Name of the threatening process:

Nomination of Wind Turbines as a Threatening Process

Bird and Bat Mortality from Wind Turbines that will impact migratory and listed EPBC species or cause species that are as yet not listed to become vulnerable, endangered of critically endangered.

A description of the threatening process that distinguishes it from any other threatening process, by reference to:

(i) its biological and non-biological components.

1.0 The Nature of the Threat of Wind Turbines to Migratory, Vulnerable, Endangered and Critically Endangered Birds and Bats.

The threat posed by wind turbines to birds and bats has been only recognised in the last decade. Conservation planning to date has been concerned with the use of terrestrial and marine environments, with little research on the use of the air above the ground by threatened species. As the threat posed by wind turbines was not predicted the response to the threat has been hampered by a lack of understanding of how and how many birds and bats have been killed by turbines. Though many have been clearly hit by blades many others have not. The inability of birds with acute eyesight like wedge-tail eagles, great manoeuvrability like white throated needle- tails and especially bats with echo location abilities to avoid turbines has been an unpleasant surprise to most researchers. The explanations offered to date have been based on conjecture – not research.

The location of carcasses associated with turbines has also been problematic. Larger birds of prey found dead at the foot of the turbines are the most obvious, but it is likely that animals hit by blades or the turbulence they generate could end up a considerable distance away. Predation of carcasses has lead to further underestimation of the impact of existing turbines.

The siting and management of wind turbine facilities presents a challenge to conservation managers to evaluate the use of the air column in which these turbines operate by migratory, vulnerable, endangered and critically endangered birds and bats.

For territorial or seasonally territorial species or for species that revisit the same limited habitat areas, poorly sited wind turbines present an ongoing threat that could greatly diminish populations or even cause extinction.

1.1 Site Selection

Birds and bats of many species are killed in significant numbers by wind turbines in various locations overseas[1] [2] [3]. The principle means of reducing and /or eliminating the impact of wind turbines on birds and bats is in site selection.

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[1] Shawn Smallwood, Carl Thelander, and Linda Spiegel Raptor Mortality at the Altamont Pass Wind Resource Area Research funded by the National Renewable Energy Laboratory. www.iberica2000.org/documents/EOLICA/ALTAMONT/Dr.Smallwood_presentation.pdf

[2] From the defenders of wildlife RENEWABLE ENERGY WIND ENERGY RESOURCES PRINCIPLES AND RECOMMENDATIONShttp://www.defenders.org/habitat/renew/wind.html

[3] **Convention on the Conservation of Migratory Species of Wild Animals RESOLUTION 7.5***

With few limits on number, size and location of turbines relative to flight paths of birds and bats they pose a new and significant threat to these listed species. Sites for wind turbines in Australia are principally chosen for their utility – reliability of the wind, proximity to suitable transmission lines etc[4]. Their interaction with birds and bats is only required to be evaluated after site selection and sometimes considerable onsite investment. Further it is possible for consultants to justify the selection of almost any site given the lack of guidelines, principles and research protocols developed for site evaluation - except for those guidelines developed by the wind industry.

Given the lack of Government guidelines and protocols regarding evaluating the interaction with wind turbines with EPBC species, consultants invariably 'defend' the selection of a given site -after it has been selected for other more 'utilitarian' reasons.

There is a general paucity of collated data and authoritative research by which to evaluate bird and bat movements and their likely interaction with wind turbines. This is especially so during the night-time when many species are known to fly during migration and are likely more vulnerable to striking turbines. To date there has been no evaluation of movement of any of these species at night over any proposed site before construction[5].

Rather than the current very limited site by site evaluation, there's a needs for more comprehensive policy guidelines and the development of exclusion zones to prevent turbine siting which could threaten the species as listed under the act.

1.2 Behaviour of Birds and Bats Leading to Vulnerability to Wind Turbines
There are many aspects related to the behaviour of migratory, vulnerable, endangered and critically endangered birds and bats that need to be considered in relation to the risk posed by wind turbines[6]. These species often fly at the height of turbine blades for a variety of reasons from moving between feeding and breeding site to arrival and departure at staging areas for migration or along migratory routes. Other species move between the coast and the mountains seasonally, or simply follow 'the rain' in search of wetlands. This behaviour for any given species is not entirely predictable and varies with seasonal conditions.

1.2.1 International Migration eg Short-tailed Shearwater, Latham's Snipe
Many of the species listed in migratory treaties between Australia, China and Japan **travel at night**, not only in migration but likely also between wetlands while feeding, often within the range of heights at which turbine blades operate[7]. Poorly sited turbines represent a threat to such migratory species.

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[4] Siting Guide for Wind Farms in Australia Coy, Jay; Sadaka, Nabeel and Lamborn, Julia* Swinburne University of Technology Conclusion pp13 (2004?) http://www.nzsses.org.nz/Conference/Session5/09%20Coy%20Sadaka%20Lamborn.pdf

[5] **WIND TURBINES AND MIGRATORY SPECIES** Adopted by the Conference of the Parties at its Seventh Meeting (Bonn, 18-24 September 2002**Windfarms and Birds :An analysis of the effects of windfarms on birds, and guidance onenvironmental assessment criteria and site selection issues** *Report written by BirdLife Internationalon behalf of the Bern Convention RHW Langston & JD Pullan, RSPB/BirdLife in the UKcontact: Rowena.Langston@rspb.org.uk September 2003 pp20*

[6] As 5 above *pp20*

[7] As 5 above, *also pp20*

1.2.2 Intra -continental Migration eg Orange-bellied Parrot (OBP)

Other species listed as vulnerable, endangered and critically endangered birds and bats move between States or between Tasmania and the mainland. Travelling over coastlines, and moving between feeding sites these species are threatened by poorly sited turbines. Being such a small bird OBPs will be hard to find as strike mortality, especially given the predation effect in Tasmania. Turbine strike could threaten this species with extinction.

1.2.3 Regional Species eg Grey-headed Fruit Bat

Other species listed as vulnerable, endangered and critically endangered birds and bats move between roosting areas and feeding grounds and could be threatened by poorly sited turbines.

1.2.4 Resident eg Black-eared Miner

Other species listed as vulnerable, endangered and critically endangered birds and bats move within home ranges and often disperse more widely as juveniles. These species are threatened by poorly sited turbines. For birds that occupy discreet territories, like black eared miners and species like Tasmanian Wedge-tailed Eagles there is a problem with ongoing mortality. As a bird or pair of birds is killed others of the same species are likely to re-occupy the same territory and suffer the same fate creating a mortality "sink".

1.2.5 Rising on Thermals – Raptors eg Tasmanian Wedge-tailed Eagle

Ridge lines and cliff faces and even sand dunes are often used by birds of prey as soaring areas for which to gain altitude to hunt, mate and travel on thermals and updrafts. Turbines placed on cliffs, ridges and adjacent to dunes can threaten these species. In Smallwood on Altamont[8] he states in regard to raptors in general;

"Turbines on steeper slopes and in canyons were generally more dangerous to raptors, but ridge crests and peaks within canyons were also dangerous"

Two Wedge Tailed Eagles have been killed within two months in the first year (2003) of operation of the turbine facility at Starfish Hill, South Australia[9]

1.2.6 Variation in Weather Conditions

The risk wind turbine facilities pose to vulnerable, endangered and critically endangered and migratory birds and bats is increased with strong winds and poor visibility, reducing these animals ability to navigate around turbine blades. This risk is greater for many of these species if these weather conditions coincide with periods when these animals depart or arrive at sites or are moving between feeding grounds.

1.3 Moving Turbine Blade impact

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[8] Shawn Smallwood, Carl Thelander, and Linda Spiegel Raptor Mortality at the Altamont Pass Wind Resource Area Research funded by the National Renewable Energy Laboratory. Pp 48 (Conclusions) www.iberica2000.org/documents/EOLICA/ALTAMONT/Dr.Smallwood_presentation.pdf

[9] RENEWABLE ENERGY INDUSTRY ENVIRONMENTAL IMPACTS By Andrew Chapman - 15/11/03Country Guardian website at http://www.countryguardian.net/Chapman.htm

The blades of wind turbines vary mostly from 30m – 50m or more in length with larger blades likely to dominate future wind farm development.

Mark Duchamp in his paper, published on the web, Chilling Statistics September 2004 writes in regard to the tip speed achieved by wind turbines;

"*Large turbines of the latest technology may have blades that rotate more slowly than those of older types; but they are much longer - 35 to 50 meters - and sweep much larger areas. They also reach higher in the sky, up to 125 meters high, affecting more species of birds and bats.*

Furthermore, in spite of their slower rotation, speed at the tip is very high. Their increased length accounts for that. To give an example: General Electric model 1.5S has a rotor 70.5-meter-wide (diameter), and a generating rotor-speed varying between 11 and 22 rpm (2).

