



NSW GOVERNMENT
Department of Planning

***MAJOR PROJECT ASSESSMENT:
Capital Wind Farm***

Director-General's
Environmental Assessment Report
Section 75I of the
Environmental Planning and Assessment Act 1979

October 2006

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EXECUTIVE SUMMARY

Renewable Power Ventures Pty Ltd is the Proponent for the 63 x 2.1 megawatt wind turbine Capital Wind Farm Project. The Project also includes an electrical substation to facilitate connection to an existing TransGrid 330 000 volt transmission line, a facilities building, temporary and permanent wind monitoring towers, underground cables, a twelve kilometre internal overhead power line, and access tracks and works.

The Project will be located about 12 kilometres south-west of Tarago on ridges of the Great Dividing Range to the east of Lake George in three groups: Grose Hill; Ellenden; and Hammonds Hill (Refer Figure 1). The wind turbines will be a three bladed rotor type, 90 metres in diameter, mounted on 80 metre tall towers. The top of the blade sweep will be approximately 124 metres above ground level.

The Capital Wind Farm Project has a capital value of \$220 million.

The wind farm will be capable of generating 405 600 megawatt hours per year of electricity without any emissions from burning fossil fuels. This will offset the equivalent of approximately 390 000 tonnes of CO_{2e} emissions per year if it displaces coal fired power generation or 264 000 to 284 000 tonnes of CO_{2e} per year if it displaces gas fired generation.

The wind turbines and electrical substation will be located wholly within the Palerang local government area. The transport of materials, including turbines, will pass onto roads in Goulburn Mulwaree local government area.

There were 85 public submissions which included 49 objections. Both Palerang and Goulburn Mulwaree Councils made submissions and raised no objections to the project. The Department of Environment and Conservation, Department of Natural Resources, Sydney Catchment Authority, and the Roads and Traffic Authority also provided submissions on the Project. The Federal Civil Aviation and Safety Authority also made a submission.

The objections raised in the public submissions concerned the visual impacts of the Project, the perceived potential for losses of amenity with increased noise, concerns with losses in property values, ecological impacts from bird and bat deaths from striking the turbine blades, and various construction related impacts including erosion and sedimentation.

The Proponent prepared a Submissions Report which addressed the issues raised in the submissions to the Project.

The Project will provide a range of benefits while the potential impacts are considered to be manageable and is therefore in the public interest. Following a comprehensive assessment the Department recommends approval of the proposed development, subject to the recommended conditions in APPENDIX A to manage and mitigate residual impacts. The recommendations cover on-going compliance mechanisms, independent reviews, community consultation and complaints management, and performance audits.

Specific recommendations are proposed to address issues identified in the assessment process which include:

- Construction and operational noise;
- Flora and fauna;
- Visual impacts;
- Soil and water management;
- Traffic and road dilapidation;
- Indigenous heritage management;
- Interference to television and radio reception; and
- Decommissioning and site restoration.

Figure 1 – Locality Map



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1 BACKGROUND

1.1 Changed Assessment and Approval Regime

The Capital Wind Farm Project is a proposal the Department was working on prior to the commencement of Part 3A of the *Environmental Planning and Assessment Act* (EP&A Act). At that time it was classified as State significant development under Part 4 of the EP&A Act and Director-General's requirements had been issued but no Development Application had been lodged.

Amendments were made to the EP&A Act which introduced Part 3A to the EP&A Act. These amendments changed the assessment and approval process for major projects in New South Wales. In addition, a new planning instrument, State Environmental Planning Policy (Major Projects) 2005 (MP SEPP), was made. The MP SEPP identified the types of developments subject to Part 3A.

1.2 Capital Wind Farm - A Major Project Under Part 3A

The Capital Wind Farm Project met the criteria for major projects under Schedule 1, Group 8 clause 24 of the MP SEPP i.e. it is development for the purpose of a wind electricity generation facility with a capital investment of more than \$30 million.

On 9 November 2005, and before any Development Application had been lodged, the Director-General, as the Minister's delegate, formed an opinion that the Capital Wind Farm Project was a project to which Part 3A of the EP&A Act applied. The Proponent was notified that the Project needed to comply with the new environmental assessment provisions of Part 3A.

1.3 Status of the Previously Issued Director-General's Requirements

The transitional arrangements under clause 8J of the EP&A Regulation 2000 enable the Director-General to adopt with or without modifications, previously issued Director-General's requirements for the purpose of meeting the assessment requirements under Part 3A.

The Department consulted with the Department of Environment and Conservation (DEC), the key government agency with an interest in this proposal, regarding the currency of the previously issued Director-General's requirements. The DEC accepted the previously issued requirements subject to the inclusion of a reference to draft threatened species and cultural heritage guidelines prepared for Part 3A assessments.

The scale of the proposal had been reduced by the Proponent from 100 to 63 turbines since issuing the original Director-General's requirements. However, the Department still considered that the Project raised the same issues addressed in the original Director-General's requirements subject to including a requirement to prepare a Statement of Commitments and reference to the draft guidelines identified by the DEC. On this basis the Department modified the Director-General's requirements under the provisions of the EP&A Regulation and issued these to the Proponent on 30 January 2006.

2 PROPOSED DEVELOPMENT

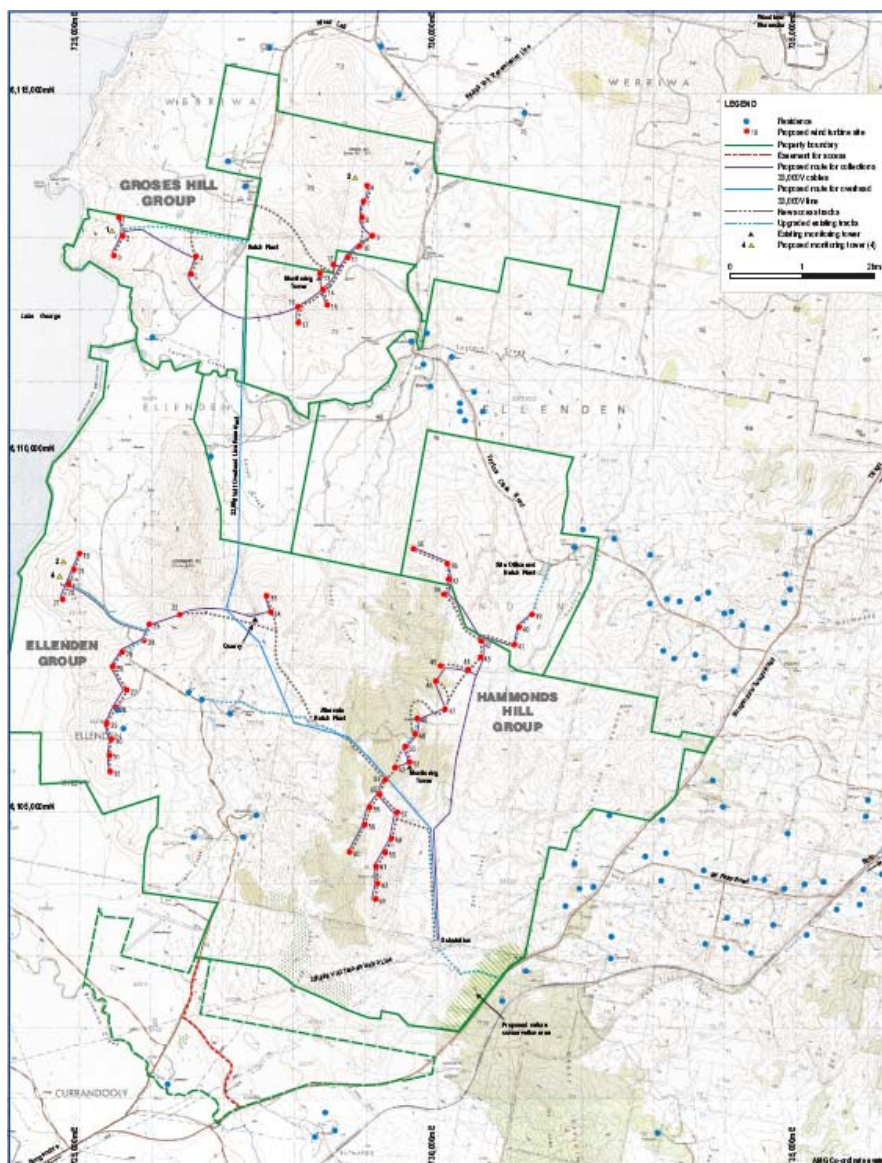
The Project is located on ridges of the Great Dividing Range to the east of Lake George, approximately 12 kilometres south-west of Tarago and about 10 kilometres north of Bungendore in the Southern Tablelands of New South Wales (See Figure 1).

The wind turbines are set out in three distinct groups as follows:

Groses Hill	17 turbines
Ellenden	17 turbines
Hammonds Hill	29 turbines

Figure 2 illustrates the layout of these groups.

Figure 2 Project Layout



The wind farm will be dispersed over an area of about 12 square kilometres, however the actual area occupied by the wind turbine equipment is about six hectares for the turbine footings and construction assembly areas. The access tracks will require approximately 16 hectares, and include some upgrades to existing tracks.

2.1 Approval Originally Sought

The main components of the wind farm will involve the installation and construction of the following:

Project Element	Description
Wind Turbines, Nacelle and blades	The wind turbines will be enclosed in the nacelle. These are 6 metre long by 3 metre high housings for the gearbox, generator, motors, brakes, electronic components, wiring, hydraulic and lubricating oil systems. The nacelle will be mounted on top of tapered steel towers, 80 metres tall with an approximate diameter of 4.5 metres at the base and 2.5 metres at the top. Each turbine will have three blades 88 to 90 metres in diameter designed to rotate at about 15.5 revolutions per minute when operating.
Footings	The turbines will be anchored to the ground on footings. The footings are 1.3 metre thick reinforced concrete slabs with a diameter of 15 metres. The base of each footing will be 2 to 3 metres below the ground level and backfilled with soil and grassed. Some of the footings may be raised above ground level if strong rock prevents deeper excavation.
Generator Transformers	Each turbine will have a padmount transformer near its base on a concrete slab to raise the generator voltage from 690 to 33 000 volts. Any oil filled transformers will incorporate measures to contain spills.
Mobile Concrete Batching Plants	Two mobile concrete batching plants, consisting of a trailer mounted concrete mixer, cement bins, sand and aggregate stockpiles, will be used. The batch plants will be powered by diesel generators and will each have a capacity of 50m ³ /hr.
Underground Cables	There will be approximately 20 kilometres of trenching to place underground power and control cables to connect each of the turbines and to transmit the generated output either direct to the electrical substation or to an overhead line linking to the electrical substation. Control cables that enable monitoring and control of turbine operation will be co-located in trenches for the power cables. Trenches will be approximately 1 metre deep and 0.75 metres wide.
Internal Overhead Transmission Line	Approximately 12 kilometres of 33 000 volt overhead electrical transmission line will connect the Grose Hill Turbine Group and the electrical substation. The transmission line will be supported on either concrete or wood pole structures spaced, on average, 100 metres apart. The poles are proposed to be 18 metres in length with 2.5 metres placed below ground.
Electrical Substation	A 33 000 to 330 000 volt electrical substation including a 160 MVA rated transformer will be constructed in a valley to the southeast of the Hammonds Hill Group and to the west of Dry Creek. The electrical substation will be approximately 160 metres by 70 metres and be surrounded by a 2 metre high security fence. The ground surface will be partly concreted and partly crushed rock. It is likely to include small buildings to

Project Element	Description
	<p>house control equipment, switch gear, capacitors and batteries. Primary and secondary containment will be provided as a precaution for any oil that may leak or spill from the transformer.</p> <p>The existing track from the Tarago to Bungendore Road will need to be upgraded to maintain access to the electrical substation. A new access track will be constructed to connect the electrical substation to the Hammonds Hill Group of turbines.</p>
Facilities Building	<p>A 20 x 20 metre facilities building will be constructed adjacent to the electrical substation to house instrumentation, electrical and communications equipment, routine maintenance equipment and stores, a small work area and staff amenities. It will be a slab on ground construction, with a metal roof to collect rain water. A composting or septic system will be installed to treat waste water.</p>
Internal Tracks	<p>Will occupy up to 16 hectares and includes the upgrading of existing tracks and new tracks. Access to the turbines will be provided by tracks along each of the ridges. A new section of access track is proposed between Hammonds Hill Group and the Ellenden Group. On-site access tracks used for construction and operation will be unsealed and 5 metres wide. During construction an additional width of up to 10 metres will be required to allow the 'crawler' crane and oversized vehicles access. Following completion of construction these wider tracks will be rehabilitated to 5 metres. An existing quarry, located within the project area, will be used to win material to construct, upgrade and maintain the tracks.</p>

2.2 Amendments to the Project

The Proponent prepared a Preferred Project Report for the Capital Wind Farm Project and forwarded this to the Department in a letter dated 30 May 2006 (see APPENDIX F). The project, as presented in the exhibited Environmental Assessment, has not changed in any appreciable manner. However, the Proponent has made the following amendments:

- No wetting agents will be used during construction to control dust.
- The Proponent will purchase a Cat7 Fire Tender for the Taylors Creek Rural Fire Service prior to construction commencing on site.
- The Proponent will seal the Western Leg Road/Taylors Creek Road intersection to a distance of 100 metres south, 200 metres north, and 100 metres west of the intersection, prior to construction commencing on the site.
- The Proponent will ensure that the Cultural Heritage Management Sub Plan of the Construction Environmental Management Plan will require all staff to undertake site induction training on compliance and recommended procedures for the protection of Aboriginal objects.

The Proponent also acknowledged that Section 87 Permits under the *National Parks and Wildlife Act* are no longer required consequent to the Project being dealt with under Part 3A of the EP&A Act.

2.3 Justification

The Capital Wind Farm Project embodies the principles of Ecologically Sustainable Development (ESD). It also addresses issues associated with greenhouse gas emissions and climate change. These are discussed below.

Ecologically Sustainable Development

The principles of ESD arose out the 1987 World Commission on Environment and Development report titled *Our Common Future* (the Brundtland Report). The report identified that the current patterns of economic growth could not be sustained without significant changes in attitudes and actions, and that lifestyles would need to be adopted that could sustain development within the planet's means.

Australia's response was to develop a National Strategy that was adopted by the three tiers of government in 1992 (i.e. Federal, State, and local government).

ESD, according to the National Strategy, means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the quality of life for both present and future generations is increased. Sustainable development in the National Strategy is embraced in four principles which are also expressed in Schedule 2, clause 6 (Justification of Development) of the NSW *Environmental Planning and Assessment Regulations*. These include:

- The Precautionary Principle – This suggests that if there are threats of serious or irreversible damage then the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- Intergenerational Equity – This involves value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the wellbeing and welfare of the community, population or society.
- Conservation of Biological Diversity and Ecological Integrity – This refers to the diversity of genes, species, populations, communities and ecosystems, and the linkages between them. Maintaining biological diversity safeguards life support functions and may be considered a minimal requirement for intergenerational equity; and
- Improved Valuation, Pricing and Incentive Mechanisms – This acknowledges that the environment is not a free resource but has a monetary or social value which, when recognised, can control its exploitation.

These four principles aim to prevent and reverse adverse impacts of economic and social activities on the ecosystem, while continuing to allow the sustainable, equitable development of societies. The application of these principles to the Capital Wind Farm Project is discussed below. Consideration of the issues which has led to the Department's conclusions on these principles follows this discussion.

The Precautionary Principle

The environmental consequences of the wind farm have been assessed using appropriate specialists in relevant disciplines. The assessment process involved analysis and interpretation of the potential environmental impacts associated with the Project. This process has enabled the impacts to be identified with a reasonable degree of certainty. Where there was uncertainty, then the worst case scenario was examined.

The Department's assessment did not identify that the Project would result in any serious or irreversible damage. Environmental monitoring will be coupled with adaptive management measures developed as part of a strategy to reduce any uncertainty regarding environmental impacts.

Intergenerational Equity

The Project is consistent with the principles of social equity and intergenerational equity through the harnessing of a renewable resource for energy production. The generated electricity can displace a certain amount of harmful greenhouse gas emissions that would otherwise have been created by conventional coal fired power stations.

This contributes in a positive way to improving the health, diversity, and productivity of the environment for the benefit of future generations.

Conservation of Biological Diversity and Ecological Integrity

The Project has the potential to kill certain avian and bat species. However, these matters were investigated and the risks associated with the potential impacts were considered to be acceptable. Nevertheless, environmental monitoring will be coupled with a bird and bat adaptive management program as a precautionary measure to ensure responses occur to problems so they do not become major environmental impacts that could affect ecological processes or biological diversity.

Improved Valuation, Pricing and Incentive Mechanisms

The notion that the wind farm has the capacity to generate "pollution free" electricity is not strictly true. The Project will affect the acoustic and visual environments and it was therefore important to ensure the polluter managed these impacts. Noise limits are proposed to be licensed based on adopted noise criteria. It is also proposed to make the licensed levels subject to regular compliance monitoring. The visual assessment identified mitigation measures the Applicant has to put in place to ensure that both the broad landscape and individual residences views would be moderated to acceptable levels.

The National Strategy embraces eight sectorial strategies including one for energy use, energy production and transport. The objective for the energy sector strategy is "to limit harmful emissions arising from energy production and distribution wherever economically efficient, and to promote alternative energy sources". Electricity production fuelled by wind meets this objective because it uses a renewable energy source to generate power for the use by the wider community with minimal harmful atmospheric emissions that could disrupt ecological processes and life support systems. It is also an alternative technology to conventional coal powered electricity generation.

2.3.1 Greenhouse Gases

Anthropogenic greenhouse gas emissions are generally acknowledged to be responsible for much of the climate change. In NSW one third of these emissions come from electricity generation.

The recent Victorian Bald Hills Wind Farm Panel Inquiry Report (24 June 2004) into a proposed 52 turbine wind farm in South Gippsland, Victoria concluded that the greenhouse effect does exist and should be considered relevant.

The Panel also concluded that significant greenhouse benefits would flow from the Bald Hills Wind Farm.

New South Wales does not have a definite wind farm policy position however it has in place a number of initiatives which address greenhouse gas emissions including the:

- Mandatory Greenhouse Benchmarks Scheme - developed by the New South Wales Department of Energy, Utilities and Sustainability. This Scheme addresses the greenhouse gas emissions from the New South Wales electricity sector;
- New South Wales Government's Energy Directions Green Paper - published in December of 2004 recognised higher greenhouse gas production as one of the negative externalities associated with greater demand for electricity that was brought about by a deregulated electricity industry.

The NSW Government more recently announced its involvement in the participation of a discussion paper on a National Greenhouse Gas Emissions Trading Scheme. The paper discusses a possible model the Government may consider participating in for a greenhouse emissions trading scheme. Key features of the Project are:

- An emissions cap and trade scheme for the electricity industry that generates 35% of all of Australia's greenhouse gas emissions;

- The scheme that is proposed would cap greenhouse gas emissions from Australia's electricity industry at between 1997 and 2000 levels by 2030;
- Electricity generators would be required to hold permits to emit. If they hold insufficient permits, then they could purchase some from the market; and
- Generators would also be allowed to acquire offsets for their greenhouse emissions through forestry, carbon capture and storage or changes to industrial process emissions.

The Commonwealth Government has in place a renewable energy target program which places a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9 500 GWh (gigawatt hours) of renewable energy per year by 2010 under the Mandatory Renewable Energy Target (MRET) scheme. There is a \$40/MWh penalty for non-compliance. The 9 500 GWh/annum by 2010 target will be phased in according to a schedule. All retailers and large buyers are required to maintain the 9 500 GWh/annum of new renewables between 2010 and 2020.

2.3.2 Energy Balance

The Department notes that there can be a wide variation in the assumptions used to estimate the energy balance, or 'payback', of wind power. According to a recent UK report "most studies suggest that wind turbines take between 3 to 10 months to produce the electricity consumed during their life-cycle – from production and installation through to maintenance, and finally decommissioning"¹.

The Environmental Assessment examined the greenhouse gas budget in a lifecycle assessment which accounted for the greenhouse gases produced during manufacturing of components, transport to and from the site, and through construction machinery used on the site. The assessment was based on results from a wind farm in the United States. The Proponent estimated that the Capital Wind Farm greenhouse gas emissions on a life-cycle basis would be around 10 to 15 kg CO_{2e}/MWh².

¹ *Wind Power in the UK – A guide to the key issues surround onshore wind power development in the UK*, Sustainable Development Commission, May 2005.

² The greenhouse gas emissions on a lifecycle basis reported in the studies used by the recently approved Woodlawn Wind Farm ranged from 7 to 20 kg CO_{2e}/MWh.

3 STATUTORY CONTEXT

3.1 Permissibility

The wind farm proposal is located within Palerang Council which is made up of the former Tallaganda Shire and parts of the former Yarrawlumla, Mulwaree and Gunning Shires. However, in the absence of a Palerang local environmental plan the provisions of the local planning instruments that prevailed over the land, prior to the amalgamation into Palerang Council, apply³.

In this case all 63 turbines and part of the electrical substation are located within areas covered by the former *Mulwaree Local Environmental Plan 1995* (MLEP). Similarly, parts of the transmission line and substation, underground cables, and access tracks are located in the former Yarrawlumla Shire. Therefore, the provisions of the Mulwaree LEP will apply to the turbines and part of the substation, and the provisions of the Yarrawlumla LEP will apply to the works involving construction of the other components including part of the substation and associated building.

The turbines are within the 1(a) General Rural Zone under the Mulwaree LEP. Wind farms and associated infrastructure would be a permissible use in this zone, with consent, in accordance with clause 9 of the Mulwaree LEP (Zone Objective and Development Control Table).

The components of the project subject to the Yarrawlumla LEP are all within the General Rural 1(a) zone. The construction of the substation and the associated works is consistent with the zone objectives and therefore permissible.

A summary of the various planning instruments and regulatory Acts this proposal is subject to is presented in APPENDIX G.

3.2 Minister's Power to Approve

Schedule 1, Group 8 clause 24 of the State Environmental Planning Policy (Major Projects) identifies wind electricity generation facility with a capital investment of more than \$30 million as projects to which Part 3A of the EP&A Act applies. The Director-General, as delegate to the Minister for Planning, formed the opinion that the Capital Wind Farm Project met these criteria and declared the Capital Wind Farm to be a project to which Part 3A of the EP&A Act applied (see also Section 1.2 above).

³ The *Local Government Act 1993*: Proclamation, 11 February 2004, Schedule C, Section 9(1) addresses activities of former councils. Section 9 (1) states that anything that was done by a former council that had effect immediately before the proclamation date continues to have effect as if it had been done by the new council.

4 ENVIRONMENTAL ASSESSMENT REPORT EXHIBITION AND ISSUES RAISED

4.1 Environmental Assessment Report Exhibition

A Project Application was lodged on 21 December 2005 and an Environmental Assessment report was prepared by Connell Wagner PPI entitled *Capital Wind Farm Environmental Assessment Volumes 1 & 2* (February 2006). The Environmental Assessment report was determined to be adequate for exhibition in accordance with the provisions of Section 75H of the EP&A Act. It was placed on public exhibition between 24 March 2006 and 28 April 2006 (see APPENDIX H).

4.2 Submissions Received

The following Table summarises the number of submissions received by the Department following the public exhibition of the Capital Wind Farm Project:

Source	Number of Submissions
Public	85
State Government Agencies	4
Local Government	2
Federal Agencies	1
Others	1
TOTAL	93

Of the 85 public submissions there were 49 which raised various objections and 36 expressed in support for the proposal. The issues raised in the submissions objecting to the proposal generally fell into the following categories:

4.3 Issues Raised in the Submissions

The following Table summarises the categories of issues raised in the objections.

Issue	Number of Objections
Noise Impacts including Operational Noise	48
Flora and Fauna Impacts including Impacts on Waterbirds	40
Visual Impacts	34
Property Values	34
Construction Related Impacts including Soil and Water Management	31
Operational Related Impacts	26
Traffic and Transport	22
Public Consultation	16
Energy Savings and Greenhouse	6

APPENDIX C describes in greater detail the specific objections raised in the submissions. APPENDIX D contains copies of the submissions received from the public authorities.

