Prepared for
Taurus Energy

# Proposed development of a wind farm at Conroys Gap, New South Wales

# *Environmental Assessment*

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# 1. EXECUTIVE SUMMARY

## Introduction

This Environmental Assessment has been prepared by **ngh**environmental for Taurus Energy Pty Ltd to assess the potential environmental impacts associated with the development of a wind farm at Conroys Gap, on the Southern Tablelands of New South Wales.

The Environmental Assessment (EA) describes the project, defines relevant planning requirements, and identifies and assesses the impacts of the proposal on the environmental, cultural and social values of the proposal area. Measures and procedures to avoid and reduce environmental impacts are also identified. The EA is intended to meet the assessment requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* and the Major Projects State Environmental Planning Policy 2005.

The proposal incorporates a range of options regarding turbine placement, size and type. Where the nature or extent of impacts are specific to a particular site or layout, these are identified separately in the assessment.

The EA focuses on key 'moderate to high priority' issues, which have the potential to produce significant environmental or human impacts. These issues were identified during reviews of other wind farms, consultations with experts, government agencies and the community, and following field investigations. Lower priority issues are those which are manageable using best practice and adaptive management. These issues are also reviewed in the EA and mitigation measures are identified.

A series of specialist studies were undertaken to assess the proposal, covering visual impacts, noise impacts, land value impacts, traffic impacts, archaeology and biodiversity. The findings of these studies have been incorporated in the EA, and the study reports are included as Attachments.

## About the proposal

### PROJECT DESCRIPTION

The Conroys Gap wind farm proposal would involve the construction, operation and decommissioning of:

- up to 15 wind turbines, each with three blades up to 46 metres long mounted on a tubular steel tower up to 80 metres high;
- upgraded existing and new access roads (approximately 8.5 kilometres of new track);
- underground electrical cabling between wind turbines (generally under access tracks);
- aerial powerline linking the wind turbines to the substation and Transgrid 132kV transmission system (up to 4 kilometres of powerline);
- a substation, an onsite control room and equipment storage facilities.

The wind farm would have a maximum capacity of up to 30 megawatts, and would operate for up to 30 years. Any renovation or replacement at the end of this period would be subject to further assessment and planning approval.

