnybrook (G8)[2]	35	35	35	36	37	39	40	42	43
Sunnybrook (G8)	16.5	17.5	19	19	19.5	20	20	20	20
Sunnybrook (G9)	15.5	16	17.5	18	18.5	18.5	18.5	18.5	18.5
G10	19	20	21.5	22	22	22.5	22.5	22.5	22.5
G11 – La Granja	19	20	21.5	22	22	22.5	22.5	22.5	22.5
G12 – Narine Green	16.5	17	18.5	19	19.5	19.5	19.5	19.5	19.5
G13	19	20	21.5	21.5	22	22.5	22.5	22.5	22.5
G14	19	20	21.5	21.5	22	22.5	22.5	22.5	22.5
G15	19	19.5	21	21.5	22	22	22	22	22
G16	20.5	21.5	23	23	23.5	24	24	24	24
G17	19	20	21.5	21.5	22	22	22.5	22.5	22
Criteria dB(A) Gray [2]	35	35	35	35	36	37	39	40	42
Gray	17	17.5	19	19.5	20	20	20	20	20
McLaughlin	17	18	19.5	19.5	20	20.5	20.5	20.5	20.5
Clear view	17.5	18.5	20	20	20.5	21	21	21	21
Mingary	16	17	18	18.5	18.5	19	19	19.5	19
Ugov	19.5	20.5	21.5	22	22.5	22.5	22.5	22.5	22.5
Criteria dB(A) Kullingrah [2]	35	35	35	36	37	38	40	41	43
Kullingrah	18.5	19.5	21	21	21.5	22	22	22	22
Widgemoor	17.5	18.5	20	20	20.5	21	21	21	21

Note: criteria source [1] Vipac (2010) [2] Vipac (2005)

* predicted noise levels have accuracy as indicated in Appendix E(a) Section 7.1





Source: Vipac, 2010

Table 6.2: Predicted noise level contours

Noise predictions for Woodlawn Wind Farm and Capital Wind Farm

Table 6.6 shows predicted noise levels taking into account Woodlawn Wind Farm, with the additional three turbines and Capital Wind Farm. The extra noise source of Capital Wind Farm means that many of the residences between the two wind farms have higher predicted noise levels than when only considering impacts from the Woodlawn Wind Farm.

Table 6.6 – Cumulative predicted noise levels (L_{Aeq}) for the receiver locations at integral wind speeds (m/s) (Vipac, 2010c)