5 ASSESSMENT

The Department has reviewed the Environmental Assessment report for the proposed development and considered all the submissions. As a result, the Department has identified a number of environmental issues associated with the proposal. A full consideration of each of the issues is provided in this Section of the report.

5.1 Operational Noise

The Project will require an environment protection licence (EPL) under the *Protection of the Environment Operations Act* from the EPA⁴. The EPA has adopted the South Australian Environment Protection Authority's *Wind Farms: Environmental Guidelines* (2003) (SA Guidelines) as the basis for operational noise assessment in relation to issuing an EPL⁵. The SA Guidelines specify the following noise criteria for new wind farms:

The predicted equivalent noise level ($L_{Aeq, 10}$) adjusted for tonality in accordance with these guidelines should not exceed:

*35dB(A); or
the background noise ($L_{A90, 10}$) by more than 5 dB(A)*

whichever is the greater at all relevant receivers for each integer wind speed from the cut-in to rated power of the wind turbine generator (WTG).

The SA Guidelines require that background noise measurements be carried out on surrounding sensitive receivers likely to be impacted by noise from the proposed wind turbines. The EPA interprets the sensitive receiver as an existing dwelling or premise, or a site where a dwelling or premise has received an approval (i.e. consent) to be built. Generally, a valid measurement position is within 20 metres of the dwelling (or at a site where a development approval has been granted for the dwelling), in the direction of the proposed wind farm, and at least 5 metres from any reflecting surface.

The SA Guidelines state that:

Background noise is measured at relevant receiver locations over continuous 10-minute intervals and particularly over the range of wind speeds at which the WTGs operate. The data must adequately represent conditions at the site and cover approximately 2 000 intervals.

Noise impacts for the Project were based on the specific noise characteristics of 63, Suzlon S88, 2.1 MW wind turbines, and a 33 000 volt to 330 000 volt substation⁶. The Applicant completed the following steps in order to specify appropriate noise assessment criteria:

- Identification of the noise source locations;
- Identification of residential receiver locations;
- Measurement of existing background sound levels at eight representative residence locations;
- Development of noise objectives based on existing background sound levels;
- Identification of wind turbine source sound power levels and spectra;
- Calculation of predicted sound levels of wind turbines at residential locations;
- Assessment of noise impact of the total project; and
- Identification of measures to mitigate potential impacts of the project.

⁴ Under the POEO Act, the EPA is still the regulatory authority for all scheduled activities and scheduled development work.

⁵ Under Schedule 1 of the POEO Act an electricity generating work that supplies or is capable of supplying more than 30 MW of electrical power from any energy source requires a licence from the EPA.

⁶ The Suzlon S88, 2.1 MW wind turbines are representative of the type of turbines being considered for this proposal.

5.1.1 Issues Raised

Thirteen public submissions raised concerns about operational noise. These included perceived issues about infrasound which the Proponent says does not occur with the turbine types selected for the Capital wind farm Project. The submissions also identified the location where operation noise exceedances have been predicted to occur under certain conditions. The Proponent has indicated that monitoring would be undertaken and if exceedances were identified then certain mitigation measures were available to ensure compliance with the operational noise criteria. Several of the submissions raised questions regarding how the noise model was selected and if certain environmental features were accounted for in the model, how the background measurement sites were selected, and if the planned relocation of the monitoring tower would affect compliance monitoring.

Please refer to APPENDIX C for a summary of the issues raised in the public submissions.

5.1.2 Consideration of Issues

The SA Guidelines compares favourably, in terms of protecting amenity, with the standards accepted for a range of countries which similarly deal with wind farms as demonstrated in the following table⁷.

Above ground level						
Country	Quantity	Limit	Wind speed 10m AGL	Min Dist	Comment	Comparison with SA Guidelines
New Zealand	LAeq/ LA95 ¹	40 dBA or L90+5	All Speeds	-	Formed the basis for the SA Guidelines	Less Stringent
United Kingdom	LA90 ²	40dBA day 43dBA night or L90+5	All speeds	-	Based on ETSU-R-97 recommendations. Uses separate night measurements but night limit is higher	Less stringent
Denmark	LAeq	40dBA	8m/s	-	Only one reference wind speed	Less stringent
Holland	LAeq	40/45 dBA (rural)	-	-	No reference to wind speed – 95% power	Less stringent
USA (Illinois)	LAeq	55dBA (day) 51dBA (night)	8m/s	340m 1000ft	Only one reference wind speed	Much less stringent
France	LAeq	L90+3 (night) L90+5 (day)	All speeds	-	Limit for all industrial noise	More stringent

1. Predict LAeq and measure LA95. The same numerical limits apply.

2. The LAeq noise level is approximately 2.5dB(A) higher than the LA90 or LA95 noise level

Probably the greatest concerns about wind farm noise are its potential to interfere with sleep. The World Health Organisation (WHO) has prepared a guideline which recommends a combination of values of 30 dB LA_{eq} 8h and 45 dB L_{Amax} as the upper levels for sleep disturbance effects⁸.

At the SA Guideline level of 35 dB(A), noise levels inside a dwelling with an open window will be approximately 10dB(A) lower i.e. 25 dB(A). This level is well below WHO guidelines for sleep disturbance effects. The SA Guideline noise criteria therefore, provide a reasonable margin against sleep disturbance from wind farm noise.

There are approximately 50 residences within 4 km of the proposed wind farm, with a total of 16 residences within 1.5 km of the nearest turbine. All non-participating residences are greater than 1.2 km distance from the nearest turbine. Only three of the 16 residences located within 1.5 km of the nearest turbine are relevant receivers i.e. non-participants in the proposal (G2 near WTG 4, G6 near WTG 6, and H24 near WTG 39).

⁷ Table extracted from: Renzo Tonin and Associates, Statement of Evidence to Land and Environment Court Proceeding No. 10196 of 2006 (TD178-01F06 (REV 8)).

⁸ *Guidelines for Community Noise*, Edited Berglund B, Lindvall T, Schwela D. World Health Organisation (1999).

The residents with wind turbines on their properties are not subject to the SA Guidelines. Predicted noise levels for these sites are referenced to the World Health Organisation community noise guideline level of 45 dB(A) for unreasonable interference or sleep disturbance.

Predicted noise levels were determined for all participating and non-participating residences within 2 km of the nearest turbine and separately tabulated in the environmental assessment. The table for the relevant receivers was presented for wind speeds ranging from 4 to 12 m/s in the west north-west direction i.e. considered the worst case wind direction for all receivers. The predicted noise levels for the participating residences were done for 8 m/s wind speed, worst case west north-west wind propagation conditions.

The predicted noise levels at most of the relevant receivers met the SA Guideline noise criteria except at three residences. At these residences the predicted noise values exceeded the criteria by:

- 0.5 dB(A) for a 6 m/s wind speed at residence E7 (closest turbine is No 32 at 1.5 km);
- 1 dB(A) at 4 m/s and 5 m/s and equalled the criteria at 7 m/s at residence G2 (closest turbine is No 4 at 1.2 km); and
- 1 dB(A) at 6 m/s and equalled the criteria at 7 m/s at residence G10 (closest turbine is No 15 at 1.6 km).

The predicted noise levels at most of the participating residences met the WHO's upper levels for sleep disturbance effects criteria except at two residences, L'Orizon and L'Orizon B. The Proponent has indicated that these two dwellings will be leased by Renewable Power Ventures. The Proponent has also indicated that Renewable Power Ventures will enter into noise agreements with the participating receiver residences that exceed background +5 dB(A). The noise agreements will describe the nature of the impact to the affected landowner.

5.1.3 Resolution

The Proponent will have to ensure that the noise levels as adopted for wind farms by the EPA and the Department (i.e. the predicted noise levels or the SA Guideline levels, whichever is lesser) are met at all residences who are not participants in the wind farm Project including the three residences where the modelling has predicted that the noise level will be exceeded⁹. The noise limits as applied to the eight properties identified in the EA are presented in the tables below must be applied to all residences that were identified as being 'representative' as described in *Table 1: Representative background sites with similar noise criteria*, Appendix H1 – Background Noise Monitoring Report found in Volume 2 – Appendices to the Capital Wind Farm Environmental Assessment:

10m (height)wind speed (m/s)	Noise level L_{Aeq} (10 minute) – 24 hours a day			
	Property described in the EA as Luckdale (G2)	Property described in the EA as Euroka (G7)	Property described in the EA as Sunnybrook1 (G8)	Property described in the EA as Torokina (G18)
4	35	35	35	35
5	36	35	35	35

⁹ Where the Proponent predicts that noise levels from the wind farm would be below the SA Guideline levels, then the noise limits specified in the licence/consent conditions will reflect the noise levels that the Proponent states would be achieved i.e. the predicted noise levels. The reason for this is to:

- ensure that the best-management practices and best available technology described in the noise impact assessment report are actually adopted by the Proponent;
- ensure that the level of achievable performance presented by the Proponent to the public, though public documentation such as the EA, is achieved;
- optimise the opportunity for further industrial development in the area without an unacceptable degradation of the acoustic amenity of the area; and
- fulfil a general aim of the environmental assessment process to minimise environmental impacts.

Noise level L_{Aeq} (10 minute) – 24 hours a day				
6	38	35	35	35
7	38	35	36	35
8	39	35	37	35
9	39	35	37	35
10	39	35	37	35
11	39	35	37	35
12	39	35	37	35

Noise level L_{Aeq} (10 minute) – 24 hours a day				
10m (height)wind speed (m/s)	Property described in the EA as The Patch (H15)	Property described in the EA as Gray Lot 7 (H5)	Property described in the EA as Bonnie Doon (H25)	Property described in the EA as Currandooley (H2)
4	35	35	35	35
5	35	35	35	35
6	35	35	35	36
7	35	35	35	37
8	35	35	35	36
9	35	35	35	37
10	35	35	35	37
11	35	35	35	37
12	35	35	35	37

It is proposed to require the Proponent to prepare an operational Noise Compliance Assessment Plan. The Noise Compliance Assessment Plan will oblige the Proponent to monitor the noise of the wind farm, assess the noise limits set by the SA Guidelines against the actual performance, and prepare a Noise Compliance Assessment Report. In the event the monitoring and assessment indicates that noise from the wind turbines exceeds the specified noise limits, the Applicant's Noise Compliance Assessment Report must investigate and propose mitigation and management measures that are available to achieve compliance with the noise limits. This may include the software controlling relevant turbines at the times necessary to reduce the noise level to within the SA Guideline criteria.

The Department must also be satisfied that the proposed noise agreements for participating residents are prepared in accordance with Section 2.3 of the SA Guidelines which states that a noise agreement is unlikely to be unreasonable if:

- a formal agreement is documented between the parties;
- the agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and its effect upon the landowner's amenity; and
- the likely impact of exposure will not result in adverse health impacts (e.g. the level does not result in sleep disturbance).

5.2 Construction Noise

Construction is anticipated to take up to 8 months. It would involve site preparation and establishment works, track upgrades, foundation construction, trenching for cables, construction of the transmission line and substation, and finally construction of the turbines. The works would be distributed over the project site and construction would occur progressively. Therefore, the extent of construction in any one area is likely to be less than 26 weeks.

5.2.1 Issues Raised

None of the public submissions raised concerned about construction noise.

5.2.2 Consideration of Issues

Daytime noise is anticipated during the construction of the wind farm from vehicle movements to and from the site and earthmoving equipment. The noise will affect both wind farm participants and the non-participants.

The EPA's *Environmental Noise Control Manual* (ENCM)¹⁰ suggests that the construction should be limited to the following times:

Monday to Friday	7:00 am – 6:00 pm
Saturday	7:00 am – 1:00 pm if inaudible 8:00 am – 1:00 pm if audible

The ENCM provides relevant noise level goals for construction periods less than 26 weeks. These equate to background, measured as $L_{A10, 15min} \leq \text{background } L_{A90,+} + 10 \text{ dB(A)}$. On this basis construction noise at the sensitive receivers for the Capital Wind Farm Project ranges between 41 dB(A) and 46dB(A). The specific levels for the individual residences are set out below:

Residence	Construction Noise Criteria
G2, G3, G4	46 dB(A)
G5, G6, G7	42 dB(A)
G8, G9, G10, G11, G12, G13, G14, G15, G16, G17, H3	41 dB(A)
H13, H15, H17, H18, H20, H21, H22, H26, H27	44 dB(A)
H4, H5, H6, H7, H11, H14, H16, H19, H24, H25	42 dB(A)
E2, E3, E6	41 dB(A)
H1, H2, E4, E7, E5	41 dB(A)
E1	42 dB(A)
H8, H9, H10, H12, H25	45 dB(A)
G18	43 dB(A)
(Background monitoring sites are shown in bold)	

5.2.3 Resolution

It is proposed to address any construction noise issues by requiring the Proponent to prepare a Construction Noise Management Plan as a subplan to the Construction Environment Management Plan in consultation with the Department of Environment and Conservation. The Construction Noise Management Plan will include:

- The identification of all work areas, site compounds and access routes (both private and public);
- Identification of the specific activities that will be carried out and associated noise sources at each work area, site compound and access route;
- The construction noise and vibration objective for sensitive receiver locations based on the EMCM;
- Assessment of potential noise and vibration from the proposed construction methods (including noise from construction traffic) against the ENCM;
- Where the ENCM objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise impacts;

¹⁰ The EPA's *Environmental Noise Control Manual* is used as a guideline. The manual is no longer in print, and is not being updated. The manual has been superseded by other DEC policy documents, including the *Noise Guide for Local Government*. However the manual still references appropriate criteria to be applied to construction noise.

- Description of management methods and procedures, and specific noise mitigation treatments that will be implemented to control noise and vibration impacts during construction;
- Procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;
- Measures to monitor noise performance and respond to complaints; and
- Where blasting is proposed, the CEMP must include a Blast Management Plan to demonstrate the measures that will be used to comply with the blast limits.

5.3 Flora and Fauna Impacts Including Impacts On Waterbirds

The Hammonds Hill and Ellenden Group of turbines are on adjacent ridges in the south of the project site. The ridges have only sparse remnants of the woodland that once grew there. Good quality woodland has been preserved on the western slopes of Hammonds Hill Group. Some native grasses are also present at these locations.

The Groses Hill Group is an exposed rocky ridge. It contains pasture improved paddocks and no stands of native trees.

The lowlands of the valleys beneath the Hammonds Hill, Ellenden, and Groses Hill ridges were cleared many years ago and have been pasture improved. These areas are now predominately used for grazing particularly by sheep. Any remaining woodland now mostly occurs on steep, hilly terrain and is discontinuous, separated by large areas of cleared land.

Impacts arising from the wind farm on the flora and fauna may be characterised as construction impacts associated with clearing and land disturbances, and operational impacts associated with the movement of the turbine blades.

5.3.1 Issues Raised

Twenty-two of the public submissions raised concerns regarding the potential impacts of the wind farm on the ecology of the area. The issues included concerns regarding potential turbine collision risks on the raptors including the wedge-tailed eagle and brown falcons. A specific concern was also raised about the grass owl which apparently prefers good quality native grassland. The Proponent re-examined the likely occurrence of this species at this location and concluded that this type of cover is rare in the area. It also looked at the owls geographic distribution and concluded that any "occurrence of the Grass Owl this far south would be a very rare event, probably involving vagrant, non-breeding birds".

Some concern was expressed regarding reliance on a limited set of wildlife databases used to describe the likely occurrences of bird species in the area. The Proponent clarified that a number of reference databases were actually used including data collected from local landowners. Some confusion was also evident in certain submissions because the original scope of the wind farm proposal was reduced and no longer incorporated an area where flora and fauna issues were likely to be more significant e.g. the Kalbilli wind turbine group.

A number of other submissions raised various concerns regarding adequacy of the flora and fauna investigations, whether koalas had been sighted, the extent of clearing that would be required around the turbines, and the effect of winter fogs on bird strikes.

Refer APPENDIX C for details regarding the matters raised in the submissions.

5.3.2 Consideration of Construction Impacts

Hammonds Hill and Ellenden Groups are close to several stands of woodland of moderate to high conservation value and includes three separate remnants of Yellow Box Woodland, an endangered ecological community. Two stands are located on the south-eastern lower slopes of the Hammonds Hill Group and one stand is located on the valley floors adjacent to the Bungendore/Tarago Road.

The Grose Hill Group contains no intact native woodland. The pasture improvement works have left only sparse patches of native pasture and no other vegetation with conservation values on or near the proposed turbine sites of this group.

The Hammonds Hill Group has two named peaks, Hammonds Hill and Big Hill. Hammonds Hill is located to the north of Big Hill. Most of the vegetation on the Hammonds Hill Group is native pasture or secondary grassland. The grassland has an intrinsic value because it represents a relict of the understorey of woodland that once occurred on the ridge. There is still some good quality woodland on the upper slopes on the western side of the ridge, extending onto the ridge at proposed turbine locations numbers 52, 53, 54, and 55. This is dominated by Scribbly Gum and Broad-leaved Peppermint, occasional Hickory Wattle, Broad-leaved Hickory, Black Wattle, and Snow Gum.

Some clearing of the Hammonds Hill Group woodland association, including the native pasture and secondary grassland, will be required to accommodate the turbines and access track. However, no endangered communities or species are likely to be affected by these works although some of these tree species are known to be feed trees for the Yellow-tailed Black-Cockatoos e.g. Hickory Wattle, Black Wattle.

A new access road and overhead transmission line is proposed to be constructed to join the Hammonds Hill and the Ellenden Group. This would be constructed through the Hammonds Hill Group woodland association midway between Hammonds Hill and Big Hill turbines and require some clearing i.e. between turbines 52 and 53. The access track and overhead transmission line would be located within the same corridor.

The Ellenden Group is characterised by virtually treeless ridges associated with Red Hill and Governors Hill peaks. There is some remnant Scribbly Gum and Broad-leaved Peppermint woodland but this is located to the north of the proposed wind turbines and will not be affected by the proposal. There are large granite outcrops mostly on the top of Governors Hill that provide good quality habitat for reptiles such as the Little Whip Snake, a threatened species. The proposed turbine layout avoids most of the rock habitat because no works would be undertaken on Governors Hill. However, some rock habitat will be disturbed by the access tracks and turbine footings on Red Hill.

The substation site is located under the 330 000 volt transmission line, in a valley approximately 1.3 km south-east of Big Hill. The site is now treeless but was once covered with Yellow Box/Manna Gum Forest woodland. The access to the substation will use an existing track that passes through one of three endangered ecological communities of the Yellow Box Woodland identified within the study area i.e. the community located adjacent to the Bungendore/Tarago Road.

The Proponent acknowledges the importance of this remnant but must use the existing track for access to construct and maintain the substation. The Proponent, in consultation with the landowner, has undertaken to fence this remnant in order to protect it from any grazing pressures and manage it as a reserve. The other two remnants of the Yellow Box Woodland are not affected by the Project.

The facilities building will also be located adjacent to the substation and will need to be accessed frequently over the life of the wind farm.

No other threatened plant species, as listed in schedules of the *Threatened Species Conservation Act* and the Commonwealth's *Environment Protection and Biodiversity Conservation Act*, were found on any of the site project areas. It is also unlikely that the areas which are heavily grazed or pasture improved could support threatened species.

However, there are sites of good quality woodland and patches of native grassland within the project area where threatened plant species could be supported. The Proponent, in consultation with the Department of Environment and Conservation, identified three such plant species, one ground orchard, one shrub, and one

grass¹¹. The limited surveys that were undertaken, combined with seasonal factors and drought conditions, reduced the chances that these plants would be found.

There are a number of threatened fauna species (excluding bats which are discussed below) that have the potential to occur in the project area because they have either been recorded in the vicinity of the project area or suitable habitat is available. These included one mammal (koala), seven birds, and three reptiles. None of these species were sighted in the project area during the targeted surveys.

Koala habitat was examined in relation to the provisions of State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)¹². The Manna Gum (*Eucalyptus viminalis*) which occurs in the project area is listed as a Koala food tree. Stands of these trees occur in several places within the project area however no evidence could be found that Koalas were present. None of the Manna Gum trees will be affected by the proposed construction works. Some individual *Eucalyptus dives*, a secondary food tree for Koalas, will be cleared.

Separate studies were undertaken for bats which included a description of species likely to occur in the project area and recordings made with automated Anabat bat detection equipment. The studies suggested that five threatened bat species could be expected to occur¹³. However, no threatened bat species were detected during targeted surveys.

5.3.3 Consideration of Operational Impacts

The operation of the Project is not expected to create any significant impacts on vegetation, mammals (excluding bats) or reptiles. There is potential for turbine blades to strike locally occurring raptors, other birds including Yellow-tailed Black-Cockatoos and waterbirds, and bats.

Raptors would have a moderate risk of being struck by turbines. The extent to which the wind farm would affect regional populations of raptors is unclear. Most of these species including the Peregrine Falcon and Wedge-tailed Eagle are at a greater risk because of their large home ranges and low reproductive rates i.e. they wander into the area and do not produce many offspring.

Waterbirds have the potential to strike turbines as they migrate between Lake George and Lake Bathurst (i.e. when there is water in the lakes). However, the extent that these flight movements will cross through the proposed turbines areas is uncertain.

Large flocks of migrating honeyeaters have been observed moving northwards (autumn) and southwards (spring). This species tends to move through the tree canopy or just above the trees. However, the openness of the project site with its discontinuous tree cover could place these flocks in the path of the turbines.

Patches of Black She-oak, a food resource for the Yellow-tailed Black-Cockatoo, occurs in the study area. There was evidence this species also uses the study area near the pine plantations in the south i.e. below Hammonds Hill Group. The strike risk for Yellow-tailed Black-Cockatoos would be moderate as they are known to cross open spaces and sometimes fly at turbine height.

Two bat species, the Yellow-bellied Sheath-tail Bat and the White-striped Freetail Bat, have some potential for collision with the turbines because their ecological niche includes the airspace swept by the turbine blades. However, within the project area there are no records of the Yellow-bellied Sheath-tail Bat, and very few records of the White-striped Freetail Bat.

¹¹ *Diurus aequalis* (Buttercup Double-tail ground orchid), *Dodonaea procumbens* (Creeping Hop Bush shrub), and *Swainsona sericea* (Silky Swainson-pea herb).

¹² SEPP 44 encourages the conservation and management of natural vegetation that provides habitat for Koalas, to ensure a permanent free-living population over the species present range and to reverse the current trend of Koala population decline.

¹³ *Pteropus poliocephalus* (Grey-headed Flying Fox), *Saccolaimus flaviventris* (Yellow-bellied sheath-tail), *Chalinobius dwyeri* (Large-eared Pied Bat), *Miniopterus schreibersii* (Eastern Bentwing Bat), and *Nyctophilus timoriensis* (Greater Longeared Bat).

5.3.4 Resolution

The Proponent has identified a number of mitigation measures to help reduce the potential impacts from the construction and operation of the wind farm. These include, among others:

- Limiting clearing of the woodlands;
- Avoiding rocky outcrops;
- Preparing sediment and erosion controls;
- Undertaking pre-clearing surveys for bats;
- Locating the access tracks to minimise any clearing;
- Limiting the clearing of the access track through the Yellow Box Woodland to just three trees;
- Backfilling open trenches as quickly as possible;
- Controlling soil and monitoring areas subject to soil erosion;
- Observing good land and agricultural management practices near the turbines e.g. no lambing, clearing away carcasses; and
- Controlling night lighting around the turbines to avoid attracting insects.

The Department accepts that these are all appropriate measures to help ensure the impacts of the Project on the flora and fauna are minimised. These and other mitigation measures are set out in a condition of approval that requires the Proponent to prepare flora and fauna management sub plans to *Construction and Operational Environmental Management Plans*.