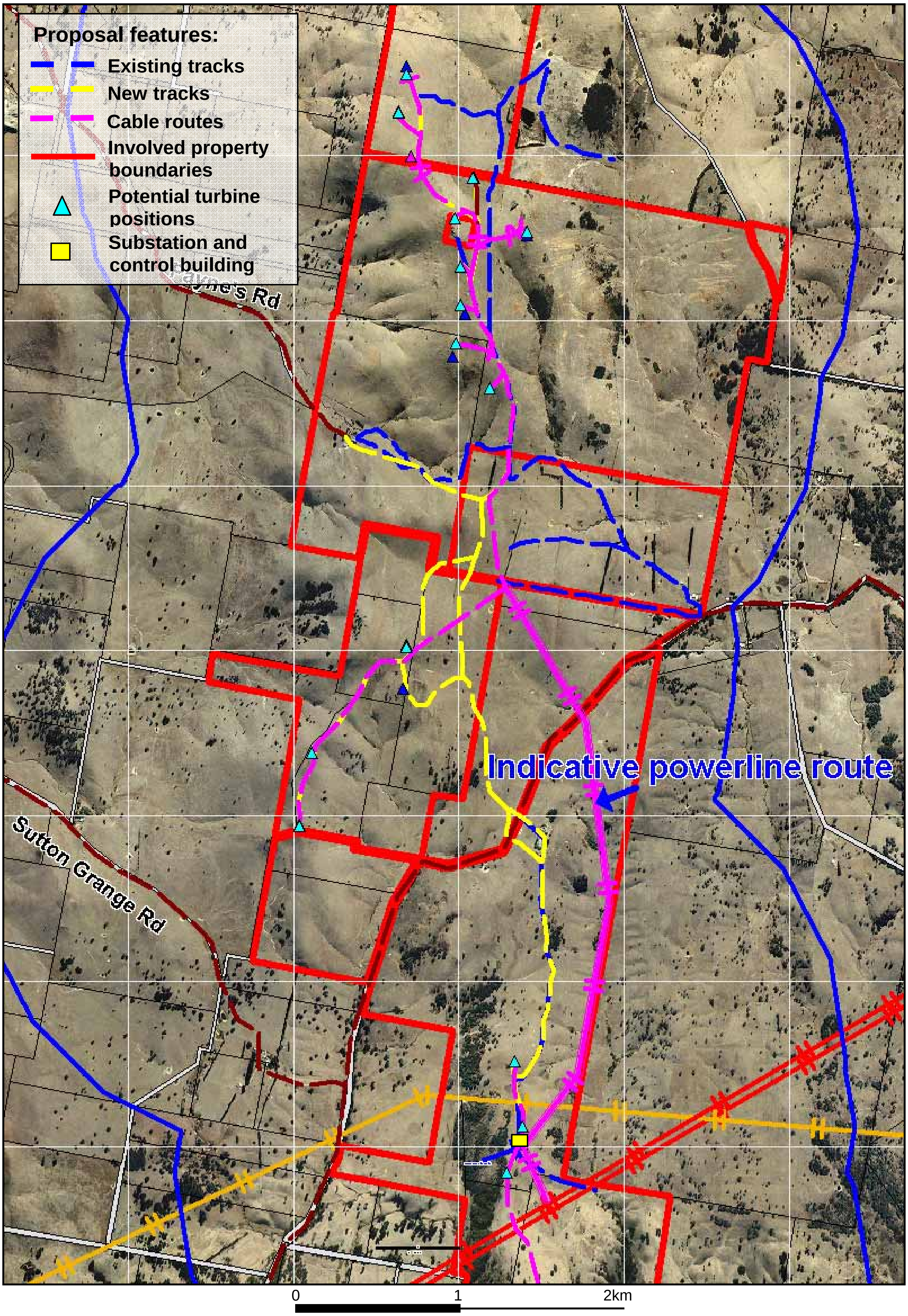



**Figure 1.1 Layout of proposed wind farm infrastructure (consolidated)**

## JUSTIFICATION AND ALTERNATIVES

### Reduced reliance on coal-fired power generation

#### Climate change

The project would reduce the current dependency of the community on fossil fuels for electricity generation, and so reduce the impacts of climate change. The stationary energy sector accounted for 48 per cent of total greenhouse gas emissions in 2002, and emissions from electricity generation make up nearly 70 per cent of stationary energy emissions (AGO 2005). In Australia, 33 percent of total greenhouse gas emissions are produced during the generation of electricity. Greenhouse gas emissions from electricity generation in New South Wales grew by 44% between 1990 and 2002 (NSW Government 2004).

Coal-fired power generators supply around 90% of New South Wales' electricity. Each megawatt-hour of electricity generated by a renewable energy generator (such as a wind farm) will reduce coal fired generation by approximately 1 megawatt-hour. This may not mean that existing coal fired power stations are shut down, but it does mean that less coal is burnt in these power stations and therefore greenhouse gas emissions are reduced. For each megawatt-hour of electricity generated by the proposed wind farm, the emission of at least 1,000 kilograms of greenhouse gases would be avoided.

The proposed Conroys Gap wind farm would reduce greenhouse gas emissions by 90,000 to 99,000 tonnes of CO2 per annum, or a cumulative effect of 2.70 to 2.97 million tonnes of $CO_2$ over the life of the project. This is the equivalent reduction in greenhouse gas emissions of taking 18,000 to 19,800 typical cars off the road for 30 years.

#### Other environmental benefits

The reduced reliance on coal-fired power generation would also provide other environmental benefits, including reductions in cooling water use and reductions in air pollution. Region-based wind farms also reduce losses from long distance power transmission, reducing the overall cost of power supply and further reducing greenhouse gas emissions and other environmental costs.

### Growing electricity demand

Growth in electricity demand will soon exceed current electricity supply during peak times. According to Transgrid's Annual Planning Statement 2005, additional generation is likely to be required by 2008 to provide for New South Wales' electricity supply needs. New electricity generators are required to meet this demand and to avoid power outages and blackouts.