Receiver locations	Predicted noise levels $_{(LAeq)}$ – Woodlawn and Capital Wind Farm *								
	4	5	6	7	8	9	10	11	12
Criteria dB(A) Torokina (1)	35	35	36	37	38	39	40	42	44
Torokina	30	31	32.5	32.5	33	33.5	33.5	33.5	33.5
Bernallah	26.5	27	28.5	28.5	29	29	29	29	29
Criteria dB(A) Bonnie Doon (1)	35	35	35	37	40	43	46	50	53
Bonnie Doon	31	32	33	33	34	33.5	33.5	33.5	33.5
Nardoo (non-relevant - CWF)	35	**35.5**	**37**	**37**	37.5	37.5	38	38	37.5
Wroxham	32	33	34	35	35.5	35.5	35.5	35.5	35.5
Rosehill	29	30	31	31.5	32	32	32	32	32
Hilltop Farm	28	28.5	30	30.5	31	31	31	31	31
Hamptons	26	27	28.5	28.5	29	29	29.5	29.5	29.5
Myolena	27.5	28.5	29.5	30	30.5	30.5	30.5	30.5	30.5
Criteria dB(A) Kildare (1)	35	35	36	37	39	40	42	45	47
Kildare	27.5	28	29.5	29.5	30	30.5	30.5	30.5	30.5
Willandra	23	24	26	25.5	26	26.5	26.5	26.5	26.5
Ellareagh	20.5	21.5	23	23	23.5	24	24	24	24
Hollymount	18	19	20.5	20.5	21	21.5	21.5	21.5	21.5
Linden Park	19	19.5	21	21.5	22	22	22	22	22
Criteria dB(A) Glendale (1)	35	35	35	37	39	42	44	47	50
Glendale	28	28.5	30	29.5	30.5	31	31	30.5	30.5
Richmond Grove	25	25.5	27	27.5	28	28	28	27.5	27.5
Bracken Ridge	23	24	25.5	25.5	26	26	26	26	25.5
Criteria dB(A) Sunnybrook (G8) (2)	35	35	35	36	37	39	40	42	43
Sunnybrook G8 (non-relevant CWF)	**36**	**37**	**38**	**38**	**38.5**	39	39	39	39
Sunnybrook G9 (non-relevant CWF)	**37**	**37.5**	**39**	**39**	**39.5**	**39.5**	40	40	40
G10	32.5	33	34.5	34.5	35	35.5	35.5	35.5	35.5
G11 – La Granja	32.5	33	34.5	34.5	35	35.5	35.5	35.5	35.5
G12 – Narine Green	32.5	33	34.5	35	35	35.5	35.5	35.5	35.5
G13	29.5	30	31.5	31.5	32	32.5	32.5	32.5	32.5
G14	30	30.5	32	32	32.5	33	33	33	33
G15	30	30.5	32	32	32.5	32.5	33	33	33
G16	29.5	30	31.5	31.5	32	32.5	32.5	32.5	32.5
G17	29.5	30.5	32	32	32.5	32.5	32.5	32.5	32.5
Criteria dB(A) Gray (2)	35	35	35	35	36	37	39	40	42
Gray	24	24.5	26	26.5	27	27	27	27	27
McLaughlin (2)	20.5	21.5	23	23	23.5	24	24	24	24
Clear view	26.5	27.5	28.5	29	29.5	29.5	29.5	29.5	29.5
Mingary	25	25.5	27	27	27.5	28	28	28	28
Ugov	31	32	33	33.5	34	34	34	34	34

	Predicted noise levels $_{(LAeq)}$ – Woodlawn and Capital Wind Farm *								
Criteria dB(A) Kullingrah [2]	35	35	35	36	37	38	40	41	43
Kullingrah (non-relevant - CWF)	**39**	**40**	**41**	**41.5**	**42**	**42**	**42**	**42**	42
Widgemoor	31.5	32.5	33.5	34	34.5	34.5	34.5	34.5	34.5

Note: criteria source [1] Vipac (2010) [2] Vipac (2005)

* predicted noise levels have accuracy as indicated in Appendix E

As noted in the January 2010 SEE, the residences between the two wind farms are mostly closer to Capital Wind Farm (eg G10 to G17) and therefore the noise levels are more affected by the noise from Capital Wind Farm than from Woodlawn Wind Farm. For example, the predicted noise level for G10 at 8 m/s is 22 dB(A) for Woodlawn Wind Farm only (with the three additional turbines) and 35 dB(A) when both Capital and Woodlawn Wind Farms are considered.

Again, as expected there is an marginal increase in predicted noise levels for most of the residences. Despite the expected increases, only Nardoo, Sunnybrook and Kullingrah have predicted noise levels that are above the criteria derived in accordance with the SA EPA Guideline. These residences showed the same noise levels and same exceedances as that predicted in the previous assessment (Vipac, 2010b). In the case of these three properties, the additional three turbines has not added to the cumulative impact of the two wind farms and the exceedances are therefore attributed primarily to the Capital Wind Farm. These residences are also non relevant receivers in respect of Capital Wind Farm and the exceedances are addressed by the existing noise agreements with the respective landowners.

6.5.3 Wind farmers

In the case where wind farmers may experience wind farm noise levels above relevant criteria, the SA EPA Noise Assessment Guideline provides for agreements to be reached between the proponent and the owner of an affected wind farmer residence. The agreement must document the nature of the impact likely to occur at the wind farmer residence and the owner's acceptance of the predicted noise levels. Such agreements should nevertheless address World Health Organisation (WHO) noise amenity guidelines.