It is simple to calculate the tip-speed from this data:

70.5 meters x 3.14 (π R2) = 221.37meters circumference x 11rpm = 2435meters per minute x 60 minutes = 146 kph

At 22 rpm (revolutions per minute), the tips go twice as fast:

70.5 meters x 3.14 (π R2) = 221.37meters circumference x 22rpm = 4870meters x 60 minutes = 292 kph

And 3 MW turbines have 50-meter long blades (instead of 35 in the above example) that reach even higher speeds at the tip: 358 kph ."

1.3.1 Fatal/injury speed strike zone

Smaller Turbines spin faster and have a smaller total area that is dangerous to birds but a larger percentage of the blade which, when turning, is likely be invisible and contribute to bird and bat mortality

The fatality strike zone is the area of the spinning blade which is most dangerous for bird and bat strike. This will vary from near zero for most species when the blades are stationary, and then increase from the blade tip toward the central hub as the wind speed and blade rotation speed increases. There appears to be little literature relating to the modelling of this important variable

1.3.2 Blade visibility zone

A subset of the fatal speed strike zone is the blade visibility zone, again from 100% when the blade is stationary and steadily decreasing up to the rotation speed at which an area of the blade back from the tip becomes invisible to the species in question.

From pp8 Thelander, et al. 2003

"Orloff and Flannery (1996) suggested that some birds try to pass through the rotor plane because they simply cannot see rotating turbine blades, or in the case of raptors, because they are fixated on a perch or prey item situated beyond the blades. Raptors may identify a perch or prey item and continuously observe it until they capture or land on it. If the raptor's target is located behind the rotating blades of a turbine, then the raptor may not see the blades or may see them when it is too late to avoid them. The relative effects of retinal smear (Hodos et

al., 2001) versus fixed focus on prey items remains unknown, as does the degree to which these two factors might interact. But the frequent fatalities of non-raptorial birds summarized in this report indicate that fixed focus on prey items is not the only reason birds attempt to pass through the rotor plane."[10]

1.3.3 Blade echo detection zone – in clear conditions

For many bat species and some bird species echo location is the principle means of obstacle avoidance. There is a paucity of research to determine at what speed blade tips become invisible to echo location, if any.

1.3.4 Visibility condition variability

Fog, cloud and smoke can all obscure turbine blades and theoretically add to the risk of bird and bat strike.

"Many studies have shown that poor weather conditions increase the occurrence of collisions with towers (Case *et al.* 1965, Seets & Bohlen 1977, Elkins 1988, Still et al 1994; see Section 3.2)[11]."

1.3.5 Wind conditions

A variety of wind conditions can increase the risk of bird and bat strike. Gusty conditions can hamper avoidance, as could strong winds or sudden wind shifts.

1.3.6 Turbulence Zones

This is another aspect of wind turbines that has been subjected to little research. At maximum and near maximum speeds air turbulence generated by turbines could be a very significant source of mortality. There are references to bats and small birds that have been flung to the ground fatally in what have been described as down drafts. For small birds and bats the turbulence caused by blade tips at maximum rotation speed may be fatal some considerable distance downwind or even upwind of rotating blades. A lethal turbulent zone, should it exist, may explain mortality of species of great agility and heightened sensory perception. The lethal turbulence zones to bats and birds created by turbines spinning at maximum or near maximum speed could be many times the area of the sweep of the turbine blades. Small birds and bats would be far more vulnerable to encountering sudden violent turbulence than large birds, fundamentally altering the distribution and likely distance from the turbines of fall of dead and injured birds and bats. This effect is referred to in the evaluation of bird and bat mortality on Prince Edward Island[12] where it is stated;

'..The estimated average number of victims varied from 0.04 to 0.09 birds/turbine/day, depending on the site and the season. Of these collisions, 43% were caused by birds being swept down by the wake behind a rotor, 36% flew directly into the rotor, and the cause of death was unknown for the remaining 21%.Winkleman (1994) believes that the total

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[10] C.G. Thelander, K.S. Smallwood, and L. Rugge Bird Risk Behaviors and Fatalities at the Altamont Pass Wind Resource Area Period of Performance:March 1998–December 2000 *BioResource Consultants Ojai, California* December 2003 • NREL/SR-500-33829 http://www.nrel.gov/docs/fy04osti/33829.pdf

[11] Potential Impacts of Wind Turbines on Birds at North Cape, Prince Edward Island. A report for the Prince Edward Island Energy Corporation
13 December 2001 Andrea Kingsley* & Becky Whittam Bird Studies Canada, Atlantic Region

[12] "see 11 above" pp 10

number killed per 1,000 MW of wind energy is low relative to other human-related causes of death.’

A description of the threatening process that distinguishes it from any other threatening process, by reference to:

(ii) the processes by which those components interact (if known).

2.0 The Monitoring of wind turbine impact to date is likely to have understated the interactions between wind turbines & vulnerable, endangered, critically endangered and migratory birds & bat species

Monitoring of wind turbine for bird and bats kills has been in response to major kills for larger species, especially eagles, hawks and vultures in Europe and the USA. These kills were indicated by mutilated carcasses at the foot of wind turbine facilities and monitoring was initially developed around the collection of these carcasses without any direct research as to how exactly they were killed by turbines.

Some initial formulaic approach to carcase collection was rapidly developed by industry and applied by various consultants to existing wind farms and individual turbines. These standardised approaches are being developed by the wind industry as the demand for evaluation of existing and proposed turbine facilities increases.

The development of the Avian Risk Management Protocol Michael L. Morrison *California State University Sacramento, California* likely in response to the public concern over eagle deaths at Altamont. (See reference 10 above.)

Later the monitoring program for turbines at Ramea New Foundland in 2003 was based on that developed for the Prince Edward Island in 2001.

The Monitoring of the Wind Turbines at Woolnorth in Tasmania is based on the 1999 Avian Risk Management Protocol. This older methodology has also been applied to the evaluation of many other wind farm proposals for Victoria such as the Dollar Wind Farm, proposal currently under consideration. The shortcomings of this approach in regard to gauging the impact on vulnerable, endangered, critically endangered and migratory species are discussed below with specific reference to the recently proposed Wind Turbine Site at Dollar in South Gippsland.

2.1 Monitoring Distances from Turbines for Birds and Bat kills

The design of monitoring programs by the wind turbine industry and the sustainable energy bodies that are charged with establishing wind generation has been in response to birds and bats found in the vicinity of wind turbines – and it has been widely assumed that the principle cause of mortality is blade strike and that the birds and bats killed by blades will fall within 50m of the turbine, the **minimum** recommended in the 1999 Avian Risk Management Protocol[13]**.**

[13] Avian Risk Management Protocol, Michael L. Morrison. Karin Sinclair *California State University Sacramento, California for the* National Renewable Energy Laboratory, Work performed under Subcontract No. CXL-7-17461 November 1998.

In regard to the monitoring at Woolnorth in Tasmania, Meredith et al. state (pp2)[14]

'Only those birds that have collided with the turbines have been included in the results. There have been two deaths of white fronted chats associated with the perimeter fence….'

These deaths were not included, though it is unlikely that they would have been killed and left by predators, died naturally or collided with the fence and died.

Physical studies are required to determine the exact nature of the threat that turbines pose to birds and bats, especially from turbulence, and the distance that dead and injured birds and bats of varying sizes could end up from the turbines in varying wind conditions. This distance is likely to be considerable especially if birds or bats are hit by the upward movement of a turbine blade at a maximum tip speed of 200-300 kph.

2.2 Collection Methodology – The Effect of Predation

Many authors attest to the problems with predation of bird and bat kills associated with wind turbines with predators habituating to the wind turbines. At Woolnorth there was even a predator fence constructed to reduce predation (Meredith pers.com.). Foxes, feral and domestic dogs, feral and domestic cats, ravens, currawongs, and a wide range of birds will also scavenge birds and bats killed by wind turbines.
In Tasmania the Tasmanian devil, tiger cat and native cat predation is additionally significant.

There have been various attempts to estimate likely predation by a variety of methods. In some instances frozen carcasses are defrosted and left over night on site to determine predator affects. As these carcasses are not fresh and warm predation is likely to be reduced. In other instances the numbers of dead birds in areas adjacent to a wind farm have been counted, but little effort has been made to establish rigorous controls or exclude or to evaluate whether these additional carcasses are not also due to wind turbine mortality**.**

The construction of predator proof fencing is problematic in that the distance from the turbines increases the cost and it does not exclude avian predators and is unlikely to exclude all terrestrial predators. Given the time consuming nature of carcass collection it is likely that a degree of predation is also occurring during the time collection is undertaken.