Domestic electricity consumption in NSW was 7,399 kWh on average in 1999, growing from 6,983 kWh on average in 1990 (DEUS 2000). Continuing this growth rate, we can estimate a figure of approximately 7,800 kWh on average for 2006. The production of electricity from the Conroys Gap Wind Farm of 90,000 to 99,000 MWh per annum would equate (on an annual average basis) to the annual electricity consumption of approximately 11,500 to 12,700 average NSW homes.

### Wind power reliability and consistency

Wind power provides reliable and dependable electricity production. While on a day to day basis wind power output fluctuates with wind speed, on an annual basis output variation is small, and generally within 15-20% of long term average. The hourly fluctuations in wind speed, and therefore wind power output, are not significant in relation to the existing fluctuation of loads within the electricity system.

### Energy decentralisation and diversification

Wind farms offer a decentralisation and diversification of the existing electricity supply infrastructure which helps to mitigate risks of power station failures, of acts of terrorism and price risks from fossil fuels which are tied strongly to international energy prices.

### Local community benefits

#### Community fund

The proponent intends to contribute $25,000 per annum during the operation period to a Community Fund to finance community projects such as local Landcare and environmental projects, sporting and other facilities, development of recreation opportunities, road and telecommunications improvements, Rural Fire Service support, heritage management and academic scholarships. The structure of the fund is to be determined, and could involve management by or joint management with the local Council and/or local community representatives.

#### Jobs and investment

Over the life of the wind farm, the proposal would inject over $10 million into the local economy from the wind farm construction and operations. This economic injection will come from:

- use of local contractors (where possible) in construction of the wind farm;
- use of local services (food and accommodation, fuel, general stores etc) during the construction period;
- ongoing use of these local services during the operation of the wind farm;
- lease payments to local landholders;
- provision of ongoing local jobs in operating and maintaining the wind farm.

It is estimated that the project would provide approximately 50 jobs during construction and 5 jobs during the operational phase of the wind farm. The wind farm would also provide an opportunity to increase local tourism.

### Alternatives

The major alternatives relating to the proposal concern wind farm location, location of turbines and other infrastructure at the proposal site, transmission line connection point, turbine number, size and type, and site access route. These elements of the proposal have been selected to minimise environmental impact and optimise the generating efficiency of the wind farm.

## CONSULTATION PROCESS

Taurus Energy has informed and consulted with the local community and other stakeholders during the planning and development of the Conroys Gap proposal. A community consultation plan has been implemented concurrently with the specialist studies. Two Open House sessions have been held at Yass, featuring informal communications between the public and the proponent/assessment personnel, presentations on key issues and specialist studies, summary handout material and information displays. The Open House Sessions yielded important information on issues of concern among local residents and the wider community. Other methods of community consultation have included community newsletters, media statements, newspaper advertisements and personal meetings.

A Planning Focus Meeting was held at Conroys Gap on 11 November 2005, involving representatives of State government agencies and Yass Valley Council. This meeting assisted with the issues identification, scoping and prioritisation process. Further meetings were held with Country Energy and Yass Valley Council. Other agencies were contacted via phone, email or mail.

After the EA has been accepted by the Director-General, it would be placed on public exhibition for at least 30 days, to allow submissions from the community, local government and state agencies. Following the consultation period, the Director-General may require the proponent to respond to the comments, revise the proposal or revise the Statement of Commitments.

### ENVIRONMENTAL MANAGEMENT

Proponents of major projects are required to provide a Statement of Commitments on how they propose to manage the project to minimise and avoid impacts. A range of impact avoidance and mitigation measures have been developed for the design, construction, operation and decommissioning phases of the project. These measures would be implemented by the proponent as part of a Project Environmental Management Plan (PEMP). An outline of the PEMP is provided at Attachment 4.

An adaptive approach has been adopted in the design and planning phase of the project, drawing on specialist assessment results and the consultation process to refine and improve the proposal.