Agreements for wind farmer residences are not applicable in the case of the Woodlawn Wind Farm as predicted noise levels at the wind farmer residences are below SA EPA derived criteria.

Table 6.8 provides the predicted noise levels (rounded to the nearest 0.5 dB(A)) of the wind farmers for the Woodlawn Wind Farm (at 8 m/s) and Figure 6.2 shows the predicted noise level contours for neutral and worse case meteorological conditions.

The noise amenity criteria (at 8 m/s) derived according to the SA EPA Guideline for nearby relevant receivers of Kildare and Glendale are 39 dB(A) respectively. Table 6.8 indicates that the predicted noise levels at 8 m/s for both neutral and worse case meteorological conditions for Woodlawn wind farmer residences are well within the SA EPA criteria and all predicted values are 30 dB(A) or less. As such it would not be necessary to establish noise agreements for these locations.

Table 6.7 – Predicted noise levels (L_{Aeq}) at 8 m/s wind speed for wind farmers (non-relevant receivers)

Receiver	Distance to nearest turbine	Predicted L_{Aeq} level dB(A) at 8 m/s	
		Neutral conditions	Worse case conditions
Woodlawn Farm	2.28	25.5	29.5
Kalua	2.71	24.0	27.0
Cowley Hills	2.09	27.0	31.0
Pylara	2.80	26.5	30.0

6.6 Cumulative noise impact assessment

At the time of the 2004 Woodlawn Wind Farm EIS, the potential noise impacts of the following developments were not included in the noise assessment:

- Operational Capital Wind Farm
- Additional transformer at Capital Wind Farm substation
- Woodlawn Bioreactor

These developments were considered in detail in the previous SEE (Aurecon, 2010).

With the proposed additional three turbines, the cumulative impact in respect of Capital Wind Farm has been updated in this SEE.

6.6.1 Capital Wind Farm

Table 6.6 shows the cumulative predicted noise impacts (worse case meteorological conditions) of the operational Capital Wind Farm and Woodlawn Wind Farm (with the additional three turbines) for relevant receiver locations. Noise assessments for Capital Wind Farm have been reported by Vipac in 2005, 2006 and 2008. Table 6.9 provides a comparison of relevant noise criteria and predicted noise levels as follows:

- criteria for relevant receiver locations (Woodlawn Wind Farm) including non-relevant receivers for Capital WF
- criteria determined in accordance with SA EPA 2003 Guideline
- predicted noise levels from Woodlawn Wind Farm, Capital Wind Farm and both wind farms

The predicted noise levels shown as ‘Bold’ in Table 6.10 exceed the criteria developed in accordance with the SA EPA 2003 guidelines. These residence locations, Kullingrah (G7) and the two Sunnybrook residences (G8) and G9) are all wind farmer residences for the Capital Wind Farm and have existing noise agreements with Woodlawn Wind’s parent company. In each case the noise impact from Woodlawn Wind Farm, including the additional three wind turbines is minor and not significant.

Torokina mid way between the two wind farms has similar predicted noise levels of 30.5 and 29 dB(A) from each of the two wind farms. Combining the predicted noise levels for each wind farm increases the overall predicted noise level by 4 dB(A). The level is still below the applicable criteria.

The other residences generally have greater differences between the predicted noise levels from the respective wind farms and have a lesser increase in the overall predicted noise level when the impacts of the two are combined.

The receivers to the north, east and south-east of Woodlawn Wind Farm are expected to be relatively unaffected by Capital Wind Farm and any wind farm noise impact would be attributed to the Woodlawn Wind Farm. The distance to these residences is such that the noise impacts will be below relevant criteria.