2.3 Collection Methodology – Methods and Frequency

All collection of bird and bat killed by wind turbines in Australia has been done by people to date. This is not very efficient. There have been recommendations for use of dogs (from overseas research[15]) to find bats, especially given the extremely small size

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[14] Bird and Bat Monitoring - a 6 page part report from Biosis published on the web at http://www.hydro.com.au/documents/Our%20Environment/BirdAndBatMonitoringAtTheWoolnorthWindfarm.pdf. No matching references found – likely unpublished. (find attached)

[15] WIND ENERGY & BIRDS/BATS WORKSHOP PROCEEDINGS
BAT ECOLOGY RELATED TO WIND DEVELOPMENT AND LESSONS LEARNED ABOUT IMPACTS ON BATS FROM WIND DEVELOPMENT ***Wind Power: Bats and Wind Turbines***
By Thomas H. Kunz *Center for Ecology and Conservation Biology Boston University*
also

of insect eating bats, many little bigger that a house mouse. The use of dogs for carcase detection would appear to be vital. For people to cover even the 50m diameter area around a dozen or more turbines and visually detect the carcasses of small bats in scrubby coastal vegetation at sites like, for example, Portland in Victoria is a virtually impossible task. The use of trained sniffer dogs would greatly increase the efficiency of bird and bat collection and may allow such recoveries to be undertaken through the night – further reducing predation. This is rather than using trained "sniffer" dogs simply to test the efficiency of human carcase collectors as some authors have recommended.

The frequency of collection of carcasses can also have significant impact on the estimation of the number of birds and bat kills.

Evaluation of turbine bird and bat interaction with the use of thermal imaging, in a variety of conditions, may provide a more accurate approach to determining the distance that needs to be searched from turbines and the best times to collect kills. It could even assist in determining the nature of predation.

From: **Bird Monitoring Program to Assess Impacts of Wind Turbines on Birds at Ramea, Newfoundland** Submitted by: Carl Brothers, Frontier Power Systems Date: September 18, 2003

Most carcasses are scavenged within about five days of dying (Kostecke et al. 2001), so clearly not all birds killed at the turbines will be found by this method. (Note: This may not be the case in a location like Ramea where scavengers are somewhat limited). At a study of bird mortality at a TV tower in Florida, an average of 2,248 dead birds were found per year when scavenger control was applied, compared with only 642 carcasses per year when no scavenger control was applied (Crawford and Engstrom 2001). A separate study to determine carcass persistence rates on Ramea may also be conducted t some point in the year (see Anderson et al. 1999) if it is determined there is a need (i.e., if a significant number of carcasses are found).

3.0 The Proposed Dollar Wind Farm – An Example Underestimating the Threat to Vulnerable, Endangered and Migratory Species in Evaluation of Wind Farm Sites – Modelling the Prediction of Mortality and Mortality Rates of Birds and Bats Species.

There is no guidance for site selection for the construction of wind turbine facilities relative to their potential impact on migratory, vulnerable, endangered and critically endangered species of birds and bats[16]. The evaluation of the suitability of sites is left to the proponent of a given wind turbine construction project with consultants undertaking research often whilst community consultation for turbine construction is being undertaken. The prime reference in Victoria is the 'Wind Atlas' which provides companies with a guide to the most reliable winds for wind power generation.

The proposal for wind turbines at Dollar as an example of these problems.

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[16] Proceedings, Bat and Wind Power Generation Technical Workshop Sponsored by Bat Conservation International, U.S Fish and Wildlife Service, U.S. Department of Energy's National Renewable Energy Laboratory and the American Wind Energy Association Hosted by FPL Energy February 19 - 20, 2004

3.1 Inadequate Observation Time

White-throated needletails are seen by locals in large numbers feeding in the very top of the Stony Creek catchment. They appear intermittently, when they are in South Gippsland as part of their migration, when the weather conditions are right and for a few days, usually in summer and autumn, each year. They were seen by the consultants but their behaviour was not recorded or perhaps not observed - yet this is a significant migratory species (JAMBA, CAMBA) that lives on the wing in Australia. An individual was found killed by a wind turbine a Toora, but searches at this site are intermittent and there is no predator proof fencing or controls and this has been the only recorded bird kill for that site..

During the Panel Hearing into the Dollar wind farm proposal the consultant for the proponent, Dr Meredith, stated that, based on the risk analysis he had undertaken, between 2 and 6 white-throated needletails would be killed annually by the turbines, should they be constructed. This raises many questions. Can an activity that will lead to the deaths of migratory species be permitted? Does this mortality estimate have any basis in reality, or is it simply as a result of the application of a formula base on limited observations? In years and seasons when white-throated needletails are common – how many could be expected to be killed? There is already some kind of mortality being generated from the dozen or so turbines at Toora and plans to establish more wind turbine sites in areas where these birds frequent. What is the acceptable cumulative mortality? Using the Precautionary Principle, what level of predicted mortality is acceptable?

The head of the Stony Creek Valley ends along a ridge line that also marks the western head of Benison Creek which leads to Corner Inlet forming a corridor between Andersons Inlet and Corner Inlet. Orange Bellied Parrots are recorded in both locations. Do they use the corridor to get from one location to another? Do other migratory species use this corridor, during the day or at night?

3.2 Proximity of Listed EPBC species

For terrestrial development the consideration of impact on EPBC species is in regard to the presence or absence of these species and their preferred habitat. When considering this proposed windfarm the actual habitat on the ground gives no indication as to what species will use this area as a flight path. The proximity of listed EPBC species, especially the Swift Parrot, is generated by records maintained and submitted by reliable bird watchers and qualified scientists. Before becoming rare in recent years this bird was known widely across South Gippsland. The fact they have not been recorded within the study area for the brief time available to the consultant's team means little. They were not recorded as observed at other known locations at those times either. Certainly a record of swift parrot from the study area would not be seen as unusual.

3.3 Lack of Night Data

Given the proximity of the Dollar site to Corner Inlet, a Ramsar Wetland and being located in the headwaters of Stony Creek that feeds in to Andersons Inlet, another noted wading bird area, it would appear vital that the night movement of migratory species, if any, be evaluated. None was undertaken in the course of this brief study. This is surprising as Biosis, the company which evaluated Dollar, was the same company that undertook the evaluation of the Woolnorth wind farm site. Unlike Dollar, at Woolnorth these consultants undertook night time observations form

migratory species and even trialled the use of Marine Radar during the site evaluation.[17]

3.4 Concentration on Resident Species

The methodology adopted by the consultant, though currently widely used, of observing the behaviour of birds relative to the height of the proposed wind turbines biases the sample to day time resident species on fine days with good visibility.

The adverse weather and nocturnal behaviour of these species was not recorded though it is widely known that many species identified in the study area travel at night. Their absence or presence will not be reflected in the terrestrial biological habitat they pass over – nor by limited day time observations (as stated above).

The behaviour of seasonal species was not recorded either. Given that Gippsland has some 280 known species of native birds recorded (Chapman, pers. com.) and the consultants observed fewer than seventy species, it is reasonable to say that their recorded observation would understate both the number and diversity of species that would interact with the proposed turbines.

With a lack of research regarding the specific nature of the threat of turbines to birds, there are clear inadequacies in observational methodology, especially relative to nocturnal bird abundance and behaviour. The mathematical formulae used to estimate the risk these turbines pose to these species were based on dubious and unsubstantiated assumptions. That risk is underestimated. In explaining the formulae development little attention was paid to the high turbine tip speed and there was no mention of the effects of turbulence on birds and bats from turbulence generated by fast turning turbine blades[18].

Regardless of the appropriateness or functionality of these formulae the principle error lies in the data selection and general lack of data The greatest limitations in the case of Dollar were in the limited time for observations, given that nature of the site.

3.5 Bats

There was an attempt to estimate the different bats on the site by analysis of sound recordings from several vantage points – but again this was over a small time frame and limited in its scope and seasonality. From the Environment Victoria website, in regard to surveys for bats at the adjacent Toora Wind farm the researcher, Brett Lane, states;

"As for bat observations, the Toora report pinpoints research hurdles. Bat research involves "Anabat" ultrasonic bat detectors. These detectors have a 20 metre range and cannot distinguish between individual bat sounds, making it technically impossible to estimate numbers."

"A significant limitation with the use of this technique is that it is not possible to accurately census bats…"

[17] Hydo Tasmania's website, www.hydro.com.au/documents/Our Environment/ following the links to Woolnorth Main Report (187 meg)
[18] Dollar Wind Farm Planning Permit Application Report, Supplement A.

The bat mortality at Toora was not mentioned in the evaluation of the Dollar wind farm site and nor were the limitations of the "Anabat" ultrasonic detectors which were also used to evaluate Dollar raised at the Panel Hearing into that development.

Grey Headed Flying Foxes do use this valley and have been annually seen in old orchards close to where turbines are planned to be erected – but again these species were not recorded by the proponent, or apparently on any data base.

3.6 Vulnerable Worms

Giant Gippsland earthworms were said to be known to many of the residents of the affected area, though none were qualified to record their presence. This species is problematic to detect as random searching by digging with spades is likely to kill or injure it. There are records for this species from less than 40 kilometres from the Dollar turbine site with recent survey data not yet entered; possibly putting records much closer. The habitat throughout much of the turbine site is suitable for the worms.

3.7 Research Required to Ensure that the Proposed Dollar Wind Farm does not Threaten Species as Listed under the EPBC Act.