As indicated in the discussion above, the uncertainty about bird and bat strikes can only be clarified by direct observation and monitoring. The Department therefore recommends that the Proponent prepare a *Bird and Bat Adaptive Management Program*. The program would need to be undertaken by a suitably qualified expert approved by the Director General and:

- Incorporate monitoring, and a decision matrix that clearly describes how the Proponent will respond to the outcomes of monitoring;
- Incorporate an on-going role for the suitably qualified expert;
- Set out monitoring techniques, taking into account best practice bird and bat monitoring methods for wind farms such as those identified in the current editions of AusWEA *Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia*, and *Assessing the Impacts of Windfarms on Birds - Protocols and Data Set Standards*;
- Account for natural and human changes to the surrounding environment that might influence bird and/or bat behaviour such as changes in land use practices, and significant changes in water levels in nearby waterbodies;
- Incorporate a decision making framework that sets out specific actions and when they may be required, to reduce identified impacts on birds and bats including the shutting down of specific turbines at certain times in order to avoid impacts;
- Identify 'at risk' bird and bat groups and include monthly censuses of their movements; and
- Apply the mitigation measures outlined by the Proponent in the Environmental Assessment report.

The *Bird and Bat Adaptive Management Program* would also require the Proponent to prepare annual reports from the start of operation describing the activities and effectiveness of the mitigation measures undertaken within the adaptive management program.

5.3.5 Conclusion

The Department has assessed the potential flora and fauna impacts of the Project. Clearing is anticipated to occur for the turbine footings, construction pad, access tracks, and construction associated with the transmission line. This construction would result in the removal of some vegetation and locally affect habitat quality and food sources. The Proponent has chosen to manage the endangered ecological community of the Yellow Box

Woodland at the location where the access road to the substation is located as a conservation area by fencing and excluding stock.

Pre-clearing surveys will need to be undertaken by a qualified ecologist in order to provide a greater level of certainty that native fauna, including bats, if present are sensitively relocated to suitable habitat within the study area that will not be subject to construction. Similarly, pre-clearing survey will also need to be undertaken for the three threatened plant species. Any of the proposed tree planting surrounding the substation should be done with species selected to improve the habitat values of the project area e.g. primary and secondary food trees for the Koala and food trees for the Yellow-tailed Black-Cockatoo.

The reptile survey identified the presence of suitable habitat for the threatened reptile *Suta Flagellum* (Little Whip Snake) at the Grose Hill Group. This species could be adversely affected by construction associated with the turbine footings and special care will be required.

The Department's assessment identified that the operation of the turbines would pose the greatest environmental risks. The risks arise from the potential for birds, particularly waterbirds, possibly raptors, and bats to collide with (i.e. strike) the moving blades.

Waterbirds recorded within the broader study area, some of which are threatened species (e.g. the Freckled Duck), currently occur in relatively low numbers. However, it is noted that these numbers could increase when Lakes George and Bathurst fill with water.

Species of Honeyeater are known to migrate through this area in flocks during the autumn and spring. The migratory paths are not known but could overlap with the wind farm array.

There is limited scientifically rigorous data in Australia regarding the impacts on waterbirds, raptors, migratory birds, and bats due to wind turbine blade strike. Future changes in surrounding land use practices (including the construction and operation of the nearby Woodlawn Wind Farm), seasonal and climatic events that would fill the adjacent lakes after the commencement of the operation of the wind farm introduce variables with unforeseen consequences to bird and bat behaviour that could not be quantified at the environmental assessment stage for this Project. The actual impacts can only be accounted for by direct observations after the commencement of operation of the wind farm i.e. monitoring.

The Department is satisfied that the disturbances and risks posed to the flora and fauna of the study area from the construction and operation of the wind farm are acceptable providing the measures outlined above, including adaptive management, are implemented. Bird and bat monitoring surveys post operation of the wind farm will be especially important during and after the filling of Lakes Bathurst and George in order to assess whether waterbirds and bats are likely to move between these two waterbodies in a path through the turbines.

5.4 Visual Amenity

The proposed Capital Wind Farm would be visible at distances greater than 10 km in some directions, particularly across Lake George because of the unimpeded views presented by the flat plain of the lake bed. The Department's experience for other wind farm proposals suggests that visual impacts are lessened by distance with the greatest visual impacts occurring within a 4 km radius of the wind turbine.^{14, 15}

The visibility of the Capital Wind Farm turbines is variable due to the difference between the locations of the three turbine groups, differences in the elevation of the turbines and topographic variations across the locality. The turbines will be located on 750 metres to 935 metres high ridges. The turbines will be mounted on 80 metre high tapered steel tubular towers with a diameter varying from 4.5 metres at the base to 2.5 metres at the top. The

¹⁴ Environmental Impact Assessment Report – DA No. 176-8-2004-I – Crookwell II Wind Farm, Department of Infrastructure, Planning and Natural Resources (May, 2005).

¹⁵ Environmental Impact Assessment Report – DA No. 250-10-2004-i – Proposal by Woodlawn WindEnergy Joint Venture for a Wind Farm Within Goulburn Mulwaree Council and Palerang Council, Department of Planning (August, 2005).

turbines will have three, 44 metres long blades, 88 metres in diameter i.e. the highest point, measured to the blade tip, is 124 metres.

The Proponent undertook a visual assessment in order to gain a better appreciation of this variability and determine which perspectives would be most affected. The assessment was based on a methodology which identified:

- how visible the turbines would be for 21 of the 31 neighbouring residences within 3 km of the wind farm site (see Figure 3 below);
- distance of a residence from the wind farm (for the nearest turbine); and
- spatial extent of the visible turbines e.g. the wind farm angle of view.

Five locations were also selected in order to pick up the remaining 10 residences located within 3 km of the wind farm site¹⁶. These included:

- Taylors Creek Road east end residences on the southern side of the road (Label A in Figure 3);
- Taylors Creek Road east residences on the northern side of the road (Label B in Figure 3);
- Mt Fairy Road residences (Label C in Figure 3);
- residences located South of Big Hill (Label D in Figure 3); and
- residences located north of Bungendore at Hope Drive.

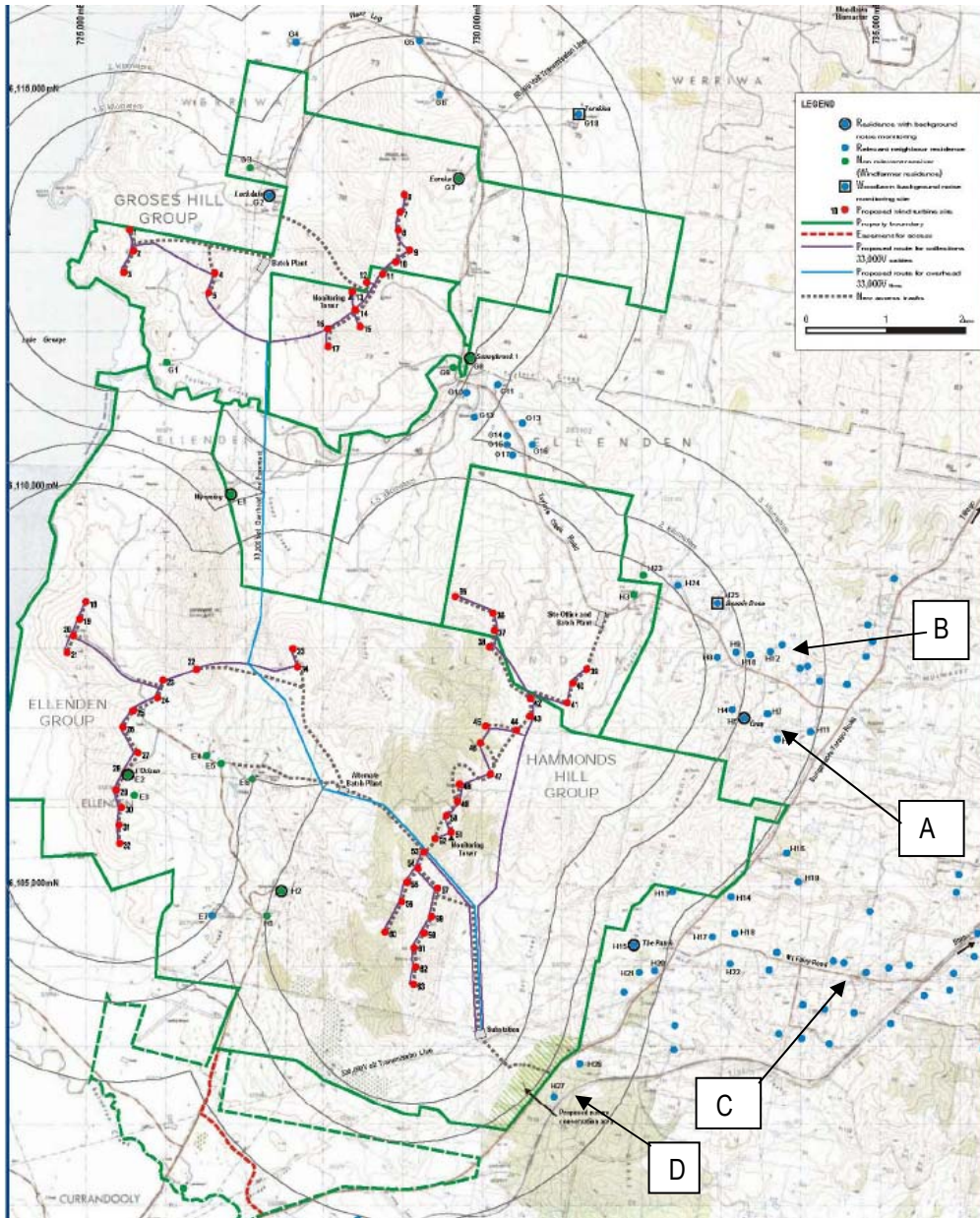
The assessment also selected ten viewpoints on public roads surrounding the wind farm located close to residences not associated with the proposal. Viewpoints 2-9 are represented in Figure 4 below. Viewpoints 1 and 10 are too distant to include in Figure 4. The analysis included an estimation of the:

- distance to the nearest turbine;
- number of turbines that would be visible in the mid-ground (1-3 km), mid-background (3-5 km) and background (>5 km); and
- angle of view.

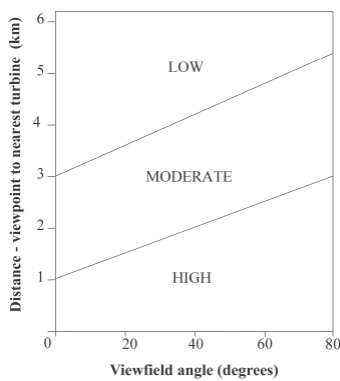
Photomontages were constructed for these ten viewpoints in order to get an appreciation of how the visible turbines would appear from that point.

¹⁶ See Table 7.2 of Appendix C, *Review of Visual Impact, in Capital Wind Farm Environmental Assessment, Volume 2 – Appendices.*

Figure 3 – Location of Residences Surrounding the Wind Farm Project



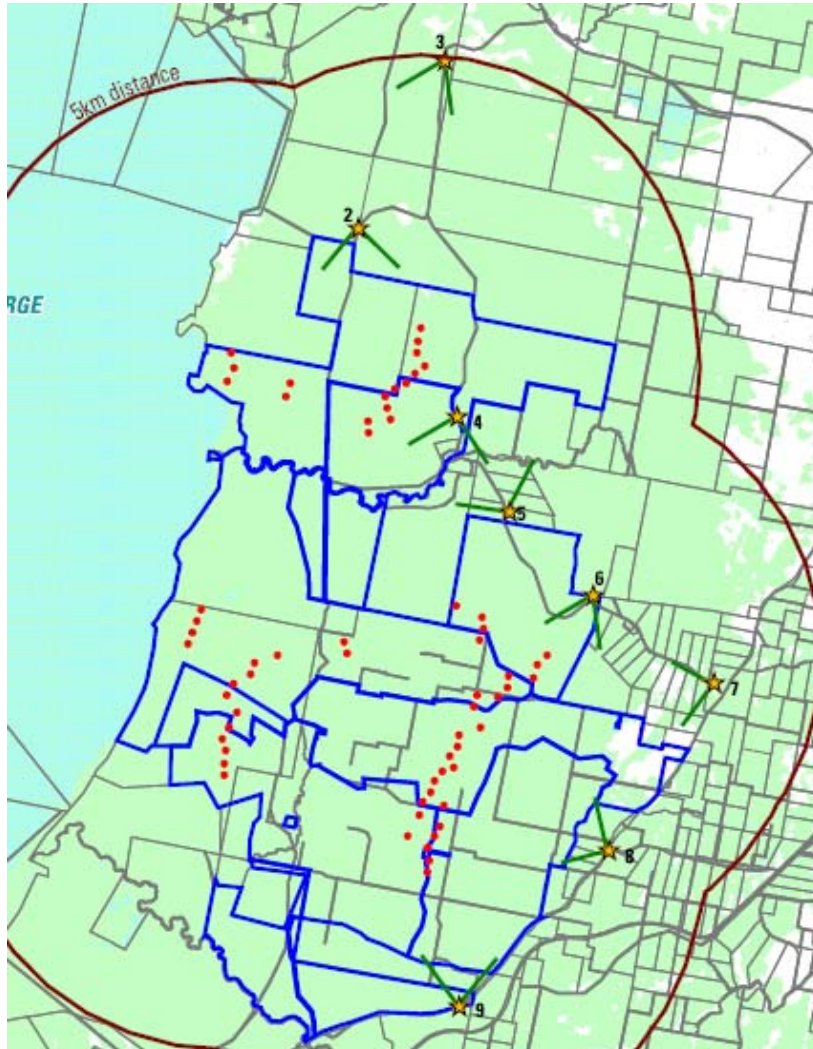
In every instance the Proponent ranked the visibility as Low, Moderate, or High using an index which took into account distance to the turbine as well as the angle of view as set out in the figure below.



On this basis the Viewpoint No. 2, located at the entrance to Lakoona (G2 in Figure 3), and the Viewpoint No. 6, located along Taylors Creek Road near Nardoo (H23 in Figure 3), rated High. Viewpoints Nos. 4, 5, 7, 8, and 9 (Taylors Creek Road north, Taylors Creek Road middle, Taylors Creek Road at the eastern end, the intersection

of the Mt Fairy and Tarago Roads, and Tarago Road respectively) were rated as Moderate. Viewpoints Nos. 1, 3, and 10 (Gearys Gap Lookout, Taylors Creek Road north of West Leg Intersection, and Hope Drive at Bungendore respectively) were rated as Low.

Figure 4 – Location of Viewpoints (Note: Viewpoints 1 and 10 are too distant for this figure and not represented)



The viewpoints for the 21 of the 31 residences which occur within 3 km of the wind farm and at the other five locations were similarly scored by the Proponent. These residences potentially have views to between four and 29 turbines. Eleven of these residences rated High and included two of the three residences associated with viewpoint No. 2 and three of the 10 residences associated with viewpoint No. 6 i.e. the viewpoints which rated High.

Taylors Creek Road is the closest road to a wind turbine at a distance of 0.7 km. The northern section of Taylors Creek Road has eight residences which all have views to the wind farm. All these residences scored either High or Moderate in the visibility ranking.

The scheme used here is acknowledged to be arbitrary but does provide a comparative ranking for the viewpoints. It does not represent a visual impact assessment because it does not indicate whether the visibility is adverse or favourable, merely that the turbines are visible and a relative comment on how visible.

The village of Bungendore is approximately 10 km to the south of the wind farm and it will receive partly filtered distant views. A recent residential subdivision to the north of Bungendore is approximately 6 to 8 km from the

southern part of the wind farm. The greater distances from the wind farm for dwellings associated with these areas mitigates the visibility since the turbines become less dominant in the field of view.

The village of Tarago is approximately 12 km to the north-east of the nearest turbine. The topography mitigates any views of the wind farm from Tarago.

The wind farm will be visible for north bound traffic on the Bungendore to Tarago Road up to 10 kilometres to the south of the wind farm. Views to the site from the south are partly limited by the Great Dividing Range, particularly east of the Tarago to Bungendore Road. The closest resident to the south is more than 3 km from the nearest turbine.

Views to the site from the west are across Lake George. Therefore, it will be visible by travellers along the Federal Highway. However, these views are almost always more than 10 km from the wind farm and there are no residences within Lake George. The motorists would make up the largest number of viewers, albeit transient, for the Capital Wind Farm Project.

Views to the site from the north-west, from Collector to Tarago Road, are limited to the north of the ridge that is about 8 km north of the wind farm. Closer in, at the foot of the Grose Hill Ridge there are two residences located within 2.3 km of the wind farm. These two residences form the group associated with the high visibility rating for viewpoint No. 2.

Residents within the visual catchment are likely to have a different visual perception of the Project than transient viewers (e.g. viewers from the roads) because residents views will generally be from stationary points over longer periods of time. The residents' perceptions would be strongly influenced by their attitudes towards wind power generation and possibly other impacts associated with the proposal such as noise.

5.4.1 Issues Raised

The majority of the submissions received from the 49 objectors to the Project mention either directly or indirectly, concerns with visual impacts of the wind farm.

Twenty-eight submissions raised specific issues regarding the visual nature of the Project. These dealt with such matters as:

- the impact on the view scape of Lake George;
- concern about maintenance to ensure any wind farm would be kept neat and tidy;
- opportunities to change the layout to get some turbines set-back from property boundaries;
- visibility of the turbines from a particular residence; and
- changes in the rural character of the setting.

Most of the remaining objectors' submissions did not go into any detail, deferring to general beliefs that the wind farm would have adverse visual impacts.

Refer to APPENDIX C for details regarding matters raised in the submissions.

5.4.2 Consideration

Although wind farms potentially create other environmental impacts, one of the main concerns to the local community is the perception that they will have adverse visual impacts. It is not possible to shield these tall turbines from all views therefore a wind farm will change the static rural outlook to a dynamic less natural vista with a strong vertical and artificial element in the landscape.

There are no absolute rules when assessing visual impacts of wind farms and each wind farm needs to be assessed individually on specific issues. As a general rule which can be applied at the local level (i.e. for those dwellings within view of the wind farm) the severity of the visual impact can be influenced by how close a turbine is located to an individual's property (either dwelling or the border of a larger landholding). This principle is

acknowledged in wind farm guideline documents and more recently in development control plans prepared for certain local government areas (See APPENDIX B - *Summary of Visual Impact Assessment Criteria in Selected DCPs and Guidelines*). It was also born out in the Proponent's qualitative visual assessment. It is also likely that the closer a residence is to a turbine the more likely it will receive a range of impacts including noise, shadow flicker, and visual intrusiveness compounding the overall objections.

The range of opinions on the visual impacts are often extreme, with supporters claiming wind turbines are things of beauty adding interest to the landscape, and opponents vehement that these are industrial machines which are out of place and a blight on the countryside. (Note: These diametrically opposed views were encountered during discussions held with some residences) Some submissions for the Capital Wind Farm also placed the greenhouse benefits attributed to these developments above any negative values associated with visual impacts.

There are two key visual impact considerations for the Capital Wind Farm Project:

- The effect on the quality of the broad landscape that is going to be intruded upon; and
- The effect on individual residences.

Broad Landscape

The location of the individual turbines placed as they are on top of the ridge lines to maximise exposure to the wind, ensures high visibility and would result in a considerable change to the visual character of the broad landscape.

The wind farm would be seen up to 10 km to the south, approximately 10 km to the west, more than 10 km to the north-west but in a setting that has already been significantly modified since settlement.

The existing modifications in the landscape reflect changes arising from long-term agricultural and settlement in the rural country side. Most of the original woodland vegetation has been removed for pasture establishment. The pasture ensures that there is still a high proportion of vegetation in most views, albeit cleared paddocks containing mostly exotic grasses. However, adjacent to the Hammonds Hill group of turbines there is still some remnant woodlands.

Fencing, exotic tree windbreaks, and farm tracks criss-cross the open views of the valleys associated with the Hammonds Hill, Ellenden, and Grose Hill. Closer settlement has occurred along the southern 8 km section of Taylors Creek Road where approximately 25 residences have been built and silviculture (i.e. pine plantations) is practiced south of the substation site.

There is a network of local roads, power lines and communication towers. The Federal Highway is about 10 km west of the site. The Tarago to Bungendore Road is a main road that serves local and through traffic between Goulburn and Queanbeyan. A 330 000 volt line passes to the south of the wind farm site. A separate 66 000 volt line passes through the wind farm from north to south. The Collex property to the north-east contains the highly disturbed areas surrounding the closed Woodlawn Mine, now operating as a biogas landfill. The Collex property has been given an approval to construct and operate a 25 turbine wind farm although this has not been built yet.

The visual catchment does not contain a public recreation reserve such as a national park. However, a stand out feature of the landscape is Lake George located to the west of the Project. It is a flat, treeless lake bed covered with grasses on areas exposed by receding water. The flat relief of Lake George makes it possible for the proposal to be seen by motorists from the Federal Highway which winds its way along the western side of Lake George. These are distant, approximately 10 km, views. Certain sections of the Federal Highway contain vegetation which would shield the views along parts of the highway.

The Proponent presented ten simulations (photomontages) in its assessment. The visual simulations prepared by the Proponent illustrate the extent to which the turbines will be visible at a selection of sites surrounding the wind farm. It is evident from the simulations that the scale of the turbines will be substantially greater than any other vertical structure within the landscape. There is no doubt that the wind farm would initially be visually dramatic. However, it is also clear from the visual simulations (notably Viewpoint No. 1 at Gearys Gap Lookout) that greater distances from the turbines reduce their overall dominance in the landscape.

Individual Residences

The greatest number of viewers to the proposed wind farm will be road users, although in some sections of the affected roads the views would be screened by roadside vegetation. Approximately 60 homesteads and residences located within 9 km of the wind farm site, and not associated with the wind farm, would also see a varying number of turbines. For example all 63 turbines would be able to be seen from areas around the Gearys Gap Lookout which is approximately 9 km from the wind farm.

The extent to which turbines would be visible to individual residences is influenced by the layout of the wind farm and the orientation of residences. These factors determined the view field angle in the visibility assessment which estimated that 13 of the approximately 33 residences located within 3 km of the wind farm had a high visibility score and nine of these 33 had a moderate visibility score. In this case the view field angle ranged between 15 degrees and 130 degrees.

The Department notes that the visibility assessment is presented as a worst case scenario because it did not take into account that trees and shrubs which surround residences as well as localised variations in landform may be effective in reducing the visibility. The Department observed, during a field inspection of the Project, that there are many instances where this localised variation will be effective in screening the turbines. Similarly there were other instances where, given the height of the turbines and setting of the residence, partial screening or no screening would occur.

The visibility assessment suggests that the 13 residences with a high visibility ranking and nine residences with the moderate score are likely to be the most intruded upon by the proposal. The visibility assessment also suggests that there may be opportunities to mitigate visual impacts of those residences which rated high and moderate in the visibility index by landscaping around these dwellings. However, in some instances it may be necessary to use mature stock in order to achieve this.

The Department has previously been advised by an independent visual consultant (when undertaking an assessment of the Crookwell II wind farm) that the visual impact of turbines generally drops rapidly at approximately 4 km¹⁷. Therefore it would be appropriate to address visual impact mitigation for all residents with views to turbines located within 4 km of their dwelling, irrespective of the results of the analysis which attempted to score a visibility index.

5.4.3 Resolution

A number of measures that are available that can offset the visual intrusiveness associated with wind farms were identified by the Proponent in its Environmental Assessment report. These included:

- The use of colour to reduce visual contrast between turbine structures and background;
- Undergrounding cables between turbines;
- Locating the substation and facilities building away from most public viewpoints;
- Maintaining revegetation on disturbed areas to avoid erosion;
- Minimising cut and fill for site tracks, installing effective drainage and revegetating disturbed soils quickly; and
- Maintaining tracks to avoid erosion.

A number of other mitigation measures commonly adopted for wind farms include¹⁸:

- Using local material for fill to minimise colour contrast;

¹⁷ Ibid.

¹⁸ See for example - Gipe, P, *Design as if People Matter: Aesthetic Guidelines for the Wind Industry* a paper presented to the American Wind Energy Assoc. conference in Washington, DC March 30, 1995.

- Establishing screen planting around the substation to ensure that no components of the substation are visible;
- Designing and constructing substation and facilities buildings to fit in with the rural setting;
- Providing aesthetic uniformity by ensuring the rotor, nacelle, and tower of each turbine look similar and their rotors spin in the same direction;
- Ensuring the turbines are spinning when there is wind. (Apparently the public perception is that it is being cheated if it has to put up with the visual intrusion and there is no real benefit i.e. the turbines are not working);
- Prohibiting any advertisements/manufacturer logos on the turbines;
- Controlling lighting;
- Good "housekeeping" by managing the site to be free of litter, and ensuring maintenance wastes are disposed of correctly e.g. lube oils;
- Removing or re-locating certain turbines; and
- Keeping the public informed.