## Planning context

Part 3A of the *Environmental Planning and Assessment Act 1979* integrates the assessment and approval regime for all Major Projects that need the approval of the Minister for Planning, previously dealt with by Parts 4 and 5 of the Act. Under the Major Projects State Environmental Planning Policy 2005, the proposed Conroys Gap wind farm would be considered a Major Project for the purposes of Part 3A. The proposal has followed the Part 3A process, involving the submission of a Project Application, the convening of a Planning Focus Meeting of state and local government representatives and the preparation of this EA, based on requirements issued by the Director-General of the Department of Planning.

The EA includes Assessments of Significance of the impacts on threatened species, threatened communities and other matters, as required under State and Commonwealth legislation. The project was referred to the Commonwealth Minister for the Environment for consideration under the EPBC Act. The Minister responded on 23 May 2006, indicating that the proposal is not a controlled action and assessment and approval under the EPBC Act would not be required.

The proposed wind farm would be permissable with development consent under the Yass Valley Council Local Environmental Plan. In addition to development approval the proposal would require approval from Yass Valley Council to undertake road improvement works on Paynes Road under section 138 of the *Roads Act 1993* and a determination from the Civil Aviation Safety Authority (CASA) under the Civil Aviation Safety Regulations relating to aviation safety issues.

## Site location and description

The Conroys Gap site is located on private farmland, approximately 17 kilometres west of Yass. The site stretches for around 7 kilometres in a north-south orientation and covers four properties, north and south of Black Range Road.

### NATURAL VALUES

The topography at Conroys Gap is characterised by steep-sided, rounded ridgelines. There are no major watercourses near the subject site and few permanent streams.

Within the Southern Tablelands region, flats and low hills typically carry grassy woodland habitats and higher hills and ranges support dry shrubby forests (NPWS 2005). Lowland grasslands and woodlands have been heavily depleted by clearing for agriculture and are poorly represented in conservation reserves (Fallding 2002).

The subject site generally carries mixed native-exotic pasture, with small degraded and fragmented areas of remnant forest and woodland.

Remnant native vegetation surveyed at the site is derived from at least three vegetation types, including Box-Gum Woodland, listed as an Endangered Ecological Community under State and Commonwealth legislation.

The site contains potential habitat for four threatened plant species, three of which are associated with woodlands and grasslands and one with dry shrub forest. Only one threatened plant species was recorded within the survey area; the Yass Daisy.

Several fauna habitats are present in the wider study area, including modified wetlands and watercourses, secondary grassland and dry forest remnants on ridgetops and woodland remnants in valleys. Parts of the subject site have at least moderate potential to provide habitat for threatened fauna species, including two microbat species, four birds and one invertebrate.

No threatened fauna species were recorded at the subject site during the survey. The fauna survey results suggest a generally low reptile, bird and mammal diversity and abundance. Bird fauna recorded at the ridgetop turbine sites was restricted to a small number of species, most commonly Magpies, Richards Pipits and Wedge-tailed Eagles. Waterbirds such as the Wood Duck and White Ibis were recorded at dams and watercourses.

#### SOCIAL AND ECONOMIC VALUES

The site covers four properties, used for grazing cattle and sheep, and residential use. The region has a long history of agriculture, particularly wool production, with diversification now occurring into the horticultural industries. Along with a strong agricultural base, the region benefits economically from the proximity to Canberra, the Hume Highway transport corridor, and rail connections to the capitals.

The Conroys Gap area is largely a cultural landscape due to modifications resulting from 180 years or so of agriculture. The landscape has an iconic rural character but this landscape is widespread in the region. Five landscape character types were identified in the region; country towns, transport corridors, waterways, agricultural land, and ranges and hills.

The main users of the area are graziers/primary producers, rural residential land owners, towns' people, arterial road users and recreational users. Each group varies in their sensitivity to the proposed wind farm based on a number of factors including their attachment and relationship to the landscape of the area.

Tourism and recreation opportunities at the site include horse-riding and the Hume and Hovell Walking Track, which runs through the site along Black Range Road. Community infrastructure in the study area includes the road system, powerlines and telecommunications facilities.

Local residents comprise traditional farmers and hobby farm or 'lifestyle' settlers, some of whom may commute to work in Canberra and Yass. The land surrounding the subject site is zoned 1(a) Rural Agriculture, although there is potential for further large lot residential development from sub-division and concessional lot applications, particularly to the east of the site.