Considerable investment was made in the site selected before the potential environmental impact was evaluated. Due in part to a lack of adequate guidelines for site selection it was apparently assumed by the proponent that there was likely to be little or no environmental impact. The limited site evaluation appears to reflect this, though it does appear that many unexpected species were encountered during the site surveys in areas around the site. Powerful Owls adjacent to the site, Sooty Owls a few valleys distant, seasonal concentrations of white-throated needletails and the Gippsland giant earthworm, apparently encountered by a number of residents.

There have been inadequate seasonal surveys for birds, no effective survey for bats and no effective surveys for nocturnal migratory species. Given the proximity of the proposed wind farm to Corner Inlet, the local and regional records for vulnerable endangered critically endangered and migratory species at least 14 months use of thermal imaging supported by year round and regular daytime observations throughout all seasons is required. Monitoring at the nearby Toora wind farm for bird and bat strike could also be valuable in the evaluation of the proposed Dollar wind farm - though this needs to be upgraded considerably with the installation of predator proof fencing around turbines and more systematic collection of bird and bat carcasses.

Records of bird and bat kills from the nearby Toora wind farm are very likely to be greatly understated, given the shortcomings in methodologies for surveys, as mentioned above. Also, as landowners are paid considerable sums of money for facilitating turbines there is an unfortunate incentive for them to remove/hide bird and bat carcasses. Land owners should be allocated permits by State agencies for the collection of carcasses with an obligation to properly collect and record location and time that any carcasses found a condition of that permit.

Better siting guidelines are needed to ensure more efficient, cost effective evaluation and to provide local communities with better information on which to base their input to State based wind farm siting decisions.

Name any species or ecological communities listed as threatened under the EPBC Act that are considered to be adversely affected by the threatening process:

4.0 Species Potentially Affected by Wind Turbines

The known range of the following species has not been excluded from areas where wind turbines can be constructed. In Australia there are operating wind turbines from Thursday Island to the south coast of Western Australia, Victoria and Tasmania – even in Antarctica. Wind Turbines are a threat to all of the species listed below when they are sited near migratory routes used by these species and near where they approach and depart from feeding and breeding grounds within their known Australian range.

4.1 Critically Endangered Birds

Scrubtit (King Island) *Acanthornis magnus greenianus*

Spotted Quail-thrush (Mt Lofty Ranges) *Cinclosoma punctatum anachoreta*

4.2 Critically Endangered Bats

Bare-rumped Sheathtail Bat Saccolaimus saccolaimus nudicluniatus

4.3 Endangered Birds

Brown Thornbill (King Island) Acanthiza pusilla archibaldi

Wedge-tailed Eagle (Tasmanian) Aquila audax fleayi

Glossy Black-Cockatoo (South Australian), Glossy Black-Cockatoo (Kangaroo Island) Calyptorhynchus lathami halmaturinus

Eastern Bristlebird *Dasyornis brachypterus*

Swift Parrot *Lathamus discolor*

Helmeted Honeyeater *Lichenostomus melanops cassidix*

Black-eared Miner Manorina melanotis

Orange-bellied Parrot *Neophema chrysogaster*

Forty-spotted Pardalote Pardalotus quadragintus

Western Whipbird (western heath) Psophodes nigrogularis nigrogularis

Southern Emu-wren (Fleurieu Peninsula), Mount Lofty Southern Emu-wren Stipiturus malachurus intermedius

Regent Honeyeater Xanthomyza phrygia

4.5 Endangered Bats

Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat Hipposideros semoni

4.6 Vulnerable Birds

Slender-billed Thornbill (western) Acanthiza iredalei iredalei

Grey Grasswren (Bulloo) Amytornis barbatus barbatus

Thick-billed Grasswren (eastern) Amytornis textilis modestus

Thick-billed Grasswren (Gawler Ranges) Amytornis textilis myall

Thick-billed Grasswren (western) Amytornis textilis textilis

Noisy Scrub-bird Atrichornis clamosus

Muir's Corella (southern), Western Long-billed Corella (southern) Cacatua pastinator pastinator

Baudin's Black-Cockatoo, Long-billed Black-Cockatoo *Calyptorhynchus baudinii*

Cape Barren Goose (south-western), Recherche Cape Barren Goose Cereopsis novaehollandiae grisea

Western Bristlebird Dasyornis longirostris

Red Goshawk Erythrotriorchis radiatus

Crested Shrike-tit (northern), Northern Shrike-tit Falcunculus frontatus whitei

Squatter Pigeon (southern) Geophaps scripta scripta

Partridge Pigeon (western) Geophaps smithii blaauwi

Partridge Pigeon (eastern) Geophaps smithii smithii

Purple-crowned Fairy-wren (western) Malurus coronatus coronatus

Crimson Finch (white-bellied) Neochmia phaeton evangelinae

Red-lored Whistler Pachycephala rufogularis

Princess Parrot, Alexandra's Parrot Polytelis alexandrae

Regent Parrot (eastern) Polytelis anthopeplus anthopeplus (incorrect subspecies)

Superb Parrot Polytelis swainsonii

Western Whipbird (eastern) Psophodes nigrogularis leucogaster

Western Whipbird (western mallee) Psophodes nigrogularis oberon

Australian Painted Snipe Rostratula australis

Southern Emu-wren (Eyre Peninsula) Stipiturus malachurus parimeda

Mallee Emu-wren Stipiturus mallee

4.7 Vulnerable Bats

Greater Large-eared Horseshoe Bat Rhinolophus philippinensis (large form)

Southern Bent-wing Bat Miniopterus schreibersii bassanii

Grey-headed Flying *Pteropus poliocephalus*

4.8 Vulnerable Worms

Giant Gippsland Earthworm Megascolides australis
Known from within 20k of the proposed Dollar Wind Farm in South Gippsland

4.9 Migratory Species

Migratory Species listed on both the China Australia Migratory Bird Agreement and the Japan Australia Migratory Bird Agreement

2. Sooty Shearwater *Puffinus griseus*

3. Leach's Storm-Petrel *Oceanodroma leucorhoa*

4. White-tailed Tropicbird *Phaethon lepturus*

5. Red-footed Booby *Sula sula*

6. Brown Booby *Sula leucogaster*

7. Great Frigatebird *Fregata minor*

8. Andrew's Frigatebird *Fregata andrewsi*

9. Least Frigatebird *Fregata ariel*

10. Cattle Egret *Bubulcus ibis*

(*Ardeola ibis*)

11. Great Egret *Egretta alba*

12. Eastern Reef Egret *Egretta sacra*

13. Yellow Bittern *Ixobrychus sinensis*

14. Glossy Ibis *Plegadis falcinellus*

17. White-bellied Sea-Eagle *Haliaeetus leucogaster*

18. Sarus Crane *Grus antigone*

19. Red-legged Crake *Rallina fasciata*

20. Corncrake *Crex crex*

22. Painted Snipe *Rostratula benghalensis*

23. Grey Plover *Pluvialis squatarola*

24. Lesser Golden Plover *Pluvialis dominica*

25. Ringed Plover *Charadrius hiaticula*

26. Little Ringed Plover *Charadrius dubius*

27. Mongolian Plover *Charadrius mongolus*

28. Large Sand-Plover *Charadrius leschenaultii*

29. Caspian Plover *Charadrius asiaticus*

30. Little Curlew *Numenius borealis*

(*Numenius minutus*)

31. Whimbrel *Numenius phaeopus*

32. Eurasian Curlew *Numenius arquata*

33. Eastern Curlew *Numenius madagascariensis*

34. Black-tailed Godwit *Limosa limosa*

35. Bar-tailed Godwit *Limosa lapponica*

36. Redshank *Tringa totanus*

37. Marsh Sandpiper *Tringa stagnatilis*

38. Greenshank *Tringa nebularia*

39. Wood Sandpiper *Tringa glareola*

40. Common Sandpiper *Tringa hypoleucos*

41. Grey-tailed Tattler *Tringa incana*

(*Tringa brevipes*)

42. Terek Sandpiper *Xenus cinereus*

(*Tringa terek*)

43. Ruddy Turnstone *Arenaria interpres*

44. Asian Dowitcher *Limnodromus semipalmatus*

45. Latham's Snipe *Capella hardwickii*

(*Gallinago hardwickii*)

46. Pin-tailed Snipe *Capella stenura*

(*Gallinago stenura*)

48. Red Knot *Calidris canutus*

49. Great Knot *Calidris tenuirostris*

50. Red-necked Stint *Calidris ruficollis*

51. Long-toed Stint *Calidris subminuta*

52. Sharp-tailed Sandpiper *Calidris acuminata*

53. Dunlin *Calidris alpina*

54. Curlew Sandpiper *Calidris ferruginea*

55. Sanderling *Crocethia alba*

56. Broad-billed Sandpiper *Limicola falcinellus*

57. Ruff *Philomachus pugnax*

58. Red-necked Phalarope *Phalaropus lobatus*

59. Grey Phalarope *Phaloropus fulicarius*

60. Oriental Pratincole *Glareola maldivarum*

61. Pomarine Jaeger *Stercorarius pomarinus*

63. Black Tern *Chlidonias niger*

64. Caspian Tern *Hydropogne tschegrava*

(*Hydroprogne caspia*)