In addition to the above measures, the Department supports the inclusion of a condition which requires the Proponent to provide landscape screening on neighbouring properties, at the request of the resident, with views of turbines located within 4 km of their dwelling. The 4 km cut-off is consistent with the Department's approach adopted for other wind farms and should help to mitigate the visual impacts for the dwellings subject to the greatest visual intrusion. It will be necessary for a landscape consultant to provide advice for each individual residential treatment e.g. which screening species to use, where mature stock should be used in order to get the most effect, how to screen out the wind turbines and still retain at least a partial outlook if desired by the resident.

5.4.4 Conclusion

The modifications that have already taken place within the broader landscape occurred over many years (or generations when considering vegetation clearing) and for this reason there is a greater acceptability to change. The wind farm project would become an important element in the visual catchment and present a strong image of contrasting form, colour, and elevation. However, the placement of a wind farm at this location would not, in itself, spoil the landscape because it has already been subjected to cumulative and progressive changes indicative of activities associated with a working rural area. Even Lake George, shouldered by the Federal Highway on its western side, subdivided by fence lines and grazed extensively when it is dry, no longer presents as a pristine feature.

Individual residences located within 4 km and with views to the wind turbines are likely to experience the greatest visual intrusion. The Department's assessment indicates that this may be up to 38 residences not associated with the Project. These include 12 residences between 1.2 km and 2.0 km distance to the nearest turbine, 21 residences between 2.1 km and 2.9 km distant from the nearest turbines, and five residences between 3.4 km and 3.8 km from the nearest turbine. The visibility ranking carried out by the Proponent bore this out i.e. up to 22 residences of the 33 within 3 km of the turbines would be subject to a Moderate to High visibility score.

The acceptability of the changes to the visual outlook will always be a matter of conjecture because of the subjectivity of individual likes and dislikes. However, the Department is satisfied that this Project is acceptable because of the relatively small number of residences affected by the Project and the opportunity to screen the views of those most affected. It is anticipated that the screening will reduce the major visual intrusiveness of the proposal on those most affected so that these impacts will not be excessive.

5.5 Property Values

The question of wind farms adversely affecting property values arises when a reduction in a particular amenity value, such as visual or noise, lowers the saleability of the property. This is usually reflected as a lower market value for the property.

5.5.1 Issues Raised

Sixteen submissions raised concerns regarding the potential for a wind farm to affect the value of surrounding properties. In particular these submissions wanted to know what local evidence was available to support the Proponent's position that wind farms do not adversely affect property values. The Proponent identified several cases of anecdotal evidence based on Australian experience. This included a summary of informal investigations made into property prices at Salmon Beach in Western Australia. Some international studies on property values were referenced in the Submissions Report prepared by the Proponent.

5.5.2 Consideration of Issues

The Department acknowledges that any negative effect wind farms may have on property values is a particular concern to landholders. However, there is limited quantifiable data which can be used to identify any valuation effects.

The most extensive survey to examine the effect of wind farms on property values was undertaken in the United States and presented in an Analytical Report by the Renewable Energy Policy Project¹⁹. The study did not model the changes in property values, rather it was an empirical review where data from ten wind farm sites was collected and subjected to a statistical regression analysis to determine price changes in three ways:

- How property values (prices) changed over the entire period of the study for the view shed and comparable region;
- How prices changed in the view shed before and after the projects came on-line; and
- How property values changed for both the view shed and comparable community but only for the period after the project came on-line.

The results identified that in 30 separate analyses (i.e. ten wind farm sites subjected to three assessments), 26 property values in the affected view shed performed better than the comparable properties. The study conclusion that "there is no support for the claim that wind development will harm property values" was qualified with a statement that more data will need to be analysed as it becomes available. This suggests that the conclusions drawn from the analysis are indicative and preliminary and should be used cautiously when translating to other sites that were not investigated.

The Bald Hills Wind Farm Panel Inquiry in Victoria examined the issues of property devaluation for neighbouring properties in a more qualitative manner²⁰. A number of property valuers and real estate agents provided submissions and appeared before the Panel Inquiry as expert witnesses. From a review of this evidence the Panel Inquiry report concluded that:

All that appears to emerge from the range of submissions and evidence on valuation issues is the view that the effect of wind energy facilities on surrounding property values is inconclusive, beyond the position that the agricultural land component of value would remain unchanged. On this there appeared to be general agreement.

The Department notes the concerns expressed in the submissions for the Capital Wind Farm Project regarding the potential to adversely affect property values. The assessment did not identify that the existing use of the land was likely to be lessened i.e. the amenity values of the existing rural residential or agricultural uses, or any existing or approved change in the use of the land would be adversely affected by the Project. There will be changes to the visual landscape. However, it is not possible to factor in how this will affect property values. There is no conclusive evidence that significant value changes, transfers or inequities would result from the project proceeding.

¹⁹ Sterzinger, G et. al *The Effect of Wind Development on Local Property Values*, May 2003.

²⁰ *Bald Hills Wind Farm Project: EES, EES Supplement and Called-in Permits Panel Report*, Victorian State Government, 24 June 2004.

Some submissions raised concerns regarding future land use changes that were anticipated to be made i.e. subdivision of land for rural residential. However, at the time of the consideration of the Project, no applications for these developments had been made. It would therefore be inappropriate, in the absence of a strategy document which identified any future higher density settlement outside of the existing 40 hectare minimum subdivision, to support these objections²¹.

5.6 Soil and Water Management

The soil landscapes of the project area have been characterised on the basis of the NSW Soil Conservation Service's Braidwood and Canberra soil landscape maps. The project site has also been identified to be wholly within the Lake George catchment. Any runoff from the site will be collected by unnamed drainage creeks, Taylors Creek (located between the Ellenden and Groses Hill turbine groups), and Butmaroo Creek (located to the south-west of the site and flows into Lake George draining the southern side of the Hammonds Hill via Dry Creek and Ellenden Groups via Wrights Creek).

5.6.1 Issues Raised

Eight submissions raised general concerns regarding the potential for the Project to exacerbate soil erosion and affect sedimentation. The Proponent has indicated that these matters would be addressed in an environmental management plan which describes erosion control practices and rehabilitation of sites with plantings.

There were also concerns about the disposal of spoil and how this would be handled. The Proponent clarified that any excess would be used to form the pad at the base of each tower and as road base for the access tracks.

Several submissions required clarification about the water sources that are proposed to be used to meet the construction demands including concreting. The Proponent identified the ground water resource beneath Butmaroo Creek as the likely source to supply the one off construction water requirement of approximately 20 ML. The Department of Natural Resources identified that the *Water Act* states that all works connected to a source of underground water and used for water supply must be licensed. The license is a separate requirement from any approval made by the Minister.

5.6.2 Consideration of Issues

The identified soil landscapes for each of the component work sites have different characteristics but all present as being highly susceptible to erosion from diffuse and concentrated runoff.²² This applies throughout the project area i.e. to the Groses Hill, Ellenden, and Hammonds Hill groups as well as the substation site.

The characteristics of each soil landscape will probably present their own erosion and sedimentation management requirements when undertaking earthworks for tracks, turbine footings, underground cable trenching, or substation construction. It will therefore be necessary to apply appropriate erosion control measures to match these characteristics. The Proponent acknowledges that construction of the project will involve disturbances to the slopes and could exacerbate erosion and that this issue will need to be addressed in a comprehensive Soil and Water Management Plan.

Lake George is an important inland wetland that is listed in the national directory of important wetlands²³. The Project is located within the Lake George catchment and any runoff from the site could eventually make its way into Lake George. The surface drainage does not supply domestic drinking water but is used by stock when collected in dams.

²¹ Mulwaree Shire Council's *Settlement Strategy* document dated November, 2003 applies to the Tarago village area. Tarago was described in the strategy document as an area with limited opportunities for future growth constrained by the lack of sewerage and its location in Sydney's drinking water catchment.

²² Field observations in these areas confirm that there are a lot of erosion gullies on the slopes.

²³ Usback, S. and James, R. *A Directory of Important Wetlands in Australia*, (undated), Australian Nature Conservation Agency.

Construction works will involve earthworks, pouring concrete, storage and handling of equipment, and temporary facilities for the construction workforce. Certain activities will need to be managed to avoid impacts to the local drainage system and to ensure sedimentation of Lake George is not accelerated and the transport of potential pollutants (e.g. oil and lubricants) does not occur. These works include:

- Soil disturbances associated with the earthworks i.e. access tracks, trenches, footings;
- Stockpile storages;
- Works associated with watercourse crossings;
- Sewage effluent from the construction workforce; and
- Storage and handling of fuels and oils.

The risk for soil and water contamination if transformer oil leaks or spills has been addressed by the Proponent by committing to construct containment bunds around the transformers. (Note: The 33 000 to 330 000 volt transformer will contain approximately 50 000 litres of oil, and the padmount transformers could each contain many litres of oil each.)

5.6.3 Resolution

The Department supports the Proponent's commitment to develop a Soil and Water Management Plan. The incorporation of the measures proposed by the Proponent in Section 5.5.4 of the Environmental Assessment report into the Soil and Water Management Plan also represents good management practice. These and other mitigation measures are set out in a condition of approval that requires the Proponent to prepare Construction and Operational Soil and Water Management Plans.

5.6.4 Conclusion

The shallow, friable soils located on steeply sloping lands that are proposed to be disturbed for the construction of the wind farm will present difficult challenges. However the Department is satisfied that a diligent and carefully crafted Soil and Water Management Plan that is subject to review and approval will satisfactorily address soil and sedimentation issues arising from the construction of the Project.

5.7 Operational Related Impacts

The Environmental Assessment report identified certain hazard and safety issues associated with the proposed wind farm. These included:

- Aviation safety;
- Bushfire risk;
- Shadow flicker;
- Physical safety of site infrastructure; and
- Electrical safety.

Aviation

The EA identified that because of the height of the turbines (i.e. maximum of 124 metres) there may be aviation safety issues regarding aircraft landing fields, intrusion into air traffic zones (i.e. the turbines sit atop ridges and are a maximum of 118 metres high), and there could be impacts with aerial crop spraying.

The nearest landing fields are Goulburn (35 km north) and Canberra (35 km south-west). Height limits associated with developments in the vicinity of airfields are based on obstacle limitation surfaces (OLS), for which the airfield operator must monitor the immediate airspace to ensure that it is not affected by potential developments. OLS can extend to 16 km from an aerodrome. The EA identified that the Civil Aviation Safety Authority (CASA) confirmed that the wind farm would not represent a hazard to airfield users.

Under Civil Air Safety Regulations, CASA must be informed about structures with a height greater than 110 metres above ground level. The Proponent sought comments from CASA regarding the need to mount obstacle

lights on the turbines, at the time of the preparation of the EA. CASA advised that lighting would not be required to mark or light the towers. CASA further advised that should the Project be given approval and constructed then the Applicant should provide, for each tower, the coordinates, final height (in mAHD), and the ground level of the site so that aeronautical charts can be updated.

Matters relevant to CASA are addressed in the Department's recommendations.

Neither the Department of Defence nor the Aerial Agricultural Association of Australia (i.e. the industry body representing aerial spraying) raised any concerns regarding the Project when consulted by the Applicant.

Bushfire Risk

The NSW Rural Fire Service has previously commented on the fire risk potential for wind turbines at other wind farm proposals. Its view was the turbines themselves do not present any greater risk of fire than that of other structures such as transmission lines, power poles, houses, sheds or workshops providing the turbine manufacturer's installation and maintenance guidelines are observed.

Some parts of the land the proposed wind farm is sited on are identified as "bushfire-prone land" in the Mulwaree LEP. The Proponent has indicated that it would prepare a Bushfire Risk Management Plan in consultation with the local Rural Fire Service. In addition the Proponent made a commitment to purchase a Cat 7 Fire Tender for the Taylors Creek Rural Fire Service.

The Proponent will be required to prepare the bushfire plan as part of the *Construction and Operation Environmental Management Plans* and in consultation with the Taylors Creek Rural fire Service. The plan will be based on the 2001 *Planning for Bushfire Protection* guidelines prepared by the Rural Fire Service. The Proponent will also be required to purchase the fire tender for the Taylors Creek Rural Fire Service in accordance with its stated commitment.

Shadow Flicker

The Environmental Assessment defines shadow flicker as "a visual effect that occurs when rotating turbine blades cause intermittent shadowing as the blades momentarily block the sun's path". For example if you live very close to the turbine it may be annoying if the blades chop through the sunlight and cause a flickering or strobe effect while the blades are moving.

The Proponent assessed the potential for shadow flicker using the WindFarmer software and the associated factors. These factors include, for example, elevation of the turbine, solar azimuth angle, distance between the wind turbine and the location of the residence, and diameter of the turbine blade.

There are no criteria in New South Wales for shadow flicker. However, the Victorian Government's planning guidelines for wind farms state that *shadow flicker experienced at any dwelling in the surrounding area must not exceed 30 hours per year as a result of the operation of the wind energy facility*²⁴.

The modelled results indicate that shadow flicker effects at distances greater than 1 km are indistinct or faint. At a distance of less than 400 metres between the turbine and residence, there is a potential for the sun to be completely blocked by turbine blades of 3.5 metres width. For the Capital Wind Farm Project, there are only two residences located at distances of less than 400 metres, L'Orizon A at 68 metres and L'Orizon B at 283 metres. The modelling predicted that these residences would receive approximately 494 and 113 hours/year of shadow flicker respectively. Both these residences will be leased by the Proponent.

The next closest residences, the Euroka Homestead at 700 metres and Ellenden at 800 metres, are within the zone of potential blade flicker. Euroka is located to the north-east of the Groses Hill Group and is likely to be affected by approximately 20 hours/year of shadow flicker. Ellenden is located to the south-east of the Ellden

²⁴ Sustainable Energy Authority Victoria, *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria*, May 2003.

Group and is likely to be affected by shadow flicker for approximately 8 hours/year. However, these residences are surrounded by a dense stand of pine trees that should mitigate some of the flicker effects. In addition, the owners are participants in the wind farm venture.

The closest non-wind farm participant is the Luckdale Homestead at 1.2 kilometres. The homestead is beyond the shadow flicker zone.

Physical Safety of Site Infrastructure

The design and construction of the wind farm will be subject to a number of Australian and overseas standards. These standards include:

- AS/NZS 1170:2 Structural Design Actions – General Principles;
- AS 2550 – Cranes – Safe Use
- AS 3600-2001 Concrete Structures;
- AS 4100 – Steel Structures (except tower)
- Steel Tower – DIN 18 800
- IEC 61400-1 – Wind Turbine Generator Systems – Safety Requirements.

The Proponent also indicated that it would prepare a Health and Safety Plan and conduct all construction works in accordance with the requirements of the WorkCover Authority.

Electrical Safety

The Proponent identified Australian Standards and Energy Supply Association of Australia standards that would be applied to cover electrical matters including, for example:

- Lightning protection and grounding;
- High and low voltage switchgear and control gear;
- High and low voltage fuses;
- Circuit breakers;
- Transformers;
- Electric cables;
- Overhead transmission lines; and
- Underground cables.

The wind farm has also been designed with an automated control system to detect faults and disconnect the faulted equipment from the system. In addition the 33 000 volt padmount transformers and the 330 000 volt transformer will be protected by surge diverters, lightning masts, and an underground earth grid.

The Proponent will be required to prepare a comprehensive Safety Management System in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 9 'Safety Management'*. The Safety Management System would ensure that the procedures and programs for the maintenance and testing of the safety related equipment are appropriate for the life of the wind farm.

5.8 Traffic and Transport

The main imported components of the wind farm (the nacelle, hub, and blades) and the Australian fabricated four piece towers will be transported to the site via Goulburn, using the Hume Highway although at this stage it is unclear which port of entry the components will arrive from and where the towers will be fabricated. These components are oversized and overweight and would require escort vehicles, traffic management plans and a transport permit from the Roads and Traffic Authority.

The transport of the components to Goulburn via the Hume Highway was examined in the environmental assessment. The northern exit from the Hume Highway to Goulburn was determined to be the easier and safer one for the long vehicles. The exact route through Goulburn is also a matter that will need to be agreed with

Council. It would be preferable that the selected route is the shortest route to the wind farm site with the appropriate carriageway and clearance through all sections, or at least the one that causes the least disruption to local transport and commercial activities.

Construction vehicles will access the wind farm site from Goulburn via the Braidwood Road to Tarago. From Tarago the wind farm will be accessed via the Collector Road and Taylors Creek Road.

The Proponent has put forward a strategy to minimise the construction traffic movements along Taylors Creek Road. It involves only permitting access for all heavy vehicles and the over sized and over weight vehicles from the northern end of Taylors Creek Road at its intersection with Collector Road. Delivery of loads to the Groses Hill Group will be via a 5km section of Taylors Creek Road and Western Leg Road. These vehicles will exit the site by backtracking to Collector Road.

However, the delivery to Ellenden and Hammonds Hill Groups will travel down (south) Taylors Creek Road, to the entrance point to these groups at approximately 3.6 km west of the intersection of Taylors Creek Road and Bungendore Road. After making their delivery, the empty vehicles will turn right onto Taylors Creek Road from this entrance point. This leads them to Bungendore Road i.e. the empty vehicles will continue down Taylors Creek Road returning to Goulburn via Bungendore Road and avoiding a return trip along Taylors Creek Road.

5.8.1 Issues Raised

Eight public submissions raised concerns about traffic related matters and road safety particularly from the potential for construction traffic which involves oversized and overweight vehicles. Road safety was also mentioned in relation to the distraction that would be caused by the operating wind farm to passing motorists. The Department is not aware of any circumstance where wind turbines would present any greater road safety concerns than exist with other day to day distractions experienced by road users. These include billboards, building with unusual designs or colours, or the sudden appearance of native animals.

Many of the issues raised in the public submissions will be addressed by the Proponent in a Construction Traffic Management Plan. Palerang and Goulburn Mulwaree Councils both raised concerns regarding traffic management and pavement damage from the anticipated heavy vehicles.

The Department's consideration of traffic and transport issues is addressed below.

5.8.2 Consideration of Issues

The delivery contractor will need to finalise delivery routes from the entry port to the Hume Highway to ensure the road widths and clearances are adequate. The contractor will also be responsible for obtaining any necessary transport permits and permissions from the Roads and Traffic Authority.

The existing level of traffic currently experienced on the Tarago/Bungendore Road north of Collector Road is less than 550 vehicles per day²⁵. Collector Road carries approximately 50 vehicles per day. These roads are currently operating at a Level of Service "A"²⁶. The Environmental Assessment estimates approximately 17 500 one-way vehicle movements over the eight month construction period. This equates to approximately 150 two-way vehicle movements per day associated with all the construction traffic. It is anticipated that the construction of the wind farm will have a minimal impact on the existing capacity of the Tarago/Bungendore Road and Collector Road because of the current low level of existing traffic movements, sealed pavements, and wide alignments.

Construction traffic will turn off Collector Road and enter Taylors Creek Road. Taylors Creek Road is an unsealed secondary rural road primarily used by the approximately 30 residences located adjacent to this road.

²⁵ URS, *Environmental Impact Statement – Woodlawn Wind Farm* Section 14, Traffic and Transportation, September, 2004.

²⁶ Level of Service "A" is defined as free flow conditions, providing high degree of freedom for drivers to select desired speed and manoeuvre within traffic stream.

There is also a local school bus operating in the morning and afternoon. Existing traffic volume is low and ranges from 16 to 65 vehicles per day for various sections of the road.

The Proponent has recognised that Taylors Creek Road is narrow with poor sight distances at some points which could compromise the safe two-way passing of heavy vehicles. There are also a number of creek crossings with single lane causeways located in dips, some with poor sight distances.

Negotiating the heavy vehicles and over sized and overweight vehicles on Taylors Creeks Road will present large challenges to the Proponent who has indicated that a Traffic Management Plan will need to be prepared in consultation with Council. It is also likely that the local Taylors Creek Road community will be subjected to reduced amenity from intermittent traffic restrictions, dust, and increased level of traffic noise during the short term construction period.

Road aggregate material is proposed to be quarried using an on-site resource located to the south-east of turbine 34. It is anticipated that up to 22 500 m³ will be quarried in the estimated 8 months construction period. This equates to approximately 2 930 trucks loads of aggregate. The majority of the truck movements will be within the project area and avoid using the local roads. However, it is anticipated that up to 580 one-way truck movements for carrying aggregate will be made on Taylors Creek Road.

Palerang Council noted the likely damage that could be expected on Council's road network from the number of heavy vehicle movements that are required for this proposal (estimated in the Environmental Assessment at 8 500). It also identified the need to upgrade entrances to turbines group accesses and low standard gravel roads proposed to be used in the construction and operation of the wind farm.

5.8.3 Resolution

The Proponent has identified a number of mitigation measures it proposes to implement in order to minimise traffic and transport impacts including:

- The preparation of a comprehensive Traffic Management Plan, in consultation with the local Traffic Management Committee. The plan will need to address construction traffic identified for Taylors Creek Road.
- The one-way delivery strategy for turbine components at the Ellenden and Hammonds Hill Groups (and the return of empty vehicles from the Hammonds Hill Group by backtracking);
- Finalising the route through Goulburn in consultation with Council;
- Sealing the approaches to and intersection of Taylors Creek Road and Western Leg Road prior to construction commencing;
- Using traffic control personnel where large vehicles are required to execute difficult or potentially unsafe manoeuvres;
- Restricting deliveries to times outside of school zone periods and when the bus is operating on Taylors Creek Road;
- Making local deliveries to the site during daylight hours only;
- Developing an inspection and maintenance program for the local road access and on-site track network to ensure maintained and safe conditions e.g. regular grading and dust suppression; and
- Implementing a community consultation program to ensure residents are informed on construction program timing and management.

Palerang Council agreed that the measures proposed by the Proponent are acceptable and address the likely impacts if these measures are transformed into conditions of approval. Council also proposed conditions to address transport and road impacts which cover:

- The need to prepare a comprehensive Traffic and Transport Management Plan;
- The identification of development standards to be met for site access road entrances off Taylors Creek Road, Western Leg Road, and the existing entrance off Bungendore Road;
- The need to provide engineering design drawings for proposed works in public roads;
- Development standards for all private access roads including the road to the facilities building;

- A requirement to provide parking and a turning area adjacent to the facilities building; and
- Measures to provide effective permanent drainage works within the properties in the vicinity of each entrance to divert stormwater away from driveways and away from public roads.

The Department has included the mitigation measures outlined above in the Recommend Conditions of Approval and further suggests that the Traffic and Transport Management Plan include:

- Installation of suitable warning signs and signs at locations along the route to alert other transport users of the oversized vehicle activities;
- Awareness program for all wind farm construction transport drivers to alert them to non-vehicle users of the road e.g. stock, horse riders, pedestrians etc;
- Specific arrangements for monitoring and maintaining Taylors Creek Road during construction including grading and dust suppression.
- Restricted speed limits in certain sections.

A road dilapidation report will also need to be prepared to ensure that any road/footpath/cycleway damage (aside from that resulting from normal wear and tear) attributable to the construction of the Project, will be repaired to a standard at least equivalent to that existing prior to any disturbance.

It is noted that the Proponent has agreed to enter into a Planning Agreement in accordance with Section 93F of the EP&A Act with Palerang Council. The agreement covers a commitment by the Proponent to seal the unsealed sections of Taylors Creek Road. This commitment is above what would be required to mitigate the traffic and transport impacts associated with the Project. By making this commitment the Proponent has imparted a gesture of goodwill and demonstrated a corporate social responsibility which provides a wider community benefit. A separate recommended Condition of Approval has been included for the Planning Agreement.

5.8.4 Conclusion

The Department is satisfied that the traffic and transport issues raised by this Project can be adequately addressed by Conditions of Approval which address the mitigation measures outlined above.

5.9 Electromagnetic Interference

The Department has previously assessed that the accuracy of predicting television interference is low even where there is a large effort put into investigations.