# Environmental assessment

#### FLORA AND ECOLOGICAL COMMUNITIES

The principal impacts to flora values would occur during the construction phase. The works would permanently displace approximately 4.3 hectares of secondary grassland derived from dry shrub forest on the ridgetop turbine and substation sites, and a smaller area of exotic pasture under the proposed powerline and new access track connecting the northern, central and southern turbine clusters. Around 2 hectares of native secondary grassland would be disturbed and reinstated following the construction of the turbines and rehabilitation of areas used for construction facilities. The siting of the turbines and the routing of the powerline through cleared parts of the 'Ferndale' property would largely avoid the need to clear or trim native trees.

Vegetation surrounding the development footprint would be affected by vehicle access and parking, materials laydown and spoil deposition and retrieval. Potential peripheral impacts may include soil compaction, soil erosion and sedimentation and the introduction and spread of weeds.

Neither the direct or peripheral impacts are likely to affect species or communities of conservation significance. The impacts of the proposal on flora values would not be significant.

#### FAUNA AND FAUNA HABITATS

The key operational impacts of the proposal for fauna relate to the operation of the wind turbines. The turbines may affect fauna through bladestrike or disrupting the availability or use of habitat. The potential bladeswept area of the turbines would range from 34 to 126 metres above the ground. The impacts of the wind farm would be most acutely felt by bird and microchiropteran bat species utilising aerial habitat within this bladeswept zone.

### Birds

Experiences at other Australian wind farms and a recent assessment of the cumulative wind farm collision risk for threatened and migratory birds commissioned by the Commonwealth Government (Biosis Research 2006) strongly suggest that bladestrike impacts would not be significant.

All bird species recorded at the site and most likely to be affected by the proposal are widespread and not considered threatened. At the time of survey, there were no unusual or significant congregations of birds at the site.

Based on experiences elsewhere in Australia, local raptor species and night-flying waterbirds are the species at most risk of bladestrike. Six raptor species were considered to be at moderate or moderate-high risk at the individual level; Wedge-tailed Eagle, Little Eagle, Australian Kestrel, Brown Falcon, Australian Hobby and the Spotted Harrier.

Two species were assessed to be at moderate or moderate-high risk at the population impact level; Wedge-tailed Eagle and the Little Eagle. For these species, the indirect impacts of the proposed wind farm on local hunting habitat have the potential to affect the reproductive success of local breeding pairs which may adversely affect the health of populations at the local and possibly region scales. These species are frequently recorded close to human development, and are likely to be able to habituate to the proposed wind farm over time. While some risk exists to individual birds at the site, blade collisions are expected to be rare.

Small ephemeral wetland habitats are present in watercourses, paddock dams and wet pastures in the study area and surrounding farmland. Small numbers of waterbirds were recorded at the site, in dams and wet drainage lines. Waterbird movements across the turbine ridges are expected to be infrequent, and the risks of bladestrike or habitat avoidance for waterbirds are likely to be low.

Most woodland birds in the study area are likely to use habitat with at least some tree cover. Many threatened woodland species are poor dispersers and are unlikely to venture far from remnant woodland patches. The subject site is one of the most extensively cleared areas in the district. The principal flight paths for woodland species are likely to follow valleys and lowland areas carrying remnant woodland and water sources. Birds moving at tree canopy height through neighbouring lowland woodland remnants are unlikely to be affected by the ridgetop wind turbines.

For most species, the proposal area is unlikely to provide limiting, uncommon or significant habitat. In view of the substantial buffer distances involved, the wind turbines are not expected to alter habitat utilisation rates on neighbouring farmland, remnant woodland and wetlands.

Habitat impact risks to the Wedge-tailed Eagle at the site may be higher because this species has a slow reproductive rate, has a large breeding territory and is sparsely distributed in the landscape, and because of the possible importance of the high ridge habitat as an updraft hunting resource and food supply (rabbits). Further survey and monitoring is recommended, recording habitat use and breeding success over an extended period, coupled with an adaptive approach to wind farm management.

The Conroys Gap proposal is not considered likely to significantly affect bird species at the population level.