65. Common Tern *Sterna hirundo*

66. Black-naped Tern *Sterna sumatrana*

67. Bridled Tern *Sterna anaethetus*

68. Little Tern *Sterna albifrons*

69. Lesser Crested Tern *Thalasseus bengalensis*

(*Sterna bengalensis*)

70. Common Noddy *Anous stolidus*

71. Oriental Cuckoo *Cuculus saturatus*

72. White-throated Needletail *Hirundapus caudacutus*

73. Fork-tailed Swift *Apus pacificus*

74. Barn Swallow *Hirundo rustica*

4.10 Migratory Birds Protected by JAMBA only

1 Streaked Shearwater *Calonectris leucomelas*

2 Wedge-tailed Shearwater *Puffinus pacificus*

3 Fleshy-footed Shearwater *Puffinus carneipes*

5 Short-tailed Shearwater *Puffinus tenuirostris*

6 Wilson's Storm-petrel *Oceanites oceanicus*

10 Masked Booby *Sula dactylatra*

16 Garganey Teal *Anas querquedula*

21 Eastern Golden Plover *Pluvialis dominica*

23 Turnstone *Arenaria interpres*

24 Red-necked Stint *Calidris ruficollis*

26 Baird's Sandpiper *Calidris bairdii*

27 Pectoral Sandpiper *Calidris melanotos*

29 Curlew Sandpiper *Calidris ferruginea*

30 Knot *Calidris canutus*

34 Buff-breasted Sandpiper *Tryngites subruficollis*

35 Broad-billed Sandpiper *Limicola falcinellus*

47 Little Whimbrel *Numenius minutus*

56 Crested Tern *Sterna bergii*

57 Asiatic Common Tern *Sterna hirundo (JAMBA*

Note: Plovers *Charadriiformes* waders (European golden plover *Pluvialis apricaria,* blacktailed godwit *Limosalimosa,* Eurasian curlew *Numenius arquata*) are not at this stage considered vulnerable to turbines in Europe. Given the paucity of bird turbine collision data in Australia and the fact that many species display very different behaviour in Australia[19] species from these groups should be considered threatened until data from existing turbine monitoring in their likely habitat has been analysed.

4.11 Cumulative Risk

Though mortality to protected species on an annual per turbine basis may be portrayed as low for any given site this is cumulative with both the increase in the number of turbines and the cumulative annual impact over decades. Over time species that are currently conservation dependent could become vulnerable, species that are currently vulnerable become endangered and species that are currently endangered or critically endangered become extinct. Unusual seasons or weather conditions could also see unpredicted risk to migratory, vulnerable, endangered and critically endangered species of birds and bats.

[19] Latham's Snipe is a day time bird and conspicuous in Japan while being nocturnal and secretive in Australia for instance, possibly increasing the risk that it will be killed by turbine blades here.

Name any species or ecological community, other than those that are listed under the EPBC Act, that could become eligible for listing in one of those categories because of the threatening process:

a) Bats

Goulds wattled bat (*Chalinolobus gouldii)*
Goulds wattled bat is recorded as a turbine strike mortality (Toora, see above) from the limited Australian data available and is a species that could become eligible for listing under the EPBA Act their presence is not taken into account and sites for wind turbines are not carefully selected or, when constructed, not thoroughly monitored, and managed.

There is a growing concern about the current unrecorded fatalities and likely future impact of wind turbine facilities on this species group of bats.

From the Australasian Bat Conservation Society Website

"Impacts of wind farms on bats.[20]
There is an increasing number of reports from around the world, of fatal impacts by wind turbines on bats. Where reliable data are available, the bat deaths reported range from 1.6 per turbine per year 1 to over 90 bats per turbine per year 2. Even a relatively low number of deaths per turbine per year, could result in many hundreds of mortalities for a single wind farm development. High annual mortality rates may prove catastrophic for populations of some bat species…"

From the US Bat Conservation website there is also a statement regarding the impact of windfarms on bats.[21]:

1. Bat fatality at wind turbines has been documented worldwide in Australia, Canada, Germany, Spain, and Sweden, and occurs throughout all regions and in varying habitat conditions across North America.

2. Bat fatality at wind turbines is largely understudied; to date, only 12 studies have been conducted in the U.S. Numerous information gaps remain and warrant investigation. Only one refereed journal article on bat mortality at turbines has been published.

3. Bat fatalities have been reported at nearly all wind energy facilities in the U.S. and annual mortality has been estimated to vary from <2 to nearly 50 bats/turbine/year. These estimates may represent conservative minimums in some situations when searcher efficiency and scavenger removal rates are not adequately addressed.

9. Hoary, red, and silver-haired bats are killed most frequently, but there are regional differences in species composition of fatalities.

[20] Australasian Bat Conservation Society Website, links, brochures http://abs.ausbats.org.au

[21] US Bat Conservation Society Website http://www.batcon.org/wind

12. Peaks in bird and bat kills appear to be largely non-overlapping, with bats preceding birds in fall migration.

13. No endangered species of bat has yet been found and reported killed at a wind farm in the continental United States. However, observations to date are too few to speculate on risk levels to several endangered species that occupy habitats in the vicinity of proposed and existing wind farms (e.g., the Indiana bat during migration).

14. Red bats are one of the species most frequently killed by turbines in the U.S. and they appear already to have been reduced sharply from historical numbers. There is serious concern that proliferation of wind energy development could push such bats toward endangered status unless methods to prevent or minimize mortality are found.

15. Unlike many species of birds, bats are long-lived, have low reproductive rates, and appear to be especially vulnerable to wind turbines. Unless solutions are soon discovered to prevent or minimize this new threat, the cumulative impact on populations of bats could become extremely serious.

b) Birds

Wedge-tailed Eagle (*Aquila audax)*
Wedge-tailed eagles have been recorded as struck by turbines in Australia, but not by official monitoring that has been published as yet. This species is currently widespread, but it is long lived with a low reproduction rate. There is serious concern that poorly located turbine sites could become mortality 'sinks' for this species. When animals are struck and killed they leave either a partner bird to be 'paired' or vacate a territory that will continually be re-occupied by eagles; possibly being killed faster than they can reproduce. If no care is taking with siting, dozens or hundreds of wind turbines could cause a significant and ongoing mortality for this species. Based on international research at Altamont Pass in California eagles are particularly susceptible to turbine strike.

In South Australia about the Starfish Hill wind farm, a facility developed by Starfish Hill Wind Farm Pty Ltd, a wholly owned subsidiary of Tarong Energy, based in Queensland.

"· On 22 September 2003 the group said a Wedge-tailed Eagle had been killed at the Starfish Hill wind farm…'

'· During the first week in October 2003 a second eagle was found…."

Hawks, Vultures, eagles and owls have been recorded as being struck by turbines blades in many areas of the world. The first major significant records of turbine strike were from Altamont in the USA;

"A two-year study to evaluate the extent and significance of the impact of wind turbines on bird life was started in 1989 in Altamont Pass, California. The study site included about 16 percent of the approximately 7,000 turbines in the Pass. One hundred fourteen dead birds were found between February 1989 and February 1990. Eighty-one were raptors, the majority of which were red-tailed hawks, American kestrels, and golden eagles. Sixty-three percent of all deaths were attributed to turbine collision, 12 percent to electrocution, 5 percent to wire collision, and 20 percent to

unknown causes. Most deaths resulted from amputation injuries. "It was estimated that over 300 raptors were killed by windfarm-related injuries within the Altamont Pass area during the first year of study (1989-1990).[22]"

Turbine strike of eagles at this site is an ongoing problem to this day; with this from a recent press release from the Center for Biological Diversity, USA:[23]

"Alameda County Board Of Supervisors To Decide Wind Turbine Permits On Thursday, July 7, 2005…"

"…The Board of Supervisors of Alameda County, California, will decide the terms and conditions for new permits for the thousands of existing wind turbines at Altamont Pass on Thursday, July 7, 20 Wind turbines at Altamont have killed an estimated 880 to 1,330 golden eagles, hawks, owls, and other protected raptors each year for the past 20 years…"

[22] BioSystems Analysis, Inc. 1990. Wind turbine effects on the activities, habitat, and death rate of birds. Prepared for Alameda, Contra Costa, and Solano Counties, California. 2 pp.

[23] Press Release July 1, 2005 Contact: Jeff Miller, Center for Biological Diversity (510) 499-9185

Justification for this nomination

Provide justification for listing the threatening process as a key threatening process under the EPBC Act, with particular reference to:

(a) evidence that the threatening process could cause a native species or ecological community to become eligible for listing in any category, other than conservation dependant:

(b) evidence that the threatening process could cause a listed threatened species or ecological community to become eligible for listing in another category representing a higher degree of endangerment:

(c) evidence that the threatening process adversely affects two or more listed threatened species (other than conservation dependant species) or two or more listed threatened ecological communities:

5.0 Known Wind Turbine Mortality

In reference to (a) above: Both powerful owls *(Ninox strenua)* and sooty owls *(Tyto tenebricosa)*, species on State Conservation Significance throughout their range, have been recorded as living adjacent to, and within a few kilometres of, proposed and existing turbine sites at Toora and Dollar respectively. If proper account of these species is not taken in site selection for wind farms and if there is not thorough monitoring and management of existing turbine facilities such facilities threaten these species.