Table 6.8 – Comparison of criteria and predicted L_{Aeq} level dB(A) at 8 m/s for relevant receivers updated to include the additional three turbines

Note: shaded rows are representative receiver residences

Relevant Receiver	Criteria at 8 m/s wind speed (10 m)		Predicted noise levels at 8 m/s wind speed (10 m)		
	CWF PA and WLWF DC conditions	SA EPA 2003 Criteria	Woodlawn WF only	Capital WF only	Capital and Woodlawn
			Vipac (2010c)	Vipac (06 or 08)	Vipac (2010c)
Torokina (G18)	37	38	30.5	29	33
Bernallah (G5)		38	19.5	28.5	29
Bonnie Doon (H25)	35	40	27.5	32	34
Nardoo (H3)		40	24.5	38	37.5
Wroxham (H24)	35	40	27	34	35.5
Rosehill		40	24.5	32	32
Hill Top Farm		40	25.5	31	31
Hamptons		40	24.5	29.5	29
La Lee		40	7	Not assessed	26
Myolena		40	26	Not assessed	30.5
Kildare	36	39	30	Not assessed	30
Willandra		39	26	Not assessed	26
Ellareagh		39	23	Not assessed	23.5
Hollymount		39	20.5	Not assessed	21
Linden Park		39	21.5	Not assessed	22
Glendale	35	40	30	Not assessed	30.5
Richmond Grove		40	27.5	Not assessed	28
Bracken Ridge		40	25	Not assessed	25.5
Kandahar		40	11.5	Not assessed	25
Kullingrah (G7)		37	21.5	**42.5**	**42**
Widgemoor (G6)	35	37	20.5	34.5	34.5
G8 – Sunnybrook		37	19.5	**38**	**38.5**
G9 – Sunnybrook		37	18.5	**39**	**39.5**
G10	37	37	22	36.5	35
G11 – La Granja		37	22	35	35
G12 – Narine Green		37	19.5	35	35
G13		37	22	32	32
G14		37	22	32.5	32.5
G15		37	22	32	32.5
G16		37	23.5	31	32
G17		37	22	32	32.5
Gray (H5)		36	20	26	27
McLaughlin (H4)		36	20	27	23.5
Clearview		36	20.5	29	29.5
Mingary		36	19	27	27.5
Ugov		36	22.5	Not assessed	34

Note: PA – Project Approval (Capital Wind Farm) and DC – Development Consent (Woodlawn Wind Farm)

6.7 Construction noise

Construction noise has been covered in detail in the 2004 Woodlawn Wind Farm EIS. The construction activities are expected to be similar to those identified in the 2004 assessment. In respect of the Capital Wind Farm substation, construction noise was addressed by the 2006 environmental assessment undertaken for Capital Wind Farm. As the substation construction included the preparation of a bay for a third transformer there are limited construction activities to be undertaken, with the main one being delivery and lifting of the 33 kV/330 kV transformer into its position in the transformer yard. Auxiliary activities will include installation of the 33 kV equipment and other items for 330 kV connection to the TransGrid switchyard.

6.7.1 Working hours

Construction of the wind farm is expected to occur over a 12 month period, as indicated in the 2004 EIS. The Woodlawn Wind Farm Project Consent (DA 250-10-204-i), issued in October 2005, specifies activities are to be restricted to normal working hours.

- Monday to Friday: 7am to 6pm
- Saturday: 7am to 1pm (if inaudible at residences, otherwise 8:00 am to 1:00 pm)
- Sunday: No construction permitted (except as per Condition 19(a-c) of the Consent Conditions)

Some activities may be carried out in association with construction outside of these hours; including works not causing noise emissions which would be audible at any nearby residences not located on the Premises.

Due to the significant setback of the neighbouring rural residences from the wind turbine sites (all over 2.5 km) and the degree of mitigation of construction noise with distance it is considered that erection of the turbines during suitable weather conditions is able to be undertaken out of hours without risk of significant noise impact for neighbours. The ability to erect turbines out of hours will also assist in compressing the overall construction time, therefore reducing the overall period when any impact may occur for neighbouring properties.