The Proponent's investigations concluded that:

- VHF TV reception at dwellings 1 to 2 km from the wind farm and within a ± 25 degrees transmission path from the turbines located between the receiver and the transmitter will probably be affected by ghosting.
- UHF TV reception at residences 2 to 3 km from the wind and within ± 20 degrees from the transmission path through the turbines located between the transmitter will probably have a time variant ghosting²⁷.

The investigations also identified that there are three point to point radio communication services (mainly operated by the NSW Rural Fire Service and the Ambulance service) and an Optus microwave multichannel link with paths through the wind farm area. The investigations indicated that the line of sight paths have either vertical or horizontal clearance based on the nominal turbine sites. However one link, the UHF link between Cowley Hills and Gibraltar Hill which passes close to the Hammonds Hill Group, is the most likely to be impacted because this group of turbines is at the highest elevation.

The Proponent also identified that Canberra airport used the RADAR installation on Mt Majura. Path profiles from this site to the southern wind turbines in at least one group indicate that some will be in the line of sight and within

²⁷ If the ghosting is changing rather than static, it may be caused by the signal reflected by flexible objects e.g. the moving turbine blades.

30 km of the RADAR²⁸. The Proponent was advised by Airservices Australia that certain modifications would be required to mitigate any impacts on the RADAR arising from the wind farm development.

5.9.1 *Issues Raised*

Five submissions raised concerns about the potential for the wind farm to interfere with radio and television reception. These submissions sought a commitment from the Proponent that any identified interference would be promptly mitigated.

5.9.2 *Consideration of Issues*

The investigations undertaken by the Proponent do not describe with any certainty what the effects will be on the radio signal between Cowley Hills and Gibraltar Hill operated by the NSW Rural Fire Service, and television reception at residences around the wind farm.

The areas identified where interference with Canberra television transmission is likely to occur are close to many residents not included in the results of the modelling which describes the zones i.e. residences in the southern section of Taylors Creek Road are shown outside the affected zone.

It is the Department's position that the wind farm should not contribute to or generate any additional electromagnetic interference to facilities or residential reception in the surrounding community. If interference is attributed to the wind farm then it should be promptly corrected in consultation with the affected receiver.

5.9.3 *Resolution*

The Proponent has identified a number of mitigation measures to address potential impacts on existing communications services. These include:

- Arranging for modifications to the Mt Majura Radar system in consultation with Airservices Australia;
- Investigating the effects of any turbine layout refinements will have on fixed radio links;
- Investigating and rectifying any interference to television reception caused by the project that occurs following commissioning of the wind farm by:
 - Modifying or replacing aerials;
 - Replacing analog televisions with digital televisions;
 - Installing and maintaining parasitic antenna system; and
 - Providing a land line between the affected receiver and an antenna located in an area of favourable reception.

The Proponent has indicated that if reception issues cannot be overcome by any of the above means then it will negotiate an arrangement with the affected resident to install and maintain a satellite receiving antenna.

5.9.4 *Conclusion*

The Department believes that these mitigation measures are appropriate. However, because of the relative uncertainty in identifying both the impact zones and the severity of the potential impacts, the Department considers that the Proponent should make actual observations of any changes to television reception for residences within 5 km of the wind farm and for the three UHF fixed radio links with paths through the wind farm. Therefore the Department recommends that the Proponent be required to:

- Undertake an assessment of the existing quality of two way fixed radio links crossing the site, and television reception at residential dwellings located within 5 kilometres of a proposed turbine prior to the erection of any

²⁸ UK Interim Guidelines on the siting of wind farms near civil and military aviation facilities suggest consultation should be undertaken between the appropriate aviation authorities where turbines are within 30 km of radar facilities or within line of site of these facilities.

wind turbine i.e. the "before" baseline survey. This will include the UHF link between Cowley Hills and Gibraltar Hill;

- Re-survey the two way fixed radio links and the television reception of residences during the first six months of operation i.e. the 'after' survey; and
- Undertake any reasonable and feasible mitigation measures to rectify any interference to a level at least equivalent to the current standard, including those outlined by the Proponent, to rectify any radio and/or television reception problems attributable the wind farm in consultation with the affected receiver i.e. a comparison of the before with the after surveys.

5.10 Indigenous Cultural Heritage

The archaeological potential was estimated after consultation with local Aboriginal stakeholders, an examination of previous archaeological investigations in the study area, inspections and categorisation of the degree of disturbance of the landscape and surface visibility. Low ground disturbances has occurred throughout the study area due to land clearing with some areas subject to severe disturbance through road and dam construction. These disturbances can destroy the archaeological context of surface and subsurface materials.

Predictive models were developed for the project site based on existing archaeological records, local topography, access to and distance from permanent water, and degree of previous land disturbance. On this basis, it was decided that the sites on gentler topography close to Lake George or on reliable creek lines were more likely to contain evidence of Aboriginal occupation. This contrasts with the high, steep sided rocky ridges where it was more likely Aboriginal people travelled or used as vantage points, but not as camps.

5.10.1 Issues Raised

One public submission sought clarification on the consultation that was made with the Ngunnawal Aboriginal community. The project area lies in an area that is within the tribal boundaries of the local Ngunnawal people. No mythological sites, ceremonial sites, burial grounds, or post contact sites were identified. However, several artefact scatters, and potential archaeological deposits (PAD) were identified within the project site.

5.10.2 Consideration of Issues

The study area is considered to have areas of high, moderate and low archaeological and cultural sensitivity. The high and moderate areas are focussed on slightly elevated, gently sloping topography associated with local resource bases and reliable watercourses. This includes the eastern edge of Lake George. Areas of low archaeological sensitivity include the high, steep and rocky ridgelines within the study area which are not conducive to Aboriginal occupation because of topographic features, exposure, and distance from freshwater.

Five Aboriginal archaeological surface sites were recorded during the assessment. These consisted of two artefact scatters and three isolated finds. Four of these sites were associated with gently sloping topography surrounding creek lines and the remaining site was located on a moderate sloping ridge top.

Three of the five areas where the surface artefacts were found will not be disturbed by the Project. One of the other two areas is located in the vicinity of a turbine (Turbine No. 48), and the other area is located along the proposed access track between the Hammonds Hill Group and the Ellenden Group. This latter site is also one of six potential archaeological deposits (PAD) identified during survey work i.e. PAD 5 as described below.

The following six PADs were identified:

1. Hammonds Hill Group PAD surrounding Turbines 52 and 53 and along the proposed access road that passes between these turbines;
2. Grose Hill Group PAD at Turbines 1-3 above Lake George;
3. Ellenden Group PAD at the Red Hill Turbines (Nos 18-21);
4. The Ellenden Group PAD at turbine Nos 28-30;
5. A PAD located along the access track crossing of Wrights Creek southeast of the Ellenden Group i.e. connecting Hammonds Hill Group to Ellenden Group; and
6. A PAD located near the proposed substation at Dry Creek.

Ideally these areas of archaeological sensitivity should be avoided. However, if this is not possible then the PADs should be more thoroughly investigated prior to any construction in order to establish the archaeological and cultural significance and the need to recover any deposits. The Proponent has identified that PADs 1 and 5 (as described above) will be avoided i.e. no ground disturbances will be undertaken at either site. Instead the track proposed at PAD 1 and the Wrights Creek crossing at PAD 5 will be constructed with imported road base. No excavation will be undertaken.

5.10.3 Resolution

A Cultural Heritage Management Plan should be prepared which sets out appropriate mitigation measures to help protect sensitive sites. These measures may include:

- Targeted test subsurface excavations by a qualified archaeologist for the PAD sites 2, 3, 4, and 6 (locations as described above)²⁹;
- Establishing protocols with the local Aboriginal stakeholders regarding care and storage for any recovered artefacts;
- Invitations to the local Aboriginal stakeholders to participate in the subsurface testing programme;
- Implementing protection measures such as barrier fencing to confine construction impacts to as small an area as possible for those sites likely to be affected;
- Implementing protection measures such as fencing-off conservation areas for those sites and areas of sites that will not be directly impacted by the construction activities; and
- Protocols to be observed if any artefacts not previously identified are uncovered during construction.

5.10.4 Conclusion

The Department is satisfied that the proposed mitigation measures will adequately protect the cultural values of the project site. It should be recognised however, that targeted subsurface excavations could always uncover material that may preclude any construction works at a particular location.

5.11 Public Consultation

Sixteen of the public submissions raised various concerns regarding matters pertaining to public consultation. These included such diverse responses as the lack of consultation with the local catchment management group, whether the Proponent would be prepared to consider cash grants for local community groups, and the apparent lack of a public meeting prior to the application being lodged.

Refer to APPENDIX C for details regarding matters raised in the submissions.

5.11.1 Consideration of Issues

The Department would be particularly concerned if affected residences were not made aware of the proposal at the time of its public exhibition as this would effectively limit the opportunity to make a submission.

In this instance the Department notes that the Proponent held public meetings for the proposal at both Tarago and Bungendore prior to submitting the proposal for public exhibition.

The Department arranged and conducted a Planning Focus Meeting in the middle of 2004. The meeting was attended by representatives the Department of Natural Resources, Department of Environment and Conservation, relevant councils, Sydney Catchment Authority, and the then Sustainable Energy Development Authority. The views of these participants formed an important input into the Director-General's requirements for the Environmental Assessment report.

²⁹ A letter from AUSTRAL Archaeology dated 21 December 2005 is attached to Appendix E of the Environmental Assessment Report (Aboriginal Archaeological and Cultural Heritage Assessment). The letter outlines the test excavation strategy which should be followed for the Capital Wind Farm.

At the time of the exhibition of the Environmental Assessment report, the Department placed advertisements in the Canberra Times, Goulburn Post and Bungendore Mirror advising the exhibition details and inviting submissions from interested parties. The Department also mailed out notices to property owners located within a 10 km radius of the proposal. The mailing list was obtained from the rate payer's databases of the two councils. The notice contained a copy of the advertisement which also included details of where the Environmental Assessment report could be viewed.

The Environmental Assessment report and its appendices were also placed on the Department's website.

5.11.2 Conclusion

The Department is satisfied that the best practice was followed in this instance to ensure that the most practicable methods were employed to achieve a wide notification and coverage of the proposal.

5.12 Energy Savings and Greenhouse Gases

Wind farms are an intermittent source of energy where production is dependent on wind blowing at a rate sufficient to initiate generation and not too fast where, for safety considerations, the turbines cut out. Wind speeds can fluctuate from minute to minute and hour to hour and cannot be predicted with high degrees of accuracy over daily periods.

To make-up for the intermittency of power supplied to the grid from wind turbines certain stand-by generation or ancillary services from other power plants, potentially including greenhouse gas producing generation plants, may be required. This intermittency and the need to call on the ancillary services brings into question the actual greenhouse gas savings that is attributed to wind turbines, a key justification for permitting the construction of the Capital Wind Farm.

Electricity supply and distribution systems must maintain a balance between the aggregate demand for electric power and the total power generated by all power plants feeding the system. The interconnected network on the east coast is operated as the National Electricity Market (NEM). The NEM is operated by the National Electricity Market Management Company (NEMMCO). NEMMCO is owned by the five states which make up the market, and is paid for by the market participants.

NEMMCO is the system operator responsible for power system security and reliability, a complex task that it performs using automatic controls and sophisticated decision-support algorithms. NEMMCO notes in its report *Managing Large Changes in Wind Generation Output* that existing market arrangements will adequately manage large swings in the NEM represented by wind generation, under current policy settings, over at least the next several years³⁰.

The National Electricity Rules of the Australian Energy Market Commission classify wind generation as an unscheduled generator³¹. As unscheduled generators, wind farms don't participate in the optimised dispatch process of the National Electricity Market³². Neither are wind farms constrained if there is network congestion i.e. its output is accepted into the grid at the time of production. Therefore it displaces the equivalent output from gas or coal powered generators.

5.12.1 Issue Raised

The intermittent nature of wind power generation and the need to supply ancillary services was a point identified by some objectors to the Capital Wind Farm who suggested that the greenhouse gas savings are, at the extreme

³⁰ *Managing Large Changes in Wind Generation Output*, Draft Version No: 5.0, NEMMCO (November 2005)

³¹ The registration of wind farms as unscheduled generators is outlined in the National Electricity Rules of the Australian Energy Market Commission (National Electricity Rules Version 9, last updated 27 July 2006) and the Wind Farm Model Guidelines and Checklist available from NEMMCO.

³² Baker, F and Outhred, H, *Wind Integration in Australia*, Centre for Energy and Environmental Markets, University of New South Wales (14 June 2006).

end, nil or even negative, or at least, grossly overstated. This position appears to have been derived by the belief that the component of the ancillary services known as the spinning reserve used to cope with load variations will need to be increased in order to 'smooth' the noise from intermittent wind generated electricity that is fed into the NEM. According to the objectors it follows that greenhouse gas producing fuels will supply this extra spinning reserve, cancelling out the greenhouse gas saving attributed to the electricity generated by the wind farm.

5.12.2 Consideration of Issues

Greenhouse gas savings associated with wind farms are usually presented as the proportion of CO₂ that is saved from being generated by the base load generators³³. In New South Wales coal fired power stations contribute the greatest share of the base load production. Evidence presented to the Bald Hills Wind Farm Panel Inquiry (Victoria) suggested that electricity provided to the NEM by wind farms will displace an equivalent amount of electricity provided by coal fired power stations, thus reducing the fuel required for these generators³⁴.

Calculations for the greenhouse gas savings that may be attributed to wind farms rely on a factor unique to each State termed the Annual Pool Coefficient. In broad terms the Annual Pool Coefficient for New South Wales is the average rate of emissions of greenhouse gases per unit of electricity sent out to the New South Wales grid in that calendar year by a defined set of generators and via the interconnectors linking New South Wales with Queensland, Victoria and South Australia³⁵.

For every kilowatt-hour of electricity produced by non-renewable generators, some CO₂ is emitted to the atmosphere. For example, one kilowatt-hour of electricity produced by burning brown coal will emit approximately one kilogram of CO₂ into the atmosphere.

The Australian Greenhouse Office annually determines each State's greenhouse coefficient, based on their respective sources of electricity generation. Tasmania's electricity is almost 100% sourced from hydro while Victoria's is almost entirely from burning brown coal. For 2003, Tasmania's coefficient of kilograms CO₂ per kilowatt-hour of electricity purchased was a very low 0.002 while Victoria's was 1.39 (the highest in Australia) and New South Wales' was 0.897. The quality of the coal that is being burned affects the greenhouse gas coefficient. Victoria's brown coal has a higher moisture content resulting in higher greenhouse emissions.

The Capital Wind Farm Project anticipates energy generated from the wind farm will offset the equivalent of approximately 390 000 tonnes of CO_{2e} emissions per year³⁶. This represents a savings of 9.75 million tonnes of CO_{2e} emissions over the anticipated 25 year life of the wind farm.

The characteristic variability of electricity production from wind farms as well as variability in electrical demand contributes to shifts in the frequency and voltage of the electrical system³⁷. This variable contribution to the demand on the NEM network is taken up by the ancillary services, which in New South Wales are usually gas turbine power plants.

³³ A base load power plant is one that provides a steady flow of power regardless of total demand by the grid. These plants run at all times through the year except in the case of repairs or scheduled maintenance. Fluctuations, peaks or spikes in customer power demand are handled by smaller and more responsive types of power plants e.g. gas turbine and hydro.

³⁴ This information was presented to the Bald Hills Wind Farm Panel Inquiry and provided in a detailed assessment of greenhouse benefits prepared for the Portland Wind Energy Project by Sinclair Knight Merz. See Portland Wind Energy Project EES Greenhouse Gas Abatement Analysis, Sinclair Knight Merz, October, 2001 (PWEF EES Supplemental Volume A, Report 1).

³⁵ The NSW Pool Coefficient for a year is the simple average of the five 'Annual Pool Values' from previous years, lagged by two years. See NSW Greenhouse Gas Abatement Scheme, Fact Sheet – The NSW Pool Coefficient, November, 2005.

³⁶ The pool coefficient is forecast to be 0.96 tonnes/CO₂-e for 2009, the time by which Capital wind farm will be operating.

³⁷ *Guide to Ancillary Services in the National Electricity Market*, NEMMCO, 24 August 2001.

The Department understands that ancillary services are in operation all the time and called on to smooth the frequency and voltage fluctuations inherent in the electrical supply network. Ancillary services consist of:

- Frequency Control Ancillary Services - used by NEMMCO to maintain the frequency on the electrical system, at any point in time, close to fifty cycles per second as required by the NEM frequency standards, to correct generation/demand balance in response to minor deviations in load, and to correct the generation/demand balance following a major contingent event such as the loss of a generating unit or a large transmission element;
- Network Control Ancillary Services - used by NEMMCO to control the voltage at different points of the electrical network to within the prescribed standards and control the power flow on network elements to within the physical limitations of those elements; and
- System Restart Control Ancillary Services - are reserved for contingency situations in which there has been a whole or partial system blackout and the electrical system must be restarted.

5.12.3 Resolution

It is uncertain, given the small installed wind generation capacity in the NEM, if wind generation will actually place a greater demand on the operating reserves so as to require more fuel to be used to maintain an increased stand-by capacity with the ancillary services. It has been recognised that the operating reserves induced by wind per unit of wind capacity are generally low in the circumstances where wind supplies a very small proportion of the total electricity demand³⁸ as is the case for New South Wales. However, this can grow quickly if significant numbers of wind farms are installed close to one another.

The Australian Greenhouse Office identified in a paper which examined the capability of the NEM to accept wind generation that approximately 8 000MW of wind energy could be readily accepted in the NEM and avoid the problems associated with intermittent generation if it was distributed among the existing NEM regions³⁹. At the end of 2005, there was 708MW of wind generation connected into the Australian wide electricity system. There is a large amount of approved projects which, if constructed, will increase the amount of connected wind energy to 2 740MW of electricity produced, still well below the 8 000MW threshold identified by the Australian Greenhouse Office.

This suggests that the 132 MW generating capacity for the Capital Wind Farm could be accommodated into the NEM without difficulty and it would be unlikely to cause an increase in the ancillary service generation requirements. Note that New South Wales currently has 17 MW of wind farm generating capacity installed with about 360 MW approved for construction.

The administrative processes that govern the electricity generation and distribution system are complex. For this reason it is not possible to be precise about the greenhouse gas savings for the Capital Wind Farm. It appears from the above discussion that electricity supplied to the NEM from the Capital Wind Farm will reduce the need to burn an equivalent amount of greenhouse gas producing fuel.

5.12.4 Conclusion

It is unlikely that wind generators will displace an exact equivalent of the amount of energy produced by greenhouse gas emitting generating sources since it is recognised that there are network losses to take account of. If it assumed that the only energy saved by wind generation is from gas fired turbines with a greenhouse coefficient of 0.65 to 0.70 tonnes CO₂/MWh (a lower CO₂ coefficient than for the New South Wales Pool Coefficient), the greenhouse gas emissions saved by the proposed Capital wind farm would be 264,000 to 284,000 tonnes of CO_{2e} per year.

³⁸ *Modeling the Long-Term Market Penetration of Wind in the United States*, National Renewable Energy Laboratory, May 21, 2003.

³⁹ Australian Government, Australian Greenhouse Office, *National Wind Power Study – An estimate of readily accepted wind energy in the National Electricity Market*. Prepared by Associate Professor Hugh Outhred (November, 2003).

Contrary to opinions expressed by the objectors to the Capital Wind Farm Project, it is highly unlikely that there will be a need to increase the reserve system stand-by capacity i.e. to burn more fuel to accommodate frequency and power fluctuations of the wind farm because the highest load on the reserve system is when the wind turbines are not generating. Increases in wind farm output cause the ancillary service to reduce output (decreasing greenhouse emissions). If the wind farm output decreased to zero the ancillary service output would rise to meet the prevailing load on the system (as if there was no wind farm). However, should the contribution of intermittent generation to the NEM rise significantly in the future it is expected that there may be a need for further ancillary services to be employed.

The Department has been advised by the Department of Energy, Utilities and Sustainability that the penetration level of intermittent generation up to which no additional ancillary services would be required is around 10%. Higher penetrations would need some additional ancillary services to be brought on line particularly to cope with situations where the wind turbines are generating at capacity due to high winds and then have to shut down as the wind speed exceeds the safe limit i.e. there would be a sudden change from full output to zero output. However, as wind farms are likely to be geographically dispersed this situation may not be as severe as might be supposed. Also variability of wind farm output can be dampened by relatively simple measures such as capping output, controlling the rate of change in output during critical periods and increasing interconnector capacity.

The Department notes that the Bald Hills Wind Farm Panel Inquiry addressed this same issue and concluded that wind farms provide emission free power and have a role to play in a diversified and more sustainable future energy sector⁴⁰. The Panel also identified that, on the basis of the evidence presented before it, significant greenhouse benefits will flow from the Bald Hills Wind Farm Proposal.

⁴⁰ Bald Hills Wind Farm Project: EES, EES Supplement and Called-in Permits, Panel Report: 24 June 2004.

6 CONCLUSION

According to the National Greenhouse Gas Inventory, stationary sources of energy production account for approximately 48% of greenhouse gas emissions⁴¹. In particular, electricity and heat production accounts for one third of total emissions.

The Renewable Power Ventures' Capital Wind Farm Project presents an opportunity to harness a commercial wind resource. The wind farm, as described in the Environmental Assessment report, would be capable of generating 405 600 MWh per year of electricity without any emissions from burning fossil fuels, without the need to supply fuel from another source such as mined coal, and without the need to use cooling water.

The anticipated energy generated from the wind farm will offset the equivalent of approximately 390 000 tonnes of CO_{2e} emissions per year if it displaces coal fired power generation or 264,000 to 284,000 tonnes CO_{2e} per year if it displaces gas fired generation⁴². (Note: It is likely that the CO_{2e} emissions savings will be somewhere between the coal and gas figures). Therefore, the Project represents a good example of a renewable energy initiative with certain greenhouse gas saving benefits.

The wind farm is located within the boundaries of properties owned by landholders who are participants in the venture. Consequently there is a minimum of 1.2 km between the nearest residence not part of the Project and the closest turbine.

The assessment has demonstrated that although visual impacts are lessened as the separation distances are increased, the scale of the turbines and their prominent position on the high points of the surrounding ridge lines will make the Capital Wind Farm a dominant feature for many of the surrounding residences and transient viewers. The landscape has been modified over time by agricultural land use practices and closer settlement along Taylors Creek Road. Although still predominantly rural in character, the changes that have taken place are indicative of a shift away from the pre-settlement natural landscape.

The Department acknowledges that the wind farm will be highly visible to approximately 38 residential dwellings. Measures have been advanced to partially offset this visual intrusiveness including a requirement for the Proponent to use a landscape specialist to provide advice and undertake works to screen certain residences.

The subjectivity of what is an acceptable change to the visual environment will always be debated, even where specialists in this field are brought together. However, the Department is satisfied that this proposal is acceptable because of the relatively small number of residences affected by the Project and the opportunities to screen the views of those most affected.

Lake George is an important aesthetic resource in the surrounding area. It is a wetland which, when containing water, provides an important refuge habitat for waterbirds particularly during inland droughts. The consequences of having a water feature that will attract waterbirds at such close proximity to the wind farm are unknown. The Department has addressed this by requiring the Proponent to prepare a Bird and Bat Adaptive Management Program which will identify if the turbines are causing bird and bat deaths. The adaptive management program will incorporate strategies to mitigate any deaths and may include the shutting down of problem turbines at certain times.

Overall the Department considers that the impact on flora and fauna is likely to be low.

⁴¹ October 2003, *National Greenhouse Gas Inventory – Analysis of Trends and Greenhouse Indicators 1990-2001*, Australian Greenhouse Office.

⁴² Under the NSW Greenhouse Gas Abatement Scheme, the Greenhouse Gas Benchmark Rule (Compliance) No 1 of 2003 provides an annual greenhouse gas emission coefficient for power generation in NSW. This is calculated as the average greenhouse gas emissions per unit of electricity delivered for all generating systems supplying the notional NSW Electricity Pool. The pool coefficient is determined on an annual basis by the Compliance Regulator and is forecast to be 0.96 tonnes/CO_{2e} for 2009 by which time the Capital wind farm will be operating.