Owls are of a group of species considered to be susceptible to turbine blade strike in research for the Convention on the Conservation of European Wildlife and Natural Habitats and considered at its Standing Committee 23rd meeting Strasbourg, 1-4 December 2003 on Windfarms and Birds.[24] (See below)

In reference to (b) above Both Short-tailed Shearwaters (*Puffinus tenuirostris)* and White-throated needletails *Hirundapus caudacutus* are species listed as 'Migratory' under the EPBC Act and have also be recorded as struck by turbines at Woolnorth and Toora windfarms respectively. These species could be further threatened if proper account of these species is not taken in site selection for future windfarms and there is not thorough monitoring and management of existing turbine facilities.

In reference to (c) above Both Orange Bellied Parrots (*Neophema chrysogaster*) and Swift Parrots (*Lathamus discolour*) have been recorded within 20 kilometres of

[24] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS Standing Committee 23rd meeting Strasbourg, 1-4 December 2003 Windfarms and Birds :An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues *Report written by BirdLife International on behalf of the Bern Convention RHW Langston & JD Pullan, RSPB/BirdLife in the UK contact: Rowena.Langston@rspb.org.uk September 2003 Secretariat Memorandum prepared by the Directorate of Culture and of Cultural and Natural Heritage*

existing and proposed windfarms in Victoria and Tasmania and could become critically endangered if proper account of their presence is not taken into account during site selection for future windfarms - and that there is not thorough monitoring and management of existing turbine facilities.

5.1 Australian Bat Mortality Records Associated with Windfarms

There are very limited records of Australian Turbine bat strikes and it is likely that the bulk what records exist are being held as 'commercial in confidence' data by companies/authorities operating wind farms.

5.1.1 Biossis Bird and Bat Monitoring at the Woolnorth Windfarm[25]

179 Days over 12 months from September 2002- August 2003

Table 3.2 Species involved in turbine collisions

Bat Species	Common name	No. of Collisions.
Chalinolobus gouldii	Goulds wattled	9
Unknown species		2

No carcasses were collected over the high summer months in this survey and though mammalian predators were controlled there was no avian predator control and the mortality of all species is likely understated – especially given the limits on the construction of predator proof fencing to a radius of only 50m.

5.1.2 Toora Windfarm

Brett Lane and Associates was commissioned by Stanwell to conduct a bird and bat monitoring program at Toora, which has 12 turbines. Their report was released in February 2004. There is no predator proof fencing at Toora which is situated in open farmland and the results have not adjusted for predation.

"A total of five bat carcasses were found during the monitoring period and one carcass during informal inspections**: five were white-striped freetail bats and the sixth was a chocolate wattled bat."**

As for bat observations, the Toora report pinpoints research hurdles.

"Bat research involves "Anabat" ultrasonic bat detectors. These detectors have a 20 metre range and cannot distinguish between individual bat sounds, making it technically impossible to estimate numbers. As the Toora report states: "A significant limitation with the use of this technique is that it is not possible to accurately census bats…"[26].

5.1.3 Australasian Bat Conservation Society Policy[27]

"Microbats are typically small mouse-sized bats, that eat mainly insects. They use sonar for navigation in the dark. Eight species of microbats are nationally listed as

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[25] From Hydro Tasmania's Website. Bird And Bat Monitoring At The Woolnorth Windfarm http://www.hydro.com.au/documents/Our%20Environment/BirdAndBatMonitoringAtTheWoolnorthWindfarm.pdf

[26] From Environment Victoria's website 'EV's Bird Policy' 2004 -05 http://www.envict.org.au/inform.php?menu=5&submenu=345&item=469

[27] Australasian Bat Conservation Society Website links, brochures http://abs.ausbats.org.au

threatened and are protected under the EPBC Act 1999. Many more species are listed as threatened under State laws. All reported fatalities of bats from wind turbines, in Australia and overseas, have been microbats. Megabats, or flying-foxes, are large bats. They live on a diet of fruit and nectar. They use vision for navigation. While there are no reports of megabat fatalities caused by collision with wind turbines, they too may be vulnerable. Megabats do not occur in countries where most existing wind farms have yet been built. In Australia, no wind farms have been built near megabat colonies……"

"The ABS strongly supports environmentally friendly energy generation and therefore has no philosophical objection to wind farms. However, studies in Australia and overseas have demonstrated that bat fatalities have been caused by impact with wind turbines. With the projected growth in the number of wind farm proposals, there is a need to find ways to minimise the ecological impact of wind farms on native bats…"

5.1.4 Overseas Wind Turbine Bat Mortality

From reports regarding wind turbines in West Virginia and Pennsylvania[28]
"Unexpectedly high numbers of bat fatalities reported at wind energy sites on ridge tops in the eastern United States have heightened the urgency to understand problems and find solutions…"

"…Mountaineer (Turbine Site)
• 466 bat fatalities found comprising 6 species (hoary bat, eastern red bat, eastern pipistrelle, little brown bat, silver-haired bat, and big brown bat, from highest to lowest number found). This does not constitute total estimated mortality; number of bats found must be adjusted for searcher efficiency and scavenging by habitat types."

"…Meyersdale
• 290 bat fatalities found comprising 7 species (hoary bat, eastern red bat, eastern pipistrelle, silver-haired bat, big brown bat, little brown bat, and northern long-eared bat, from highest to lowest number found). This does not constitute total estimated mortality; number of bats found must be adjusted for searcher efficiency and scavenging by habitat types…"

From Study: Bats killed at wind turbine site (The Associated Press)

"CHARLESTON, W.Va. - A study of a Tucker County wind energy farm estimates as many as 2,900 bats were killed by the whirling blades during a six-week period last year.

[28] **Wind turbines in West Virginia and Pennsylvania: an interim report** Edward B. Arnett, Bat Conservation International, Austin, TX 78716 Wallace P. Erickson, Western Ecosystems Technology, Cheyenne, WY 82001 Jessica Kerns, University of Maryland, Center for Environmental Science – Appalachian Laboratory, Frostburg, MD 21532 Jason Horn, Boston University, Department of Biology, Boston, MA 02215

Between Aug. 1 and Sept. 13, 2004, researchers with the Bats and Wind Energy Cooperative found 765 dead bats on the ground at the Mountaineer Wind Energy Center's 44 wind towers, a report summary released Sunday shows.

Researchers estimate that as many as 2,900 bats were actually killed in that period, and many more before and after. Plans for another round of intense research are apparently on hold, according to a news release from the group's scientists."

"The cooperative was organized in late 2003 by FPL Energy, owners of the Tucker County wind farm, after an initial study at the Mountaineer site found the wind turbines killed an estimated 2,092 bats in the spring and late summer of 2003."

In the Bat Conservation International- Newsletter- August 2004.htm[29] it states;

"The issue of bat deaths at wind farms was widely neglected in early wind-power assessments simply because bats, unlike birds, have no broad-based legal protection. Reports of two or three bats per turbine being killed each year at some facilities seemed a relatively small price to pay for clean energy. Such figures, however, can be misleading. We now realize that many more bats may have been killed but not counted.

Weekly surveys last summer beneath 44 giant turbines at West Virginia's Mountaineer Project revealed that an estimated 2,095 bats of seven species had been killed. However, since no surveys were conducted during the first half of the peak mortality period in August and since scavengers likely removed unknown numbers of bats during the seven-day intervals between searches, the total number of bat fatalities could easily approach 4,000.

The Mountaineer Project is the first large wind-energy site in eastern North America to be built on a high ridgeline. Exceptional bat kills are also being reported at a Tennessee wind farm on a mountaintop; 85 bats are being killed there each year at just three turbines. These are the only two wind farms built so far on ridges and mountaintops in the Eastern states.

For more than a decade, biologists have been raising concerns about ridge-top wind sites as potential threats to migrating birds, but bat migration was rarely considered. With major bat mortality confirmed at the only two Eastern wind-turbine projects located on ridges and mountaintops, the potential for devastating cumulative impacts is clear…"

[29] Bat Conservation International- Newsletter- August 2004.htm

5.2 Australian Bird Species
Biossis Bird and Bat Monitoring at the Woolnorth Windfarm[30]
179 Days over 12 months from September 2002- August 2003

Table 3.2 Species involved in turbine collisions with 6 turbines

Bird species	Common name	No. of Collisions
Hirundo neoxena	Welcome swallow	1
Pelecanoides urinatrix	Common diving petrel	3
Pelogodroma marina	White-faced storm-petrel	1
Puffinus tenuirostris	Short-tailed shearwater	2
Rhipidura fuliginosa	Grey Fantail	1
*Alauda arvensis**	Skylark	2
Strepera sp.	Currawong	1

In South Australia about the Starfish Hill wind farm, a facility developed by Starfish Hill Wind Farm Pty Ltd, a wholly owned subsidiary of Tarong Energy, based in Queensland[31]

- On 22 September 2003 the group said a Wedge-tailed Eagle had been killed at the Starfish Hill wind farm. This kill occurred before it was officially opened by Premier Mike Rann on Saturday 4 October 03.