6.7.2 Construction activities

Construction activities for the installation of the additional 3 wind turbines are expected to be similar to those described in the 2004 EIS.

The key site activities during construction of these turbines include:

- site establishment
- upgrading and construction of access tracks
- excavation and construction of turbine footings
- excavation and construction of cable trenches
- erection of turbines

Construction noise levels were predicted in the 2004 EIS for earthworks, foundation works and construction of superstructures (i.e. turbines, substation and transmission lines). The assessment indicated that the predicted construction noise would comfortably meet the 35-36 dB(A) criteria from the various activities.

Applicability to proposed variations

- The proposed variations include an increase in the number of turbines from 20 to 23 (note that 25 wind turbines were originally assessed (URS, 2004)), potentially increasing the period of construction activities associated with foundations and earthworks.
- The size and volume of the footings is less than indicated in the 2004 EIS and as mentioned in the 2010 SEE will reduce the time for excavations.

- Earthworks associated with construction of trenches (additional 0.9 km) and access roads (additional 1.1 km) represents a slight increase from the approved layout and likely very similar to that indicated in 2004 EIS.

The contractor has identified that the adherence to the normal construction hours for the turbine erection activities could significantly affect progress of construction activities, increase construction costs and may indirectly adversely affect the safe and efficient conduct of construction. Due to the significant set back of neighbouring relevant receivers from the turbine site, the proponent proposed that the normal construction hours in respect of turbine erection be relaxed under certain circumstances.

6.8 Mitigation measures

The potential noise impacts of the operation of the extended wind farm from the approved project have been considered by the recent Vipac noise assessment. All residences within 5 km of the modified Woodlawn Wind Farm turbine locations were reviewed. Four residences are identified as non-relevant receivers or "wind-farmers" and are located within 2 km and 2.8 km of the closest turbines (Table 6.8). All relevant receivers are at least 2.7 km from the nearest Woodlawn turbine site.

Predicted noise levels (L_{Aeq}) for the relevant receiver sites at integer wind speeds (Table 6.5) indicate that no exceedances of SA EPA noise criteria will occur for neutral or worse case meteorological conditions.

If a noise nuisance is reported by a relevant receiver after the wind farm is commissioned, Woodlawn Wind Pty Ltd will review the nature of the noise impact and assess the potential sources. If necessary, the equipment supplier will be required to perform testing to confirm that equipment performance is in accordance with the required noise specification.

If any noise exceedance is shown to be occurring at a relevant receiver due to the turbine operation, Woodlawn Wind Pty Ltd can vary operation of the relevant turbine(s) to achieve noise compliance. In addition, Woodlawn Wind Pty Ltd may consult with any affected landowner in regard to other measures such as installation of double glazing or other forms of sound insulation.

As mentioned above, a Construction Noise Management Plan will be implemented as part of the project Environmental Management Plan for the construction stage of the project to mitigate any potential adverse noise impacts that could affect nearby residents.

Slight increases in wind farm noise levels for some residences surrounding Capital Wind Farm are indicated. In three instances this applies to wind farmer residences for the Capital Wind Farm and the proponent has in place noise agreements with these landowners regarding exceedance of SA EPA noise criteria.

6.9 Conclusions

Based on the findings of the assessment of the noise impacts of the additional wind turbines southern end of the southern array it has been predicted that an expanded Woodlawn Wind Farm would operate with acceptable noise impacts at surrounding relevant receiver locations. The predicted noise levels for the operating wind farm indicate no exceedance of the SA EPA criteria

As previously indicated, the noise impacts on neighbours located to the west and south west of Woodlawn will be dominated by noise levels from Capital Wind Farm. These predicted levels have marginally increased (up to 4 dB(A) in the area of Glendale and Kildare) as a result of the additional three turbines. Despite this predicted increase, the predicted noise levels for relevant receivers are still indicated to fall within the relevant criteria.