Operational noise is subject to an EPL from the EPA. The Project is required to meet the operational noise criteria set out in the SA Guidelines and this will be reflected in the EPL and conditions to any approval.

The Department's recommendations provide a rigorous and strict framework for the management, monitoring and reporting on the construction and operation of the Project covering:

- Noise;
- Flora and fauna;
- Visual amenity;
- Soils and sedimentation;
- Electromagnetic interference;
- Traffic and transport;
- Indigenous heritage;
- Waste management; and
- Decommissioning.

The Project will provide a range of benefits while the potential impacts are considered to be manageable and is therefore in the public interest. The Department is satisfied that the identified adverse impacts can be mitigated to acceptable levels by the adoption of recommendations set out in this assessment report.

7 RECOMMENDATION

It is recommended that the Minister:

- consider the findings and recommendations of this report; and
- approve the Capital Wind Farm Project under Section 75J of the EP&A Act.

Sam Haddad
Director-General

APPENDIX A. RECOMMENDED CONDITIONS OF APPROVAL⁴³

⁴³ The Recommendations have been drafted as if adopted as Conditions to any Approval.

Application No:	05_0179
Proponent:	Renewable Power Ventures Pty Ltd
Approval Authority:	Minister for Planning.
Land:	Lot 10 in DP 237079, Lot 11 in DP 237079, Lot 17 in DP 535180, No 414 Book 2073, No.56 Book 1886, Vol 6429 Fol 101, Lot 1 in DP 658449, Lot 2 in DP 720169, Lot 5 in DP 837873, Lot 76 in DP 754919, Lot 78 in DP 754919, Lot 79 in DP 754919, Lot 48 in DP 754877, Lot 45 in DP754877, Lot 16 in DP535180, Lot 18 in DP535179, Lot 48 in DP754877, Crown Road Reserves, Osborne Trig Reserve.
Project:	The construction and operation of a wind farm comprising 63 x 2.1 megawatt wind turbine generators, an electrical substation to facilitate connection to an existing TransGrid 330 000 volt transmission line, a facilities building, temporary and permanent wind monitoring towers, underground cables, a twelve kilometre internal overhead power line, and access tracks and works.

In these conditions, except in so far as the context or subject-matter otherwise indicates or requires, the following terms have the meanings indicated:

Act	<i>Environmental Planning and Assessment Act, 1979</i>
AHD	Australian Height Datum
BCA	Building Code of Australia
CASA	Civil Aviation Safety Authority
Commissioning	Commencement of testing and connection of any individual turbine(s) and may include concurrent on-going construction activities
CEMP	Construction Environmental Management Plan
Construction	Any activity requiring a Construction Certificate, the laying of a slab or significant excavation work
Councils	Goulburn Mulwaree Council and Palerang Council
dB(A)	Decibel (A-weighted scale)
Department	NSW Department of Planning
DEC	NSW Department of Environment and Conservation (incorporates the former NSW Environment Protection Authority and National Parks and Wildlife Service)
Development	The development to which this Approval applies, the scope of which is described in the documents listed under Condition No. 2 of this Approval
Director General	Director General of the NSW Department of Planning, or delegate
Dust	Any solid material that may become suspended in air or deposited
EA	<i>Capital Wind Farm – Environmental Assessment Volumes 1 and 2</i> dated February, 2006 prepared by Connell Wagner PPI
EPA	NSW Environment Protection Authority (now incorporated into the DEC)
EPL	Licence issued under the <i>Protection of the Environment Operations Act, 1997</i>
ER	Environmental Representative
L _{Aeq} (10-minute)	Equivalent average sound pressure level that is measured over a 10 minute period
Lin Peak	Linear Peak

Minister	NSW Minister for Planning, or delegate
OEMP	Operational Environmental Management Plan
Operation	Within three months of the commencement of Commissioning, unless otherwise agreed to by the Director General
Premises	Sub-areas of the Site, as consistent with the relevant DEC/EPA EPL.
Principal Certifying Authority	The Minister or an accredited certifier, appointed under section 109E of the Act, to issue a Part 4A Certificate as provided under Section 109C of the Act
Proponent	Renewable Power Ventures
Publicly Available	Available for inspection by a member of the general public (for example available on an internet site or at a display centre)
Reasonable and Feasible	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements.
Regulation	<i>Environmental Planning and Assessment Regulation, 2000</i>
Relevant Government Agencies	Department of Natural Resources, Lands Department
RFS	Rural Fire Service
RTA	Roads and Traffic Authority
SA Guidelines	The South Australian Environmental Protection Authority's <i>Wind Farms: Environmental Noise Guidelines</i> (2003)
Site	The land to which this Approval applies

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GENERAL CONDITIONS

Obligations to Minimise Harm to the Environment

- 1 The Proponent must implement all practicable measures to prevent and minimise any harm to the environment that may result from the Construction, Commissioning, Operation and decommissioning of the Development.

Scope of Development

- 2 The Proponent shall carry out the development generally in accordance with the following documents:
 - (a) *Capital Wind Farm – Environmental Assessment* Volumes 1 and 2 dated February, 2006 prepared by Connell Wagner PPI;
 - (b) Submissions Report contained in the following letters received from Renewable Power Ventures to the Department of Planning:
 - 26 May 2006 response to CASA's submission;
 - 26 May 2006 response to Canberra Ornithologists Group's submission;
 - 26 May 2006 response to DEC's submission;
 - 26 May 2006 response to the summary of public submissions prepared by the Department;
 - 28 May 2006 response to Goulburn Mulwaree Council's submission;
 - 28 May 2006 response to Palerang Council's submission;
 - (c) *Preferred Project Report* contained in a letter from Renewable Power Ventures to the Department dated 30 May 2006; and
 - (d) The Conditions of Approval.

If there is any inconsistency between the Conditions of Approval and a document listed above, the Conditions of Approval shall prevail to the extent of the inconsistency. If there is any inconsistency between documents listed above (other than the Conditions of Approval) then the most recent document shall prevail to the extent of the inconsistency.

Statutory Requirements

- 3 The Proponent must ensure that all necessary licences, permits and approvals are obtained and kept up-to-date as required throughout the life of the Development. None of the Conditions of Approval remove the obligation for the Applicant to obtain, renew or comply with such licences, permits or approvals.

Lapsing of the Approval

- 4 This Approval lapses 3 years after the date of the Minister's Approval unless the Proponent has demonstrated to the satisfaction of the Director General, that work for the purposes of this Approval has been completed on the land to which this Approval applies before the date on which the Approval would otherwise lapse under this condition. Work, for the purpose of this condition includes at least one of the following:
 - (a) internal track construction;
 - (b) facilities building construction;
 - (c) 33 000 to 330 000 volt electrical substation construction;
 - (d) internal overhead transmission line construction; or
 - (e) civil works associated with the construction of the foundations for the wind turbine footings.

Dispute Resolution

- 5 In the event that a dispute arises between the Proponent and Council or the Proponent and a public authority other than the Department, in relation to a specification or requirement applicable under this Approval, the matter must be referred by either party to the Director General, or if not resolved, to the Minister, whose determination of the dispute must be final and binding on all parties. For the purpose of this condition, "public authority" has the same meaning as provided under Section 4 of the Act.

Note: Section 121 of the Act provides mechanisms for resolution of disputes between the Department, the Director General, councils and public authorities.

Provision and Protection of Public Infrastructure

- 6 The Proponent must:
- (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and
 - (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the Development.

Note: The Proponent must ensure that all works are carried out in accordance with the Act, the Regulation, the *Local Government Act 1993 (Approvals) Regulations*, and the BCA.

Planning Agreement

- 7 The Proponent must, prior to the commencement of construction, enter into a Planning Agreement with Palerang Council, in accordance with Section 93F of the Act. The Planning Agreement must address the terms of the offer made by the Proponent in its Submissions Report response to Palerang Council's submission (letter to the Department from the Proponent dated 28 May 2006 i.e. the sealing of the whole of Taylors Creek Road to an appropriate engineering standard and in consultation with Palerang Council, post construction of the wind farm).

Compliance

General

- 8 The Proponent must be responsible for environmental impacts resulting from the actions of all persons on-site, including contractors, subcontractors and visitors.
- 9 The Director General may require update report(s) on compliance with all, or any part, of the Conditions of Approval. The report (s) must meet the requirements of the Director General and be submitted within such period as the Director General may require.
- 10 The Proponent must meet the requirements of the Director General in respect of the implementation of any measure necessary to ensure compliance with the Conditions of Approval, and general consistency with the documents listed under Condition No. 2 of this Approval. The Director General may direct that such a measure be implemented in response to the information contained within any report, plan, correspondence or other document submitted in accordance with the Conditions of Approval, within such time as the Director General may require.

Pre-Construction Compliance Report

- 11 The Proponent must submit a *Pre-Construction Compliance Report* to the Director General at least two weeks prior to the commencement of construction (or within a time agreed to by the Director General). The *Pre-Construction Compliance Report* must include details of:

- (a) how the Conditions of Approval required to be addressed prior to construction have been complied with;
- (b) when each relevant condition of this Approval was complied with, including submission dates of any required report and/or approval dates; and
- (c) any approvals or licences required to be issued by relevant Government Agencies prior to the commencement of construction.

Construction Compliance Report

- 12 The Proponent must provide the Director General with a *Construction Compliance Report* within six weeks of the end of the first six months of construction (or at any other time interval agreed to by the Director General). The Environmental Representative must certify the adequacy of the report before it is submitted to the Director General. The *Construction Compliance Report* must be made publicly available and include:
- (a) information on compliance with the *Construction Environmental Management Plan (CEMP)* of Condition of Approval No. 24 and the Conditions of Approval;
 - (b) information on compliance with any approvals or licences issued by Relevant Government Agencies for Construction;
 - (c) information on the implementation and effectiveness of environmental controls. The assessment of effectiveness should be based on a comparison of actual impacts against performance criteria identified in the CEMP;
 - (d) a summary and analysis of environmental monitoring results;
 - (e) the number and details of any complaints, including a summary of the main areas of complaint, action taken, response given and intended strategies to reduce recurring complaints;
 - (f) details of any review and amendments to the CEMP resulting from Construction during the reporting period; and
 - (g) any other matter relating to compliance with the Conditions of Approval or as requested by the Director General.

Pre-Operation Compliance Report

- 13 The Proponent must submit a *Pre-Operation Compliance Report* to the Director General at least two weeks prior to the commencement of Operation (or within a time agreed to by the Director General). The *Pre-Operation Compliance Report* must include details of:
- (a) how the Conditions of Approval required to be addressed prior to commencement of Operation have been complied with;
 - (b) when each relevant condition of this Approval was complied with, including submission dates of any required report and/or approval dates; and
 - (c) any approvals or licences required to be issued by Relevant Government Agencies prior to the commencement of Operation.

Construction and Part 4A Certification

- 14 Prior to the commencement of Construction, the Proponent must erect at least two signs in a prominent place at the site boundary where the signs can be viewed from the nearest public place. The signs must indicate:
- (a) the name, address and telephone number of the Principal Certifying Authority;
 - (b) the name of the person in charge of the construction site and telephone number at which the person may be contacted outside working hours; and
 - (c) a statement that unauthorised entry to the construction site is prohibited.

The signs must be maintained for the duration of construction works, and must be removed as soon as practicable after the conclusion of the construction works.

Note: The Proponent must ensure that all works are carried out in accordance with the Act, the Regulation, the *Local Government Act 1993 (Approvals) Regulations*, and the BCA.

Environmental Monitoring

General Monitoring Requirements

- 15 The Proponent must undertake all monitoring, including recording and reporting of monitoring results, as required under this Approval and as may be specified in an Environmental Protection License (EPL) for the Development.
- 16 The results of any monitoring required under this Approval must be:
- (a) recorded and maintained in a legible form, or in a form which can be readily reduced to a legible form;
 - (b) kept for at least 4 years after the monitoring or event to which they relate took place; and
 - (c) produced in a legible form to any authorised officer of the DEC or the Department who asks to see them.
- 17 The following records must be kept in respect of any samples required to be collected:
- (a) the date(s) on which the sample was taken;
 - (b) the time(s) at which the sample was collected;
 - (c) the location at which the sample was taken (including, if relevant, a description of the DEC identification point); and
 - (d) the name and qualifications of the person who collected the sample.

Environmental Impact Audits

Environmental Impact Audit Report – Construction

- 18 An *Environmental Impact Audit Report - Construction* must be prepared and submitted to the Director General within three months of Construction completion, or at any other time interval agreed to by the Director General. The Director General may request the Proponent to make the construction audit report available to other Relevant Government Agencies. The *Environmental Impact Audit Report - Construction* must:
- (a) identify the major environmental controls used during Construction and assess their effectiveness;
 - (b) summarise the main environmental management plans and processes implemented during Construction and assess their effectiveness;
 - (c) identify any innovations in Construction methods used to improve environmental management; and
 - (d) discuss the lessons learned during Construction, including recommendations for future wind farm developments.

Environmental Impact Audit Report - Operation

- 19 An *Environmental Impact Audit Report - Operation* must be prepared and submitted to the Director General within three (3) months after a 24 month period of Operation and then at any additional periods requested by the Director General. The Director General may request the Proponent to make the operation audit report available to other Relevant Government Agencies and Council. The *Environmental Impact Audit Report - Operation* must:
- (a) be certified by an independent person at the Proponent's expense. The certifier must be approved by the Director General prior to the preparation of the audit report;

- (b) compare the operation impact predictions made in the Environmental Assessment report and documents identified in Condition 2;
- (c) assess the effectiveness of implemented mitigation measures and safeguards;
- (d) assess compliance with the systems for operation maintenance and monitoring; and
- (e) discuss the results of consultation with the local community particularly any feedback or complaints.

Where necessary, the results of the audit report must also be used to update the *Operational Environmental Management Plan* (OEMP) of Condition of Approval No. 30. The Proponent must notify the Director General, Relevant Government Agencies and Council of any updates to the OEMP and provide a copy on request.

Annual Performance Reporting

- 20 The Proponent must provide an annual return to the DEC in relation to the development as required by any EPL. In the annual return, the Proponent must:
- (a) provide a summary of complaints relating to the development; and
 - (b) report on compliance with EPL conditions.

ENVIRONMENTAL MANAGEMENT

Environmental Representative

- 21 Prior to the commencement of Construction, the Proponent must nominate a suitably qualified and experienced Environmental Representative(s) (ER) whose appointment requires the approval of the Director General. The Proponent must employ the ER(s) on a full-time basis, or as otherwise agreed by the Director General, during the Construction, and Commissioning. An ER must also be employed during Operation. The ER must be:
- (a) the primary contact point in relation to the environmental performance of the Development;
 - (b) responsible for all management plans and monitoring programs required under this Approval;
 - (c) responsible for considering and advising on matters specified in the Conditions of Approval, and all other licences and approvals related to the environmental performance and impacts of the Development;
 - (d) responsible for receiving and responding to complaints in accordance with this Approval; and
 - (e) given the authority and independence to require reasonable steps be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment be likely to occur.

The Proponent must obtain approval from the Director General for changes to the appointment of the ER during Construction. The Proponent must notify the Director General of any changes to the appointment during Operation.

Greenhouse and Energy Management Strategy

- 22 A *Greenhouse and Energy Management Strategy* must be prepared to ensure the use of non-renewable resources from Construction and Operation is minimised. The strategy must incorporate but not necessarily be limited to:
- (a) design and layout plans to balance the generation and requirement for fill materials, minimising the amount required to be transported to the site from off-site sources;
 - (b) work schedule and methods that minimise equipment idle time and double handling of material;
 - (c) instructions to throttle down and switch off idle construction equipment particularly when trucks are waiting to access the site or while being loaded and unloaded;
 - (d) measures to ensure equipment is regularly and correctly maintained for energy efficient operation;

- (e) management practices to ensure site office equipment and lights are switched off after hours except for security lighting; and
- (f) instructions to use local materials and recycled materials (demolition materials, construction materials, paper, glass etc) where appropriate.

Air Quality Management Strategy

- 23 An *Air Quality Management Strategy* must be prepared to control Dust and air emissions resulting from Construction and Operation. The strategy must include but not necessarily be limited to:
- (a) wetting of access tracks with water during dry and wind periods;
 - (b) stabilisation of exposed soils and stockpiles;
 - (c) placement of stockpiles in sheltered locations, where necessary;
 - (d) restrict traffic to defined tracks and roads and implement speed limits; and
 - (e) restoration of disturbed areas as soon as possible.

Construction Environmental Management Plan

- 24 The Proponent must prepare and implement a *Construction Environmental Management Plan (CEMP)* in accordance with the Department's publication entitled *Guideline for the Preparation of Environmental Management Plans (2004)* or its latest revision.

The CEMP must be prepared in consultation with the Relevant Government Agencies and Councils, and certified by the ER as being in accordance with the Conditions of Approval.

The CEMP must be submitted for the approval of the Director General at least one month prior to the commencement of Construction, or within such a period otherwise agreed by the Director General.

- 25 Site preparation and Construction associated with the Development must not commence until written approval for the CEMP has been received from the Director General. Upon receipt of the Director General's approval, the Proponent must supply a copy of the CEMP to the DEC and Councils as soon as practicable.

Traffic and Transport Management Sub Plan

- 26 As part of the CEMP, a *Construction Traffic and Transport Management Sub Plan* must be prepared in consultation with Goulburn Mulwaree Council, Palerang Council, the RTA and NSW Police. The sub plan must:
- (a) include the mitigation measures outlined in Section 9.5 of the Environmental Assessment report;
 - (b) sealing the approaches to and intersection of Taylors Creek Road and Western Leg Road prior to construction commencing;
 - (c) identify development standards to be met for site access road entrances off Taylors Creek Road, Western Leg Road, and the existing entrance off Bungendore Road;
 - (d) provide engineering design drawings for proposed works in public roads to Palerang Council and/or the RTA;
 - (e) develop standards for all private access roads including the road to the facilities building;
 - (f) provide parking and a turning area adjacent to the facilities building;
 - (g) provide effective permanent drainage works within the properties in the vicinity of each entrance to divert stormwater away from driveways and away from public roads;
 - (h) identify designated transport routes for heavy vehicles to the Development Site;
 - (i) include measures to minimise traffic disruption through Goulburn and in the vicinity of the Development Site;
 - (j) include measures to minimise disturbance from traffic noise;
 - (k) include measures to manage Construction traffic to ensure the safety of:
 - i livestock and limit disruption to livestock movement;
 - ii equestrian activities; and

- iii school children and limit disruption to school bus timetables;
- (l) include a community information program to inform the community of traffic disruptions resulting from the construction program; and
- (m) outline a complaints management procedure for traffic impacts.

Flora and Fauna Management Sub Plan

- 27 A *Flora and Fauna Management Sub Plan* must be prepared as part of the CEMP. The sub plan must be prepared in consultation with the DEC and include:
- (a) plans showing terrestrial vegetation communities; important flora and fauna habitat areas; locations where threatened species, populations or ecological communities were recorded; and areas to be cleared. The plans must also identify vegetation adjoining the Development where this contains important habitat areas and/or threatened species, populations or ecological communities;
 - (b) methods to manage impacts on flora and fauna species (terrestrial and aquatic) and their habitat which may be directly or indirectly affected by the Development. These must include:
 - i procedures for vegetation clearing, soil management and minimising other habitat damage (terrestrial and aquatic) during Construction;
 - ii methods to protect vegetation both retained within, and also adjoining, the Development from damage during Construction;
 - iii a habitat tree management program including fauna recovery procedures and habitat maintenance (e.g. relocating hollows or installing nesting boxes);
 - iv where possible, and where consistent with DEC requirements, strategies for re-using in rehabilitation works individuals of any threatened plant species that would be otherwise be destroyed by the Development; and
 - v performance criteria against which to measure the success of the methods;
 - (c) rehabilitation details including:
 - i identification of locally native species to be used in rehabilitation and landscaping works, including flora species suitable as a food resource for threatened fauna species;
 - ii the source of all seed or tube stock to be used in rehabilitation and landscaping works including the identification of seed sources within the Site. Seed of locally native species within the Development Site should be collected before Construction commences to provide seed stock for revegetation;
 - iii methods to re-use topsoil (and where relevant subsoils) and cleared vegetation; and
 - iv measures for the management and maintenance of all preserved, planted and rehabilitated vegetation (including aquatic vegetation);
 - (d) the mitigation measures outlined in Section 7.6 of the Environmental Assessment report which includes the construction of stock proof fencing around the high value Yellow Box Woodland and secondary grassland to the south-east of the Hammond Hill site.
 - (e) a Weed Management Strategy including:
 - i identification of weeds within the Development Site and adjoining areas;
 - ii weed eradication methods and protocols for the use of herbicides;
 - iii methods to treat and re-use weed infested topsoil; and
 - iv strategies to control the spread of weeds during Construction; and
 - (f) a program for reporting on the effectiveness of terrestrial flora and fauna management measures against the identified performance criteria. Management methods must be reviewed where found to be ineffective.

Construction Soil and Water Management Sub Plan

- 28 A *Construction Soil and Water Management Sub Plan* must be prepared as part of the CEMP. The sub plan must be prepared in consultation with Relevant Government Agencies and Councils. The sub plan must:

- (a) incorporate the mitigation measures identified in Section 5.5.4 of the Environmental Assessment report;
 - (b) where relevant, be consistent with the Department of Land and Water Conservation's *Guidelines for the Planning, Construction, and Maintenance of Tracks* (1994); RTA's *Guidelines for the Control of Erosion and Sedimentation in Roadworks*, the DIPNR *Constructed Wetlands Manual* and Landcom's manual entitled *Managing Urban Stormwater: Soils and Construction* (2004);
 - (c) identify the Construction activities that could cause soil erosion or discharge sediment or water pollutants from the Development Site;
 - (d) describe management methods to minimise soil erosion or discharge of sediment or water pollutants from the Development Site including a strategy to minimise the area of bare surfaces during Construction;
 - (e) incorporate measures to rehabilitate internal tracks to 5 metres wide following completion of construction;
 - (f) describe the location and capacity of erosion and sediment control measures;
 - (g) identify the timing and conditions under which Construction stage controls will be decommissioned;
 - (h) include contingency plans to be implemented for events such as fuel spills; and
 - (i) identify how the effectiveness of the sediment and erosion control system will be monitored, reviewed and updated.
- 29 An appropriately qualified soil scientist must be consulted according to a schedule identified in the sub plan required in Condition No. 28 to:
- (a) undertake inspections of temporary and permanent erosion and sedimentation control devices;
 - (b) ensure that the most appropriate controls are being implemented;
 - (c) check that controls are being maintained in an efficient condition; and
 - (d) check that controls meet the requirements of any relevant approval and/or licence condition.

Operation Environmental Management Plan

- 30 The Proponent must prepare and implement an *Operation Environmental Management Plan* (OEMP) in accordance with the Department's publication entitled *Guideline for the Preparation of Environmental Management Plans* (2004) or its latest revision. The OEMP must be prepared in consultation with the Relevant Government Agencies and Councils, and must be certified by the ER as being in accordance with the Conditions of Approval. The OEMP is to be submitted for the approval of the Director General no later than one month prior to the commencement of Operation, or within such period otherwise agreed to by the Director General.
- 31 Operation must not commence until written approval of the OEMP has been received from the Director General. Upon receipt of the Director General's approval, the Proponent must supply a copy of the OEMP to the DEC and Councils as soon as practicable.

Operation Flora and Fauna Management Sub Plan

- 32 An *Operation Flora and Fauna Management Sub Plan* must be prepared as part of the OEMP. The sub plan must include:
- (a) plans showing terrestrial vegetation communities, important flora and fauna habitat areas, areas to be protected, and areas to be planted;
 - (b) methods for managing flora and fauna and their habitats which are directly or indirectly affected by the Development;
 - (c) the mitigation measures outlined in Section 7.6 of the Environmental Assessment report; and
 - (d) strategies to control the spread of weeds during Operation.

Operation Soil and Water Management Sub Plan

- 33 An *Operation Soil and Water Management Sub Plan* must be prepared as part of the OEMP. The sub plan must:
- (a) include regular inspection of disturbed ground, particularly after rain, to ensure sediment control devices are maintained;
 - (b) incorporate the use of appropriate containment facilities for chemical storage in the control room, bunding around the substation transformer and padmount transformers, and facilities building to prevent discharge to the ground; and
 - (c) include measures to maintain site tracks to prevent erosion and discharge of sediment from the site.