- During the first week in October 2003 a second eagle was found dead under one of the turbines by the Tarong Energy Site Manager

Toora Windfarm – a single white-throated needletail was collected[32]

5.2.1 Migratory, Vulnerable, Endangered and Critically Endangered Bird Species
There has been little research regarding the interaction of existing turbines with bird and bats species and much of that research is commercial in confidence – the property of the commissioning companies or bodies. Only one research project has been discovered where the affects of predation have been taken into account. There are two monitored sites known are Toora in South Gippsland (no predator control or predation modelling) and Woolnorth in Tasmania where predator fence has been constructed – but only 50 m from turbines cliffs – though the publicly available data from Woolnorth is incomplete.

5.2.2 International Records of Bird Interaction with Turbines

[30] From Hydro Tasmania's Website. Bird And Bat Monitoring At The Woolnorth Windfarm http://www.hydro.com.au/documents/Our%20Environment/BirdAndBatMonitoringAtTheWoolnorthWindfarm.pdf

[31] **RENEWABLE ENERGY INDUSTRY ENVIRONMENTAL IMPACTS** By Andrew Chapman - 15/11/03 from Country Guardian website http://www.countryguardian.net/Index2.htm

[32] Dollar Wind Farm Planning Permit Application Report, Supplement A. October 2004.

There are extensive lists of bird kills generated by wind turbines overseas. As these birds are both different species and the same species but may exhibiting different behaviour (as for Latham's Snipe above) there needs to be specific Australian research before any group of species is not seen as threatened. This is especially given there is very little published monitoring data for Australian wind turbine bird strike. However a more generic approach to vulnerability of species groups, as presented below, is more instructive and provides a framework on which Australian bird researchers could build.

From "WIND TURBINE INTERACTIONS WITH BIRDS AND BATS: A SUMMARY OF RESEARCH RESULTS AND REMAINING QUESTIONS"[33]

'…Either behavior would increase risk of collisions with wind turbines placed on ridge tops. Other scientists believe that most nocturnal migrating birds migrate at elevations above today's typical turbine heights and that most topographical relief has little influence on migration behavior. Airport and weather radar studies support the latter hypothesis. Recent studies using horizontal and vertical marine radar units in tandem, which are suited to making direct measurements of flight heights up to several thousand meters,…'

From pp 5-6 CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS[34]

On the basis of the literature review, species' conservation status and more than 10 years collective experience by the BirdLife partners, the following species groups and example species are considered to be particularly sensitive, or potentially so, to wind farms (disturbance displacement, barriers to movement, collision, habitat loss or damage), although in many cases there is a lack of impact studies to date. Thus, they are likely to be focal species for detailed environmental assessment and research. This list is indicative rather than comprehensive. There are many species for which there is either no information, or no conclusive information, to date. Focal species are likely to be site and issue specific and may change in the light of further research or change in conservation status.

Species group (eg species)	**Disturbance displacement**	**Barrier to movement**	**Collision**	**Direct Habitat Loss/replacement**

[33] ***National Wind Coordinating Committee November 2004*** **WIND TURBINE INTERACTIONS WITH BIRDS AND BATS: A SUMMARY OF RESEARCH RESULTS AND REMAINING QUESTIONS** ***Fact Sheet: Second Edition pp7.***

[34] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS Standing Committee 23rd meeting Strasbourg, 1-4 December 2003 Windfarms and Birds :An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues *Report written by BirdLife International on behalf of the Bern Convention RHW Langston & JD Pullan, RSPB/BirdLife in the UK contact: Rowena.Langston@rspb.org.uk September 2003 Secretariat Memorandum prepared by the Directorate of Culture and of Cultural and Natural Heritage*

***Gaviidae,* divers (redthroated diver *Gavia stellata*)**	**x**	**x**	**x**	
***Podicipedidae* grebes**	**x**			
***Sulidae* gannets & boobies**			**x**	
***Phalacrocoracidae* (shag *Phalacrocorax aristotelis*)**				
***Ciconiiformes* herons & storks**			**x**	
***Anserini,* swans (whooper swan *Cygnus cygnus*) and geese (pink-footed goose *Anser brachyrhynchus,* European white-fronted goose *A. albifrons,* barnacle goose *Branta leucopsis,* brent goose *B. bernicla*)**	**x**		**x**	
***Anatinae,* ducks (eider *Somateria mollissima,* long-tailed duck *Clangula hyemelis,* common scoter *Melanitta nigra*)**	**x**	**x**	**x**	**x**
***Accipitridae* raptors (red kite *Milvus milvus,* whitetailed sea eagle *Haliaeetus albicilla,* lammergeier *Gypaetus barbatus,* griffon vulture *Gyps fulvus,* imperial eagle *Aquila heliaca,* golden eagle *A. chrysaetos,* Bonelli's eagle**	**x**		**x**	
***Charadriiformes* waders (European golden plover *Pluvialis apricaria,* blacktailed godwit *Limosa limosa,* Eurasian curlew *Numenius arquata*)**	**x**	**x**		
***Sternidae* terns**			**x**	
Species group (eg species)	**Disturbance displacement**	**Barrier to movement**	**Collision**	**Direct Habitat Loss/replacement**
***Alcidae* alcids/auks (guillemot *Uria aalge*)**	**x**		**x**	**x**

***Strigiformes* owls**			**x**	
***Tetraonidae* (black grouse *Tetrao tetrix*, capercaillie *T. urogallus*)**	**x**		**x**	**x**
***Gruidae* cranes v**	**x**	**x**	**x**	
***Otididae* bustards v**	**x**		**x**	**x**
***Passeriformes* especially nocturnal migrants**			**x**	

6.0 Threat Abatement Plan

6.1 Siting

The 'Siting' of Wind Turbine Facilities is the principle method of reducing their threat to bird and bat species. A systematic approach to developing exclusion zones for wind turbine construction in relation to vulnerable, endangered, critically endangered and migratory species of birds and bats is required to reduce the threat to these species.

The need to identify sites that are not suitable for wind farms is widely recognised, especially by the 'Wind Industry'. In a recently published paper on siting of wind turbines from industry it states in the conclusion;

"The potential impact of wind farm development on all flora and fauna must be minimised during construction and operation. No wind farm should be sited in the direct path of bird migration zones. The endangered Orange Bellied Parrot, the East Asian–Australasian Flyway and other such migratory patterns must be held in higher regard than the generation of wind energy..."[35]

Comprehensive cost effective monitoring combined with a capacity to stop or feather turbines when they pose a threat to these species will also ensure that the threat is reduced or eliminated from existing wind turbines.

In regard to bats in the Australasian Bat Conservation Society's Brochure on Wind Turbines and Bats it states;

" The selection of turbine sites is the most important stage for minimising harmful impacts to bats. Bat-friendly site selection involves the following steps:
. - consultation with bat specialists during the prospecting stage, and
. - thoroughly conducted EIS/EES surveys."[36]

The Humane Society of the United States (HSUS),[37] states in its submission to the Bureau of Land Management (USA):

" Siting/ zoning

We recognize that the siting of individual wind farms can be effective in preventing some adverse effects; however, we believe that this process can be streamlined by establishing zoning that would identify areas that are most likely the best and worst

[35] Siting Guide for Wind Farms in Australia Coy, Jay; Sadaka, Nabeel and Lamborn, Julia* Swinburne University of Technology Conclusion pp13 (2004?) http://www.nzsses.org.nz/Conference/Session5/09%20Coy%20Sadaka%20Lamborn.pdf

[36] Australasian Bat Conservation Society Website http://abs.ausbats.org.au

[37] The Humane Society of the United States (HSUS) in response to the Bureau of Land Management's (BLM) notice in the Federal Register on October 17, 2003 announcing the opportunity to comment on the scope of the Programmatic Environmental Impact Statement (EIS) for the development of wind energy resources on BLM-managed lands

suited for wind farms. To inform this process, we suggest BLM create an overlay of the regional information currently available about:

- Geographic and geophysical factors influencing the viability of renewable energy projects
- Wildlife distribution (including threatened and endangered species) and important supporting habitat for birds and bats
- Migratory pathways
- Areas of Critical Environmental Concern, Wilderness Areas, Wilderness Study Areas, and National Conservation Areas
- Abutting wildlife refuges, wildlife management areas, state and national parks, and other protected areas.

Audubon Society of Washington has recommended that the State of Washington complete a wind farm site ranking program, "ranking the sites in part on their potential to avoid harm to birds and bird habitats." This system would "guide the development of facilities toward locations with existing environmental damage or degraded habitat."