Bird and Bat Adaptive Management Program

- 34 A *Bird and Bat Adaptive Management Program* must be prepared as part of the OEMP and undertaken by a suitably qualified expert approved by the Director General and must:
- (a) incorporate monitoring, and a decision matrix that clearly describes how the Proponent will respond to the outcomes of monitoring;
 - (b) incorporate an on-going role for the suitably qualified expert;
 - (c) set out monitoring techniques, taking into account best practice bird and bat monitoring methods for wind farms such as those identified in the current editions of AusWEA *Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia* and *Assessing the Impacts of Windfarms on Birds - Protocols and Data Set Standards*;
 - (d) account for natural and human changes to the surrounding environment that might influence bird and/or bat behaviour such as changes in land use practices, and significant changes in water levels in nearby waterbodies;
 - (e) incorporate a decision making framework that sets out specific actions and when they may be required, to reduce identified impacts on birds and bats;
 - (f) identify 'at risk' bird and bat groups and include monthly censuses of their movements; and
 - (g) set out available mitigation measures including, but limited to, those identified in Condition No. 32(c) and commitments outlined in Section 15 of the EA.
- 35 The Proponent must prepare annual reports commencing 12 months from the start of Operation describing the activities undertaken within the *Bird and Bat Adaptive Management Program*. The reports must be prepared within 2 months of the end of the reporting period and be provided to the Director General. The reports must address the:
- (a) outcomes of monitoring;
 - (b) application of the decision making framework;
 - (c) need for mitigation measures;
 - (d) progress with implementation of mitigation measures; and
 - (e) effectiveness of the mitigation measures.
- 36 The Proponent must implement all Reasonable and Feasible mitigation measures where the need for further action is identified through the *Bird and Bat Adaptive Management Program*.

COMMUNICATION AND CONSULTATION

Information on the Development

- 37 The Proponent must make all documents relevant to this Approval, with the exception of that information that may be legitimately claimed is of a confidential commercial nature, Publicly Available at a location on the Development Site convenient for inspection by visitors.

- 38 The Proponent must establish an internet web site before Construction commences and maintain the internet web site until Construction ends. This internet web site must:
- (a) indicate the date of the last update and the frequency of the internet web site updates;
 - (b) contain periodic updates of work progress, consultation activities and planned work schedules;
 - (c) be updated within one working day where significant changes in noise or traffic impacts are anticipated;
 - (d) identify relevant approval authorities and their areas of responsibility;
 - (e) include a list of reports and plans that are Publicly Available under this Approval and details of how these can be accessed;
 - (f) include the contact names and phone numbers of relevant communications staff; and
 - (g) include the 24 hour complaints contact telephone number.
- 39 The Proponent must ensure that the local community and businesses are advised of Construction activities that could cause disruption. Methods to disseminate this information must be identified in the CEMP. Information to be provided must include:
- (a) details of any traffic disruptions and controls;
 - (b) construction of any temporary detours; and
 - (c) work approved to be undertaken outside the normal Construction hours, in particular noisy works, before such works are undertaken except for emergency works permitted under Condition of Approval No. 52(c).

Complaints Management System

- 40 Prior to the commencement of Construction, the Proponent must ensure that the following is available for the life of the Development:
- (a) a postal address to which written complaints may be sent;
 - (b) an e-mail address to which electronic complaints may be transmitted; and
 - (c) a 24-hour telephone contact line. This must provide for:
 - i complaints about operations associated with the development on the Development Site to be followed-up by the DEC with the licensee or a representative of the licensee who can respond at all times to incidents relating to individual premises; and
 - ii construction and operational complaints associated with the Development to be registered by the community.
- 41 The Proponent must keep a legible record of all complaints received in an up-to-date Complaints Register. The Complaints Register must record, but not necessarily be limited to:
- (a) the date and time, where relevant, of the complaint;
 - (b) the means by which the complaint was made (telephone, mail or e-mail);
 - (c) any personal details of the complainant that were provided, or if no details were provided, a note to that effect;
 - (d) the nature of the complaint;
 - (e) any action(s) taken by the Proponent in relation to the complaint, including any follow-up contact with the complainant; and
 - (f) if no action was taken by the Proponent in relation to the complaint, the reason(s) why no action was taken.

The Complaints Register must be made available for inspection on request of the Department or an authorised officer of the DEC. The record of a complaint must be kept for at least four years after the complaint was made.

VISUAL AMENITY

General

- 42 The Proponent must implement the landscape and visual mitigation measures identified in Section 6.10 of the Environmental Assessment report and include, where appropriate:
- (a) the use of local material for fill to minimise colour contrast;
 - (b) screen plantings around the substation to ensure that no components of the substation are visible;
 - (c) a design for the substation and facilities buildings that fit in with the rural setting;
 - (d) aesthetic uniformity by ensuring the rotor, nacelle, and tower of each turbine look similar and their rotors spin in the same direction;
 - (e) measures to ensure the turbines are spinning when there is wind; and
 - (f) good "housekeeping" by managing the site to be free of litter, and ensuring maintenance wastes are disposed of correctly e.g. lube oils.

Off-Site Landscape Sub Plan

- 43 As part of the OEMP the Proponent must develop and implement an *Off-Site Landscape Sub Plan* to address visual impacts of the proposed development for any owner of an existing or approved residential dwelling with views of turbine(s) located within four kilometres of their dwelling. The *Off-Site Landscape Sub Plan* is to be prepared by a suitably qualified landscape planner approved by the Director General.
- 44 The Proponent must notify in writing all owners of a residential dwelling with views of turbines located within four kilometres of their residential dwelling of its requirement to prepare the *Off-Site Landscape Sub Plan*, prior to the commencement of Commissioning. These owners may request, no later than six months after commencement of Operation, inclusion of their property in the *Off-Site Landscape Sub Plan*.
- 45 The landscape planner will, for each individual residential treatment, identify which screening species to use, where mature stock should be used in order to get the most effect, and how to screen out the wind turbines and still retain at least a partial outlook if desired by the resident. The Proponent must implement all Reasonable and Feasible requirements for the identified landscape works. The *Off-Site Landscape Sub Plan* is to be fully implemented within 18 months of the commencement of Operation.

Signs

- 46 No advertising or signs are to be mounted on the turbines or placed on the Development Site, except where required for safety purposes. A corporate logo may be placed on the turbines providing it is not distinguishable by the naked eye from any publicly accessible location or from any non associated properties.

Lighting

- 47 There must be no external night lighting of infrastructure associated with the Development, including the wind turbines, other than low intensity security lighting, unless otherwise agreed by the Director General or required by CASA.

NOISE

Construction Noise Management Sub Plan

- 48 A Construction Noise Management Sub Plan must be prepared as part of the CEMP. The sub plan must be prepared in consultation with Councils. The sub plan must:
- (a) identify all work areas, site compounds and access routes (both private and public);
 - (b) identify the specific activities that will be carried out and associated noise sources at each work area, site compound and access route;
 - (c) comply with the construction noise and vibration objectives for sensitive receiver locations based on the EMC;M;
 - (d) assess the potential noise and vibration from the proposed construction methods (including noise from construction traffic) against the ENCM;
 - (e) present an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise impacts where the ENCM objectives are predicted to be exceeded;
 - (f) describe management methods and procedures, and specific noise mitigation treatments that will be implemented to control noise and vibration impacts during construction;
 - (g) incorporate procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity; and
 - (h) include monitoring to measures noise performance and respond to complaints.

Blasting and Vibration

- 49 The airblast overpressure level from blasting when assessed at a noise sensitive site as defined in the Australian and New Zealand Environment Council – Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration must not exceed:
- (a) 115dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
 - (b) 120dB (Lin Peak) at any time.
- 50 The ground vibration peak particle velocity from blasting operations when assessed at a noise sensitive site as defined in the Australian and New Zealand Environment Council – Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration must not exceed:
- (a) 5mm/s for more than 5% of the total number of blasts carried out on the Site during each reporting period; and
 - (b) 10mm/s at any time.
- 51 Blasting operations on the Premises may only take place:
- (a) between 9:00am and 5:00pm Monday to Friday inclusive and between 9:00am and 1:00pm Saturday; and
 - (b) at such other times or frequency as may be approved by the DEC.

Construction Hours

- 52 Construction activities associated with the Development, including heavy vehicles entering and exiting the Site, may only be carried out between 7:00 am and 6:00 pm, Monday to Friday inclusive, and between 8:00 am and 1:00 pm on Saturdays. No work is to be carried out on Sundays and Public Holidays. The following activities may be carried out in association with Construction outside of these hours:
- (a) any works that do not cause noise emissions to be audible at any nearby residences not located on the Premises;

- (b) the delivery of materials as requested by Police or other authorities for safety reasons; and
 (c) emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

Any work undertaken outside the specified construction hours, other than those specified in (a) – (c) of this Condition No. 52, must not be undertaken without prior consent of the DEC.

Operational Noise Criteria

- 53 Noise generated from the Development must not exceed the equivalent noise level ($L_{Aeq, 10}$) adjusted for any tonality as presented in the tables below.

10m (height)wind speed (m/s)	Noise level L_{Aeq} (10 minute) – at receiver locations*			
	Property described in the EA as Luckdale (G2)	Property described in the EA as Widgemore (G6)	Property described in the EA as La Granja (G10)	Property described in the EA as The Patch (H15)
4	35	35	35	35
5	36	35	35	35
6	38	35	35	35
7	38	35	36	35
8	39	35	37	35
9	39	35	37	35
10	39	35	37	35
11	39	35	37	35
12	39	35	37	35

10m (height)wind speed (m/s)	Noise level L_{Aeq} (10 minute) – at receiver locations*			
	Property described in the EA as Wroxham (H24)	Property described in the EA as (E7)		
4	35	35		
5	35	35		
6	35	35		
7	35	36		
8	35	36		
9	35	37		
10	35	37		
11	35	37		
12	35	37		

*Receiver locations as identified in the *Environmental Assessment – Capital Wind Farm Environmental Assessment* prepared by Connell Wagner PPI dated February 2006. If compliance assessments are required at other non-associated residences as identified in the Environmental Assessment, the applicable noise limits are $L_{Aeq, 10\text{ minute}} 35\text{ dB(A)}$ where the predicted level is below $L_{Aeq, 10\text{ minute}} 35\text{ dB(A)}$, and the predicted level is above $L_{Aeq, 10\text{ minute}} 35\text{ dB(A)}$. The predicted levels are identified in the aforementioned Environmental Assessment.

- 54 The noise limits applied to the eight properties identified in Condition No. 53 must be applied to all residences that were identified as being 'representative' as described in *Table 1: Representative background sites with similar noise criteria*, Appendix H1 – Background Noise Monitoring Report found in Volume 2 – Appendices to the Capital Wind Farm Environmental Assessment.

- 55 Noise from the Premises is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits set out in the tables at Condition No. 53.
- 56 The modification factors presented in Section 4 of the *New South Wales Industrial Noise Policy* (NSW EPA, January, 2000), must be applied to the measured noise level where applicable.

Noise Compliance Monitoring During Operation

- 57 The Applicant must prepare a *Noise Compliance Assessment Plan* which must be submitted to the DEC prior to Commissioning of the wind turbines. The *Noise Compliance Assessment Plan* must outline how the *Noise Compliance Assessment*, as described in Conditions Nos. 58-59, will be achieved.
- 58 The *Noise Compliance Assessment* must include, but not be limited to:
- (a) an assessment of the performance of the wind farm against the noise limits contained in Condition No. 53.
 - (b) a commitment that noise compliance monitoring must be undertaken within three calendar months of the commissioning of the wind turbines at the locations identified in Condition No. 53⁴⁴. If prevailing meteorological conditions do not allow the required monitoring to be undertaken in this period, the DEC must be notified and an extension of time may be sought; and
 - (c) a requirement that all noise compliance monitoring results are to be submitted to the DEC within one month of completion of the monitoring. The DEC may request that additional noise compliance monitoring be undertaken and completed within a timeframe defined by the DEC.
- 59 In the event that the *Noise Compliance Assessment* indicates that noise from the wind turbines exceeds the noise limits contained in Condition No. 53, the Proponent must investigate and propose the mitigation and management measures that are available to achieve compliance with the noise limits. The *Noise Compliance Assessment* must be undertaken in accordance with the procedures presented in the *SA Guidelines*.

Note: The data obtained using the compliance assessment procedures outlined in the SA Guidelines should be used to establish the noise levels contributed by the wind farm. Other predictive compliance assessment techniques, where these techniques can be justified, may be considered. Whilst not directly applicable to wind farms, the NSW Industrial Noise Policy (INP) may provide additional guidance on predictive compliance assessment techniques.

Noise Mitigation – Vacant Lots

- 60 Reasonable and Feasible noise mitigation measures are to be provided by the Proponent for no more than one new dwelling, built on any vacant lot legally existing at the date of this Approval, upon which a residential dwelling would be permissible at the same date. Noise mitigation is to be provided if the noise levels from the Development at the approved location of the new residential dwelling would exceed the SA Guidelines.

Note: The intention is that this Condition of Approval does not apply to any potential future subdivision(s) that may be approved after the date of this Approval.

⁴⁴ The EPA may require the Proponent to repeat the *Noise Compliance Assessment* procedure if the initial *Noise Compliance Assessment* indicates that this is necessary. The EPA may require additional compliance assessment at locations not nominated in Condition No. 53 on the basis of *bona fide* complaint(s).

HERITAGE

Indigenous Heritage Management

- 61 In the event that skeletal remains, or an Aboriginal object not subject to a Section 90 permit under the *National Parks and Wildlife Act* are identified, all construction activities that will or would have the potential to impact on indigenous heritage item(s) not subject to a Section 90 permit, shall cease until the DEC is consulted and their directions complied with.
- 62 A *Cultural Heritage Management Sub Plan* must be prepared as part of the CEMP. The sub plan must include:
- (a) a targeted subsurface excavation testing program undertaken by a qualified archaeologist and done for the PAD sites 2, 3, 4, and 6 ⁴⁵;
 - (b) invitations to the local Aboriginal stakeholders to participate in the subsurface testing programme;
 - (c) protocols, established with the local Aboriginal stakeholders, regarding care and storage for any recovered artefacts;
 - (d) measures to protect all the archaeological sites identified in the Environmental Assessment report from construction activities that are carried out in the vicinity of these sites e.g. barrier fencing to confine construction to as small an area as possible and fencing-off certain sites; and
 - (e) protocols that will be observed if any artefacts not previously identified are uncovered during construction including ceasing all work in the vicinity of the object and notifying the DEC to determine an appropriate course of action prior to the re-commencement of work in the vicinity of the item.

Historical Relics

- 63 In the event that a non-indigenous heritage item is uncovered during Construction, all work in the vicinity of the object must cease and the Proponent must contact the NSW Heritage Council to determine an appropriate course of action prior to the re-commencement of work in the vicinity of the item.

MISCELLANEOUS REQUIREMENTS

Spoil and Fill Management

- 64 For the purposes of the Development, imported fill must be Virgin Excavated Natural Material as defined in the Environment Protection Authority's guideline *Assessment, Classification and Management of Liquid and Non-Liquid Wastes*.

Road Dilapidation Report

- 65 Road dilapidation reports must be prepared, in consultation with Councils, for the construction route where it passes along Cowper Road, Clinton Street, Blackshaw Road, Braidwood Road and Bungendore Road, Collector Road, West Leg Road, and Taylors Creeks Road. These reports must be prepared before Construction commences and after Construction is complete. Copies of the reports must be provided to the relevant roads authority. Any damage resulting from Construction traffic, except that resulting from normal wear and tear, must be repaired at the Proponent's cost. Alternatively the Proponent may negotiate an alternative arrangement for road damage with the relevant roads authority.

⁴⁵ PAD sites as described in a letter from AUSTRAL Archaeology dated 21 December 2005 and attached to Appendix E of the Environmental Assessment Report (Aboriginal Archaeological and Cultural Heritage Assessment). The letter outlines the test excavation strategy which should be followed for the Capital Wind Farm.

Aviation

- 66 Details of the construction timetable are to be submitted to CASA prior to the commencement of Construction.
- 67 The following details are to be submitted to CASA prior to the commencement of Operation:
- (a) the 'as constructed' coordinates of the wind turbines (in latitude and longitude);
 - (b) the final height in metres AHD for each wind turbine; and
 - (c) the ground level at the base of each of the wind turbines, in metres AHD.
- 68 In the event that required aerial weed control or application of fertiliser is restricted on any property surrounding the Development Site due to the location of turbines, the Proponent must fully fund the cost difference between aerial weed spraying or application of fertiliser and a reasonable alternative application method in the restricted area.

Hazards

Bushfire Risk

- 69 As part of the Construction and Operation EMPs, the Proponent must prepare, in consultation with the Taylors Creek Rural Fire Service, a *Bushfire Risk Management Sub Plan* based on the guidelines *Planning for Bushfire Protection* (RFS, 2001 or its latest edition). The sub plan must include:
- (a) details of the bushfire hazards and risks associated with the Development;
 - (b) mitigation measures including contingency plans;
 - (c) procedures and programs for liaison and regular drills with the Taylors Creek Rural Fire Service; and
 - (d) procedures for regular fire prevention inspections by the Taylors Creek Rural Fire Service and implementation of any recommendations.
- 70 The Proponent must, prior to commencement of construction, purchase a Cat 7 Fire Tender and give it at no cost to the Taylors Creek Rural Fire Service.

Safety Management System

- 71 At least two months prior to Commissioning, the Proponent must prepare a report outlining a comprehensive *Safety Management System*, covering all on-site systems related to ensuring the safe Operation. The report must clearly specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to the procedures. The *Safety Management System* must be developed in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 9, 'Safety Management'*, and should include:
- (a) procedures and programs for the maintenance and testing of the safety related equipment to ensure its integrity over the life of the Development; and
 - (b) an outline of a documented procedure for the management of change.

Electromagnetic Interference

Television Interference

- 72 Prior to the erection of any wind turbine on the Development Site, the Proponent must advise in writing, any owner of a residential dwelling located within five kilometres of a proposed wind turbine that an assessment of potential television interference is available to them. If requested by the owner, the Proponent must:

- (a) undertake an assessment of the existing quality of television reception; and
- (b) reassess the electromagnetic interference to television reception during the first six months of Operation.

Any reassessment must be conducted within three months of a request being made. Residential dwellings located on the Development Site are not included in this condition.

- 73 The Proponent must undertake any Reasonable and Feasible mitigation measures, at its own expense, to rectify any television reception problems identified in the reassessment conducted under Condition No. 72 and attributable to the Development, including but not limited to:
- (a) improving the existing antenna system;
 - (b) installing and maintaining a parasitic antenna system;
 - (c) installing and maintaining an alternative television connection such as a satellite receiving antenna; and
 - (d) providing a land line between the affected receiver and an antenna located in an area of favourable reception.

Radio Communication

- 74 Prior to the erection of any wind turbine on the Development Site, the Proponent must advise in writing the operator(s) of any two-way, fixed radio links crossing the Development Site that, at the request of the operator, the Proponent must:
- (a) undertake an assessment of the existing quality in consultation with the operator(s); and
 - (b) reassess the electromagnetic interference to radio reception during the first six months of Operation.

Any reassessment must be conducted within three months of a request being made.

- 75 The Proponent must undertake any Reasonable and Feasible mitigation measures, at its own expense, to rectify any radio reception problems identified in the reassessment conducted at Condition No. 74 and attributable to the Development, including but not limited to:
- (a) modifying the existing aerial;
 - (b) installing a directional antenna; and
 - (c) installing an amplifier to boost the signal.

Community Contributions

- 76 Prior to the commencement of any construction works the subject of this Approval, payment of a contribution totalling \$16 302 covering the provision, upgrade and maintenance of road infrastructure in accordance with the Mulwaree Section 94 Development Contributions Plan 2003-2008, shall be made to Goulburn Mulwaree Council.

This amount will be reviewed annually by the Proponent at the beginning of each financial year, in accordance with the rates applicable in the current version/edition of the relevant Section 94 Plan, based on CPI movements (March to March) with any movement effective from 1 July.

Waste Management and Recycling

- 77 As part of the Construction and Operation EMPs the Proponent must prepare *Waste Management and Re-use Sub Plan(s)*. The sub plan(s) must address the management of wastes during the Construction and Operation stages respectively in accordance with the NSW Government's Waste Reduction and Purchasing Policy. The sub plan(s) must identify requirements for:

- (a) the application of the waste minimisation hierarchy principles of avoid/reduce/re-use/recycle/dispose;
- (b) minimising the volume of wastewater produced and include, as a minimum, a commitment to install AAA-rated water conservation devices in the control room/facilities building;
- (c) waste handling and storage. The human wastewater management system is to be designed according to the guidelines entitled *On-site Sewage Management for Single Households* and the AS/NZS 1547-2000 - On-site Domestic Wastewater Management;
- (d) disposal of wastes. Specific details must be provided for cleared vegetation, contaminated materials, glass, metals and plastics, hydrocarbons (lubricants and fuels) and sanitary wastes; and
- (e) any waste material that is unable to be re-used, re-processed or recycled, which must be disposed at a facility approved to receive that type of waste.

Decommissioning

- 78 Within one year of decommissioning, the Development Site must be returned, as far as practicable, to its condition prior to the commencement of Construction. All wind turbines and associated above ground structures (i.e. not including turbine foundations) including but not limited to, the substation, the control and facilities building and electrical infrastructure must be removed from the Development Site unless otherwise agreed by the Director General. All other elements associated with the Development, including Development Site roads, must be removed unless otherwise agreed to by the landowner(s).
- 79 If any wind turbine is not used for the generation of electricity for a continuous period of 12 months, it must be decommissioned unless otherwise agreed to by the Director General. The Proponent must keep independently verified annual records of the use of wind turbines for electricity generation. These records must be provided to the Director General upon request. The relevant wind turbine and any associated infrastructure is to be dismantled and removed from the Development Site within 18 months from the date that the wind turbine was last used to generate electricity.
- 80 Prior to the commencement of Construction, the Proponent must provide written evidence to the satisfaction of the Director General, that the lease agreements with the Site landowners have adequate provisions to require that decommissioning occurs in accordance with this Approval.