6.2 Japan Australia Migratory Bird Agreement

The protection of species listed in this agreement and other species listed as endangered in both countries is mandatory under this agreement with no capacity to issue licences to kill species as listed and included.

The response to this agreement should be central to determining both the siting of new wind turbine facilities and the management of existing turbines in high risk zones. There is also the need for exclusion zones around areas where there is a high risk of encountering these species.

There is a further need for the protocols to feather turbine blades during periods of risk with interaction with listed and migratory species, i.e. after carcasses of these species have been recovered during monitoring.

6.3 Turbine Turbulence Research

It is vital that the turbulence generated by wind turbines be modelled and its potential threat to bird and bat species be identified for a variety of turbine types and wind speed variables. Any turbulence zones identified as a threat need to be taken into account when modelling interaction between birds, bats and turbines.

6.4 Delineating Exclusion Areas

The creation of exclusion zones for the siting of wind turbines will greatly reduce the risk they pose to threatened species and to species that could become threatened as a result of the operation of poorly sited wind turbines.

6.4.1 High Risk Zones

1. Approaches to wetlands, Bays, Inlets and the Coastline
2. Ridgelines used for navigation by migratory species
3. Locations as recorded for migratory, vulnerable, endangered and critically endangered bird and bat species.

4. Ridgelines and other geographic features used by multiple birds of prey as soaring areas.
5. Hill Topping areas for insects.

'Hill Topping' is the well documented behaviour of a wide range of insects, especially butterflies and beetles and predatory insect species of congregating on prominent hill tops to mate. Hill topping areas are likely to attract large numbers of birds and bats.

6.4.2 Risk Response – The creation of Exclusion Zones Guidelines for Wind Turbines that are not to be sited, using the precautionary principle.

For most of these areas a smaller exclusion zone would work in most years, but infrequent adverse weather conditions will see birds and bats travelling a greater distance at turbine heights approaching and leaving roosting, feeding and breeding grounds etc. These zones should be:

- **Not within 20km of the Coast, Bays, Inlets or Wetlands used by Migratory species or known migratory routes. Turbines already constructed be subject to regular monitoring by thermal imaging or as on request by state agency,**

- **Not within 20km of recorded presence of migratory, endangered or critically endangered species.**

- **Not within 20km of known migratory routes**

- **Not along ridgelines determined used by multiple species of raptors for rising to hunt**

- **Not on known insect 'hill topping' areas**

6.5 Pre construction monitoring - Standardised protocols for Site Evaluation of sites outside High Risk Zones.

With only limited site evaluation and monitoring undertaken to date there has already been significant difference between methodologies used to evaluate various sites. Evaluation of nocturnal use of turbine strike zones by birds and bats has only attempted at Woolnorth to date - as far as can be determined by published literature.

6.5.1 Thermal Imaging

Thermal Imaging for at least 14 months (overlapping 2 months for comparison) is a key potentially cost effective tool for site evaluation for gauging potential interaction with birds and bats. Such monitoring should always precede the establishment of windfarms and sites for individual turbines.

Thermal imaging provides verifiable data and technical solution to both site selection and determining the absence or presence of birds and bats regarding both the site and the area blades will turn in (including high risk turbulence zone) with increased species identification possible over time as data bases are built.

6.6 Post Construction Monitoring of Approved Wind Farms

There is a need for cost effective, practical and thorough analysis for sites on which wind turbines are potentially to be located for their potential interaction with bird and bat species.

- **Post Construction Monitoring Protocols Guaranteed by Permits from Commonwealth or equivalent from the States** making it a condition of having wind turbines sited on private properties that it is owners responsibility to not remove carcasses and provide access for periodic thermal imaging and turbine strike carcase collection and other monitoring as required. Companies may agree to reduce lease payments where property owners breach these conditions.

- **Post Construction Monitoring** by carcase collection is best standardised with periodic intensive collection during the summer and migratory seasons and randomised daily collecting of weekly periods during the year from a selection of turbines at each site

- **Capacity for the Status of Wind Turbines to become High Risk** in reaction to species recovered should they be endangered, migratory or critically endangered species of birds and bats with the development of turbine blade feathering protocols.

6.7 Standardised Protocols for Monitoring and Managing Existing Turbines in High Risk Area - Site Monitoring

By standardising protocols for the monitoring and management of existing wind turbines in 'High Risk Areas' the threat wind turbines pose to threatened species and to species that could become threatened as a result of their interaction with wind turbines could be greatly reduced.

6.7.1 Thermal Imaging

Thermal imaging provides a cost effective verifiable technical solution to both site selection and site monitoring for absence and presence of birds and bats with some speciation possible. Data builds up data log of night use to identify migratory routes of protected species not possible with current monitoring. It also provides data on the likely distance that bats and birds struck by turbines will fall.

Using thermal imaging, from: [38] **Wind turbines in West Virginia and Pennsylvania: an interim report**

"…KEY FINDINGS – THERMAL IMAGING

• Bat activity was highly variable across nights sampled.
• Individual bats were often observed flying through the rotor swept area of sampled turbines.
• Bats appeared to investigate both moving and non-moving blades.
• Occasionally, collisions between bats and turbine blades were observed.
• Most bat activity was observed during the first few hours after sunset.

[38] **Wind turbines in West Virginia and Pennsylvania: an interim report** Edward B. Arnett, Bat Conservation International, Austin, TX 78716 Wallace P. Erickson, Western Ecosystems Technology, Cheyenne, WY 82001 Jessica Kerns, University of Maryland, Center for Environmental Science – Appalachian Laboratory, Frostburg, MD 21532 Jason Horn, Boston University, Department of Biology, Boston, MA 02215

• The ratio of avoidance behavior to contact with blades is high…"

6.7.2 Use of Dogs for Carcase Detection and Collection

Dogs have a far more acute sense of smell than humans and can be trained to either retrieve or point toward carcasses of bats and birds. The use of dogs greatly increases the efficiency carcase recovery and will go some way toward reducing predation while such recovery is going on.

6.7.3 Predator Control

Predator control in vital to accurate estimation of bird and bat kills from existing turbines. The wind industry has set a high standard with the erection of predator proof fencing at Woolnorth in Tasmania that should be adopted industry wide with attention given to extending the distance of predator proof fencing based on thermal imaging, the height of the turbines and collection experience from other sites.

Excluding terrestrial predators, however, does not eliminate predation from birds during the day and this affect will have to be modelled through the sacrifice of a percentage of carcasses of the range of species collected while still fresh to determine daytime predator removal rates.

6.7.4 Frequency, Timing and Distance for Collections of Carcasses

The contracting of dog handlers for carcases collection, storage and labelling will enable daily and/or nightly collections to be made around randomly selected (functional) turbines daily during high risk period and twice weekly, as developed for Woolnorth, for the remaining part of the year. It is likely not adequate to avoid an entire season as was done at Woolnorth between 2002 and 2003 when there were no collections over high summer.

6.8 Turbine Shut Downs

Capacity to 'feather' existing turbines when there is a high risk of killing a listed species, i.e. during migration (see Box 2). For already approved and constructed turbines, with the costs borne by company that takes power under MRET (and passed onto consumers) as these turbines have been approved and bird interaction is not the responsibility of the company that gained the approval for their construction. Cost estimated from metered output of nearest turbine for the period of feathering.

Companies may chose use 'turbine feathering events' for good publicity for even 'greener power' further offsetting any costs, giving companies a competitive edge for protecting birds and bats, potentially increasing sales.

Box 2 In April of 2005 on Thursday night the first of a very large recruitment of Short-tailed shearwaters, thousands of young birds, and hundreds ended up dead and dying on the San Remo Bridge connecting Phillip Island to the mainland and on a small bridge to the Penguin Reserve. This had happened before and there was another four of five nights of this migration remaining. The Staff of the Phillip Island Penguin Parade the Road Traffic Authority who controlled the lighting, TXU, the Energy Company, the police and local shark fishermen worked together to get the lights turned off for the next few nights in what will now be an annual event.

With reliable, verifiable monitoring turbines already within 'High Risk Zones" and can be stopped at periods of bird migration and or mortality of listed species.

6.9 Other Hazard Management - Lights
The use of red aircraft navigation lights should be avoided on all wind turbines facilities as they are a known cause of bird strike for nocturnal migrant species.

6.10 Data Sharing on Carcase Collection
The Establishment of a National Data Base is vital for this purpose and the Federal Department of the Environment Threatened Species Unit appears to be only logical and practical repository for this information much of which is currently held as commercial in confidence data by companies involved in wind farm development and monitoring. This data should then be available to researchers - ideally all this information should be publicly available.

Nominator Information
The following information is subject to the provision of the Privacy Act and will not be divulged to third parties if advice regarding the nomination is sought from such parties.
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Declaration (Please read carefully and sign the declaration)

I declare that the information in this nomination and its attachments is true and correct to the best of my knowledge.

Signed Craig Falconer_____

DATE__8_/_7__/_05__