APPENDIX B. SUMMARY OF VISUAL IMPACT ASSESSMENT CRITERIA IN SELECTED DCPS AND GUIDELINES

Summary of Visual Impact Assessment Criteria in Selected DCPs and Guidelines

Guideline/Instrument	Zone (Permissible)	Zone (Prohibited)	Distances	Considerations
Goulburn Mulwaree Development Control Plan No. 1 – Wind Energy Guidelines		<ul style="list-style-type: none"> ▪ Environmental Protection Zones 	<ul style="list-style-type: none"> ▪ Minimum setback of towers from residential development is 350 metres 	<ul style="list-style-type: none"> ▪ Avoid areas of high environmental value such as <ul style="list-style-type: none"> ○ Lands protected under the NPW Act ○ World Heritage areas ○ Wilderness areas ○ Areas of National environmental significance under the EPBC Act ○ Areas affected by SEPP 44 – Koala Habitat ▪ Avoid locations where turbines are seen by many people e.g. on ridgelines within view of land zoned 2(v), 1(b), or 1(c) under Mulwaree LEP.
Wingecarribee Shire Council - Development Control Plan No 51 <i>Wind Energy Generation</i>	<ul style="list-style-type: none"> ▪ Rural 1(a) and Rural 1(b) 	<ul style="list-style-type: none"> ▪ Environment Protection 7(a) and 7(b) ▪ Special Uses 5(c) (Catchment) ▪ Rural 1(c) (Small Holdings) 	<ul style="list-style-type: none"> ▪ Merit based 	<ul style="list-style-type: none"> ▪ Prohibited on ridge lines
Lithgow City Council – Development Control Plan No 11 <i>Wind Energy Generation Facilities</i>			<ul style="list-style-type: none"> ▪ 500 metres from a dwelling not associated with the proposal ▪ 5 km from any Residential 2(a), 2(V), Rural 1(c) or 1(d) 	<ul style="list-style-type: none"> ▪ Not in areas identified as environmentally sensitive under the LEP ▪ Not in areas defined as the viewshed for Lithgow in DCP No 5 ▪ Merit based but generally not in areas within the viewshed of items of environmental heritage
Oberon Council – Development Control Plan Part O <i>Wind Power Generation 2003</i>	Only permissible in the Rural 1(a) zone	Not permitted in Rural 1(c) (rural residential)	<ul style="list-style-type: none"> ▪ Monitoring towers approved under delegation and property 	<ul style="list-style-type: none"> ▪ Not in areas having high scenic values

			<p>owners within 2 km notified.</p> <ul style="list-style-type: none"> ▪ Property owners within 2 km are notified for wind farm applications ▪ Not located within 1500 m from any registered Lot that has been created for the purpose of a dwelling ▪ Minimum setback from public roads of 250 m 	
SEDA – <i>NSW Wind Energy Handbook</i>				<ul style="list-style-type: none"> ▪ Avoid locations where turbines are seen by many people.
Western Australian Planning Commission – <i>Guidelines for Wind Farm Development</i>				<ul style="list-style-type: none"> ▪ Prepare a landscape and visual impact statement to address: siting; layout; design; number; colour; shape; height; visibility and viewsheds; and significance and sensitivity of landscape.
Victorian Government – <i>Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria</i>		<ul style="list-style-type: none"> ▪ National Parks or land reserved under the <i>National Parks Act</i> 		<p>Assess against:</p> <ul style="list-style-type: none"> ▪ Environmental Significance Overlay, ▪ Vegetation Protection Overlay; ▪ Significant Landscape Overlay; and ▪ Planning Scheme objectives; ▪ Visual impacts should be weighted having regard to Government Policy in support of renewable energy
DIPNR – <i>draft NSW Wind Energy Guidelines</i>				<p>Follow principle of “prudent avoidance” of adverse impacts. Site wind farms away from towns and villages, major roads, airport facilities and the habitat of migratory birds.</p>

<p>Draft Upper Lachlan DCP</p>			<p>The development shall not be</p> <ul style="list-style-type: none"> ▪ located within 12.5 times the blade tip height of any dwelling not associated with the development where visible from a non related dwelling or immediate surrounds, or ▪ 12.5 times the blade tip height from any lot that has been created for the purpose of a dwelling. ▪ located within two times the height of the turbine (including the tip of the blade) from a formed public road. A greater distance may be required by the road authority. ▪ located within two times the height of the turbine (including the tip of the blade) from a non related property boundary. 	<ul style="list-style-type: none"> ▪ Where turbines are proposed to be significantly higher than such properties/dwellings or where the turbines will dominate the immediate view from the dwelling or dwelling lot, increasing these separation distances is recommended. ▪ Turbine locations shall be located sensitive to non related dwellings surrounding the development. ▪ Turbine locations are to be sensitive to existing related dwellings on the subject site. Issues of excessive noise, shadow flicker, and general proximity to turbines should be minimised. ▪ Turbine locations should not surround a non related property.
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APPENDIX C. SUMMARY OF THE PUBLIC SUBMISSIONS

SUMMARY OF THE ISSUES RAISED IN THE PUBLIC SUBMISSIONS RECEIVED FOR THE CAPITAL WIND FARM PROJECT

Construction Impacts

- What measures will be taken to ensure access and construction tracks do not cause increased run-off, exacerbate soil erosion, and impacts on Lake George? (Sub 76, 59, 33, 31)
- What measures will be taken to ensure construction impacts on the local roads as a result of the use of large vehicles and heavy equipment, will be fixed? (Sub 72, 66, 23)
- How will spoil from levelling turbine sites be disposed of? (Sub 66)
- Has the Proponent done any subsurface geology testing to determine if the geology is appropriate for turbine construction? (Sub 66)
- Is it possible to relocate the proposed substation to the "other side" of Hammond's Hill? (Sub 74)
- Can the Proponent identify what water sources it proposes to use to meet the construction demands (concrete footings and dust suppression) of the wind farm and are these water sources proven? (Sub 72, 68, 23, 10)
- Are there likely to be better environmental outcomes if the access to the substation was made by extending the road currently used by the trucks who lease the Sand Mine at Lakelands? (Sub 66)
- How will the Proponent control the introduction and spreading of weed species? (Sub 66, 59)
- What measures will be taken to ensure protection of flora and fauna, including native grasslands, from construction activities associated with road and track construction and other infrastructure works such as the turbine footings? (Sub 72, 66, 59, 52, 33, 31, 7`)
- Will the Proponent provide transport and access to alternative areas for exercising horses during the construction of the wind farm? (Sub 50)
- Can Taylors Creek Road be used for construction of the wind farm without sealing it first? If so, how is it proposed to control dust off the road surface? (Sub 49)
- Will the Proponent conduct pre-construction structural surveys prior to any blasting? (Sub 23)
- Are you still proposing to use chemical dust suppression methods? (Sub 23)
- Will fire risks posed by construction activities be addressed in a plan? (Sub 23)
- Will Survey Unit 9 in the archaeological and cultural heritage surveys, a rare intact environment, be protected? (Sub 10)
- How will stock and deer be managed when constructing the wind farm? (Sub 10)

Ecology

- Do turbines contribute to the drying of the surrounding soil as a consequence of the aerodynamic disturbances from the turbine blade movements? (Sub 76)
- Have any likely impacts, including collision risks and disturbances to habitat, on the wedge-tailed eagle population living on Hammonds Hill and in other areas of the proposal, and brown falcons living on and in the vicinity of the proposal, been taken into account? (Sub 74, 72, 59, 53, 52, 51, 30, 26)
- Has the Proponent investigated the likely impacts of the wind farm on grass owls which have been observed to nest on the ground? (Sub 52)
- Will the proponent make use of flora and fauna data collected by the local naturalists and LandCare groups when preparing management plans? (Sub 59)
- Is it necessary to clear any Yellowbox gums? (Sub 74, 33)
- Is the Proponent aware of any Koala habitat on land within the area proposed for the wind farm? (Sub 73)
- Can the Proponent confirm that the ridges have been pasture improved as this is inconsistent with local knowledge? (Sub 66)
- Would the Proponent extend the area it proposes to fence off from grazing along the Tarago/Bungendore Road to a larger area so that active environmental reclamation works can be carried out? (Sub 55)
- Will the Proponent consider participating in a raptor protection program? (Sub 55)
- When assessing the potential for bird and bat strikes on the turbines, was the winter fog phenomena taken into account? (Sub 47)
- Did the fauna investigations extend to the habitats that are found on the western side of Lake George, where many of the avian species make use of the eastern side of Lake George? (Sub 38)
- Will the Proponent re-assess the flora and fauna report because the original surveys were done during the worst drought on record? (Sub 23, 10)
- Why wasn't flora and fauna information collected from local residents? (Sub 23)

- How can the flora and fauna survey done for this project account for any seasonal variations given the limited field surveys that were conducted? (Sub 10)
- The Regent Honeyeater is a threatened species whose prime habitat is yellowbox woodland. Shouldn't this species be assessed in an 8-Part Test? (Sub 10)
- Is the fencing off of the yellowbox woodland a compensatory measure or was it just good planning to avoid any disturbance to it? (Sub 10)
- Fawning is just as important as lambing and will need to be controlled to avoid attracting raptors. Should the assessment address the management of deer in the vicinity of the turbines as well as other grazing stock? (Sub 10)
- Will all trees within 200 metres of the turbines be cleared? If so, what compensatory measures will be applied to replace lost habitat e.g. hollows? (Sub 10)
- Are there likely to be microclimatic effects such as soil moisture reduction or heating effects of underground cabling upon soils? (Sub 10)

Economics

- Can the wind farm be financially competitive in a real market situation? (Sub 76, 40)
- How will the noise generated by the operating wind farm affect property values? (Sub 76, 51, 30, 26, 10)
- What evidence is there that property values could increase as a result of the construction of the wind farm and is there any local (i.e. Australian) evidence? (Sub 74, 67, 41, 38, 23, 10, 7)
- Is it possible to benchmark or evaluate all concerned properties prior to the project commencing to determine their current market value and how this may be affected once the project is completed? (Sub 49)
- What assurance can the Proponent offer to ensure that properties are not adversely financially affected? (Sub 49, 48, 47)
- Will the Proponent accept liability for damages to neighbouring properties if a bush fire is ignited as result of the operation of the wind farm? (Sub 74, 73)
- Can the Proponent demonstrate that there is a need for the electricity that this wind farm will produce? (Sub 72, 10)
- Can the Proponent justify that there will be local economic benefits from employment and contracting works? (Sub 72, 50, 42)
- What arrangements have been made by the Proponent to finance the decommissioning of the proposal if it fails or it is decided not to upgrade after the anticipated 20-25 year lifespan? (Sub 60, 53, 46)
- Can the Proponent provide a review report which examines the changes in land values for properties adjacent to other wind farms in Australia and in comparable locations in the world? (Sub 60)
- The value of our property will fall as a result of the wind farm. Can the Proponent buy us out at a fair and reasonable market value? (Sub 50)
- How will the removal or a decrease in the Federal Government's subsidy scheme affect the financial viability of the Proposal? (Sub 60)
- Do the benefits of the proposal outweigh the costs? i.e. the environmental and social costs. (Sub 59, 39, 38)

Energy Saving/Greenhouse

- Need to have an independent energy audit to assess whether wind energy produced by this proposal has a net benefit in reducing burning of coal for electricity. (Sub 79, 74, 10)
- Does the requirement for additional spinning reserve, because of the intermittency of wind supplied generation, reduce the need to burn non-renewable fuels? (Sub 76, 46)
- Has there been any consideration given as to how climate change could affect the proposal i.e. does the wind modelling take into account climate change? (Sub 60)

Noise

- Why didn't the Proponent register "noise easements" so that prospective buyers of properties in this area would have been made aware of the proposal before buying? (Sub 45)
- Are the "exclusion zones" surrounding the wind farm, as proposed, adequate to ameliorate the nuisance to householders already living in the vicinity of the wind farm? (Sub 76)
- What is the distance from the proposed substation to the residence known as Blackwood Park and will there be any noise impacts on this residence? (Sub 74)
- What are the likely "infrasound" sound impacts from the wind farm? (Sub 74, 66, 50, 10)
- Which residences are likely to be affected by infrasound? (Sub 74, 66, 26)

- What is the basis of the statement in the EA on page 10-4, paragraph 10.6 that the turbines would not cause health effects? How or who qualified this statement? (Sub 53)
- On page 10-8 paragraph 10.7.2 it says "The exceedances predicted may not occur.....". What is the position of the Proponent if it does occur as "may" does not imply certainty? (Sub 53)
- Will the Proponent include in the commitments that one or more turbines will be decommissioned if the noise levels are exceeded? (Sub 53)
- Will turbines G2, G10, and E7 be relocated, removed or switched off as suggested in the Executive Summary of the Noise Impact Assessment Report? (Sub 53)
- What was the basis for deciding which residences to take background noise measurements? (Sub 74)
- Who will bear the responsibility for shutting down turbines if they are identified as too noisy? (Sub 74)
- Are there any references in the literature which describe how noise from wind farms affect cattle and sheep grazing? (Sub 67, 26)
- Is it fair to only consider noise at the residences when activities on the properties often take place out-of-doors and along boundary fences? (Sub 50, 10)
- What noise mitigation is available to residents when they are conducting out-of-doors activities e.g. bar-b-ques, sports etc? (Sub 74, 50)
- Would you take noise measurements at the boundary of my property so that I know the true affect of your proposal? (Sub 26)
- How was the noise model, used in this assessment, selected? (Sub 74)
- The noise monitoring that was carried out seems to have been done in too short a time frame. Is this best and/or acceptable practice? (Sub 53)
- Why should people who purchased rural land have to put up with background noise that has increased as a result of the proposal? (Sub 53, 45)
- Can the Proponent re-examine the noise and visual impacts on the property called "Clearview", 145 Taylors Creek Road. In the Environmental Assessment reports, "Clearview Lot 8" is identified as H7 (at a distance of 2358 metres away from the nearest WTG). The property "Clearview, 145 Taylors Creek Road is in fact H4 with the residence being only 1915 metres to the nearest WTG. (Sub 50)
- Can the Proponent make a commitment that any increase in noise at my residence will be dealt with by tree planting or double glazing and insulation? (Sub 49)
- Can the noise data taken at my residence be independently reviewed? (Sub 47)
- Our residence (Widgemoor) is located in a natural amphitheatre and we believe the noise assessment may be inaccurate for our property. Will the Proponent re-assess noise at our residence? (Sub 23)
- How does the Proponent reconcile the fact that the Hammond Hill wind monitoring tower did not commence operation until 14 March 2006, which is 20 days after the noise monitoring trial was completed? Is this consistent with the SA guidelines? (Sub 10)
- How does the background noise monitoring account for seasonal variations? (Sub 10)
- Is the background noise data for Site 5 (H15) representative of the Mt Fairy/Hammond Hill locality or is it representative of the Groses Hill Group? (Sub 10)
- Have extraneous noises been removed from the noise monitoring data? (Sub 10)
- Are regression analysis available for the full range of winds experienced? (Sub 10)
- Will the planned relocation of the monitoring towers prevent compliance testing? (Sub 10)
- Which turbine was used for the power curve data in the noise assessment, the 2 MW Vesta V90, the 3 MW Vesta V90, or the 2.1 Sulzon S88? (Sub 10)
- What was the pitch of the blade for the noise assessment used for the power curve? (Sub 10)
- How do you explain the differences in the background noise data collected for Torokina and Bonnie Doon for the Woodlawn Wind Farm from those collected for the Capital Wind Farm? (Sub 10)
- How does the Proponent propose to address the cumulative impact of noise on these properties from Woodlawn Wind Farm and its own wind farm? (Sub 10)
- Does the modelling software (ConCawe) account for the topographic conditions and different absorption rates? (Sub 10)
- Does the modelling software (ConCawe) account for for inversion layers as is often experienced in valleys? (Sub 10)
- Does the modelling software (ConCawe) predict the noise effect of multiple turbines being in synchronous harmony? (Sub 10)

- Does the modelling software (ConCawe) allow for carriage of noise upon the laminar flow winds that sweep up and over the crests before arching down some distance later? (Sub 10)
- Has any cumulative affect been applied in the noise prediction modelling? (Sub 10)
- Isn't the upper limit, according to the SA guidelines 35 dBA, and not the minimum e.g. if the background noise is 25dBA at Site 8 (4m/s) then the criteria should be 30 dBA not 35 dBA as has been applied in the assessment? (Sub 10)
- Does the noise assessment account for distance from the source, wind speed, temperature, humidity, precipitation, and the presence of barriers and buildings? (Sub 10)

Operational Impacts

- Will the Proponent develop a fire response and mitigation plan? (Sub 68, 66, 53, 49, 48, 47)
- Will the Bushfire Risk Management Plan map, at the zone level of the NSW Rural Fire Service, the extra resources that will be required? Will it also include the Lake George Zone and the Boro-Mt Fairy Rural Fire Brigade that is located directly to the east of Hammonds Hill Group at 419 Mt Fairy Road? (Sub 42, 10)
- Is it likely that the Currandooley deer will seek out paddocks away from the wind turbines? (Sub 66)
- If the turbines are responsible for a greater number of deer being displaced onto neighbouring properties not associated with the wind farm, then will the Proponent be prepared to construct a deer-proof fence to fence off these properties? (Sub 66, 10)
- Will the underground cabling present any adverse health affects to either humans or stock including horses i.e. stray voltage? (Sub 66, 10)
- Can the Proponent provide a commitment to ensure the timely correction to any electromagnetic interference from any of the installed turbines i.e. television, radio, and radio communications? (Sub 66, 49, 45, 42, 23)
- How will the wind farm be secured from vandals and terrorists? (Sub 66)
- How will the operational wind farm affect horse behaviour i.e. can horses be safely ridden in close proximity to the turbines and does shadow flicker affect horses? (Sub 66, 50, 48, 10)
- If it is demonstrated that an existing equestrian operation is adversely affected by the installation of turbines, will the Proponent be prepared to negotiate a suitable ameliorative/compensatory arrangement? (Sub 66, 50)
- Will the Proponent discuss the risks that the project poses for ultra light aircraft? (Sub 23, 10)

Public Consultation

- Was a public meeting on the proposal ever held in Bungendore and if not, why not? (Sub 79, 10)
- Why didn't the Proponent consult with Lakelife, a catchment management group? (Sub 79)
- What consultation is required and has been undertaken, if any, with the Rural Protection Board? (Sub 66)
- Where are the turbines being sourced from and will they be thoroughly inspected for quarantine purposes? (Sub 66)
- Was the apparent community support for the proposal, as indicated in the Environmental Assessment report, based on polled data? (Sub 60, 53, 50, 42, 36)
- Would the Proponent consider cash grants for local community groups such as pre-schools, schools, LandCare, Rural Fire Services in order to gain more favourable community acceptance of the proposal? (Sub 49)
- Why hasn't there been an open day on the proposal held in Bungendore? (Sub 47)
- Why weren't the residents of Mt Fairy consulted? (Sub 42)
- Why weren't residents on the western side of Lake George consulted? (Sub 38, 36)
- Have the Ngunnawal Aboriginal community been consulted on the proposal? (Sub 36)

Traffic

- Will the operation of the wind farm increase traffic on local and arterial roads? (Sub 73)
- What measures will the Proponent take to ensure that the views of the turbines from the Bungendore/Tarago Road, a tourist route, do not cause a road safety issue i.e. are a distraction to motorists? (Sub 66, 10)
- How will the proposal affect road safety during both construction and operation? (Note: Mixed traffic presents risks and low traffic volumes do not necessarily equate to low risks) (Sub 60)
- Will the Proponent ensure that special attention is paid to all school zones that fall within the travel route of the trucks and oversized vehicles and provide additional fencing where required for safety? (Sub 49)

- What contingencies will be made to allow emergency vehicles access where a road is blocked for wind farm construction purposes? (Sub 66)
- Will construction crews be briefed on the need to give-way to horse riders? (Sub 66)
- Will the Proponent construct a bridle path alongside the section of Taylors Creek Road that is to be sealed? (Sub 50)
- How does the Proponent propose to deal with construction traffic on the currently dangerous section of the Bungendore/Tarago Road that is located approximately 3 kilometres from Taylors Creek Road leading back to Tarago? (Sub 49)
- It is anticipated that a left hand turn from the Tarago/Bungendore Road into the substation access will be a traffic hazard due to the heavy sand trucks using this road. How will the Proponent fix this road safety issue? (Sub 42)
- How will Taylors Creek and Western Leg Roads be able to cope with the forecast 34 000 trips during construction? (Sub 23)
- What measures will be put into place to ensure the safe use of the current stock crossings, and other daily agricultural activity uses, on Taylors Creek and Western Leg Roads during construction? (Sub 23)
- What are the planning issues for the alternative access routes for the proposed Ellenden Group as identified in Table 1 of the Traffic Issues Assessment? (Sub 10)
- In Table 2 of the Traffic Issues Assessment, where will the raw material for the road foundations be sourced from i.e. not the aggregate? (Sub 10)
- In Table 2 of the Traffic Issues Assessment, where will the 4000+ (two way) movements be coming from? Will these be on public roads? (Sub 10)
- Will the entrance to the substation be the one at 3 km south of the Mt Fairy Road or the one at 2 km south of the Mt Fairy Road? If it is the 3 km entrance then the endangered yellowbox woodland will be affected, while if it is the 2 km entrance there is a potential for traffic accidents. (Sub 10)
- How will the watercourses for the access to the substation be treated? (Sub 10)
- The proposal to seal the steeper grade for the access track from the substation to the Hammond Hill ridge will need to be visually assessed as it is visible from the Bungendore-Tarago Road. (Sub 10)
- What level of traffic movements can be expected for water and foundation raw material i.e. not just turbine components? (Sub 10)
- How does the Proponent propose to negotiate the return movement of turbine related vehicles at a point approximately 5km north of the Taylors Creeks and Collector Road intersection, an area where there is poor pavement and moderate curves? (Sub 10)
- What is the split of construction traffic movements on the northern and southern ends of the Bungendore-Tarago Road involving return trips for RAVs, the import of foundation raw materials, the possible import of water, and the substation construction and site work activities? (Sub 10)
- How does the Proponent propose to control the displacement of deer during construction activities in order to prevent road safety issues? (Sub 10)

Visual

- The visual impact analysis fails to acknowledge the significance of the Lake George landscape. What is the current position regarding the nomination of Lake George onto the World Heritage List or other listing that would acknowledge the cultural, historic, and natural values of the lake? (Sub 79, 77, 75, 74, 73, 48, 41, 29)
- How can the disturbance caused by the dominant turbines to the relatively "untouched surroundings" of Lake George be justified? (Sub 72, 39, 33)
- What maintenance scheduling will be done to ensure upkeep of the painted turbine and blades? (Sub 66)
- If lighting of the turbines is necessary, what assessment has been or will be undertaken to ensure no disturbances to residences and stock from night lighting and how will this influence the visual assessment? (Sub 66, 10)
- Can the scale of the proposal be reduced to off-set the visual impacts i.e. is the layout flexible, can some turbines be removed and/or can turbines be set-back from property boundaries? (Sub 64, 50)
- Does the visual assessment give due regard to the cultural, historical, and scientific values of both Lake George and the surrounding landscapes? (Sub 63, 40, 34, 32, 31, 29, 28)
- Are properties located along Tarago Road visually impacted by the proposal, and if so, to what extent i.e. would it be possible to construct specific photomontages for certain of these properties? (Sub 62)

- What measures can be taken to off-set visual impacts for residences on Taylors Creek Road whose houses are situated on the tops of hills? (Sub 52, 45)
- Would the Proponent consider removing turbines Nos 1 to 3 and 18 to 20 because these are so intrusive on the visual amenity of Lake George? (Sub 53)
- Has the layout of the wind farm been changed to fully take into account the impacts on neighbouring properties? (Sub 50, 45)
- Will the Proponent consider staging the proposal such that a very small number of wind turbines be constructed initially in order to "realistically" assess the visual, noise and other impacts? (Sub 50)
- Can the Proponent provide a commitment that once the project is completed, all construction waste materials are fully removed from the sites to minimise any further visual impacts? (Sub 49)
- Doesn't the visual analysis demonstrate that the property known as Kildare will be badly affected by the proposal? (Sub 26)
- If visual screening is not adequate for Widgemoor (1163 Taylors Creek Road) will the Proponent consider relocating or removing turbine 6? (Sub 23)
- I was told that the proposal would not be able to be seen from my residence know as Miway (39 Taylors Creek Road). Is this still the case? (Sub 24)
- Does the dominating presence of turbines act to diminish the openness of the rural character of the site creating a loss of the rural character? (Sub 10)

Waterbirds

- What is the anticipated effect from the wind farm on bird movements between Lakes George and Bathurst when the lakes have water i.e. is there a collision risk between the birds and the turbines? (Sub 80, 77, 76, 53, 52, 46, 42, 26)
- The 'supposed flight paths by water birds between Lake George and Lake Bathurst' through the shallow valleys to the north of the project site is incorrect. Will you take our 50 years of observations into account when developing any bird mitigation and management plan? (Sub 23)
- What is the anticipated effect on bird movements between Lake George and the coast i.e. is there a collision risk between the birds and the turbines? (Sub 72)
- Would the conclusions from the assessment of impacts on waterbirds in the Environmental Assessment report been different if Lake George had not been subject to a prolonged drought? (Sub 79)
- The deepest part of Lake George is where the water is retained for the longest period of time. This is in the south east corner of Lake George and is in direct line over the proposed wind farm and Lake Bathurst. The likely impacts on birds and bats should be re-assessed, taking into account that waterbirds will fly directly over the proposal. (Sub 10)

APPENDIX D. SUBMISSIONS FROM PUBLIC AUTHORITIES

and

APPENDIX E. SUBMISSIONS REPORT

and

APPENDIX F. PREFERRED PROJECT REPORT

and

APPENDIX G. ENVIRONMENTAL PLANNING INSTRUMENTS CONSIDERATION

SEE ATTACHED CD-ROM

APPENDIX H. ENVIRONMENTAL ASSESSMENT REPORT

SEE ATTACHED CD-ROM