**Bats**

Surveys at the Conroys Gap site detected three micro bat species, including the low-flying Goulds Wattled Bat (which would be at low risk of turbine collision), and the high-flying White-striped Mastiff Bat (which may be at considerably higher risk). Based on known behaviour and mortalities at other wind farm sites, some level of White-striped Mastiff Bat mortality caused by turbine collision is possible at the site.

The relatively low level of recorded mortalities at existing wind farms in south-east Australia, the absence of recorded significant species mortalities, the widespread nature of similar foraging habitat and the absence of woodland and forest habitat at the subject site combine to suggest that the proposal would not be likely to significantly affect local populations of microbats. The uncertainty regarding specific responses at the Conroys Gap site would be managed using monitoring and adaptive management.

**Threatened fauna species**

An evaluation of threatened species potential based on known habitat requirements, habitat present at the subject site and distribution information indicates that parts of the survey area have at least moderate potential to provide habitat for nine threatened fauna species:

| | |
|---|---|
| **Mammals** | **Birds** |
| Little Pied Bat | Barking Owl |
| Eastern Bent-wing Bat | Superb Parrot |
| **Invertebrates** | Swift Parrot |
| Golden Sun Moth | Gang-gang Cockatoo |
| | Diamond Firetail |
| | Regent Honeyeater. |

The Assessments of Significance conclude that the proposal is not likely to have a significant impact on threatened species or populations listed under the TSC Act or the EPBC Act.

**Monitoring and adaptive management**

The operational component of the PEMP would contain specific monitoring provisions for noise and fauna impacts, including a three-tiered monitoring program for bird and bat mortalities and habitat utilisation impacts. Monitoring methods and data standards for dead bird searches, indirect disturbance impact assessment and habitat avoidance studies would be based on protocols in the Interim Standards for Assessing the Risks to Birds from Wind Farms in Australia (Brett Lane and Associates 2005).

The PEMP would employ adaptive management in response to monitoring results and other inputs. The wind farm infrastructure and design allows a degree of flexibility to address any unforeseen impacts on biodiversity, social or other values. Mortality and habitat avoidance thresholds would be developed and used to trigger specific management responses to mitigate impacts. Specific management responses would be determined by the nature and extent of impacts.

#### LAND VALUES

Studies conducted in Australia and overseas have failed to show negative impacts on land and property values or development potential due to wind farm development. In a study into the effects of the Crookwell I wind farm on land values commissioned by Taurus Energy Pty Ltd, Henderson and Horning Property Consultants found the market evidence suggests that having a view of the wind turbines did not have an effect on land value. For the involved properties, the revenue provided by the wind farm may offset the economic attraction of sub-division and help slow the transition to small-lot rural residential development. Wind farms would not affect the underlying agricultural productive capacity of land.

The Yass district is well positioned with respect to major road and rail corridors and Canberra. The Shire is maintaining a high 5.5% population growth rate, with Sydney and Canberra residents relocating to the region for the rural lifestyle, access to high standard educational institutions, a strong commercial base and proximity to Canberra (CRDB 2005). The proximity to Lake Burrinjuck, a popular tourism and recreation destination would also add to the attractiveness of real estate in the Conroys Gap area.

Given the rising demand for affordable rural residential land in the Yass district, the wind farm is not expected to adversely affect the development potential of properties in the vicinity of the subject site. In any case, the proposal is highly reversible, with the subject site restored to effectively pre-works condition following decommissioning.

#### COMMUNITY INFRASTRUCTURE

The Hume Highway and Paynes Road would be used by construction traffic. In addition, on-farm tracks would be upgraded and new tracks constructed to provide access for construction and operational requirements. Public roads used during the construction phase would be upgraded as required and fully restored to pre-works condition or better following construction. Permanent access tracks would be maintained to a standard of stability, drainage and driving surface appropriate to farming and wind farm maintenance use following the construction period.

#### VISUAL IMPACTS

The Visual Impact Assessment (Scenic Landscape Architecture 2006, refer Attachment 8) concluded that the local landscape is substantially modified by farming practices and contains many built elements, and the wind farm would not create an unacceptable contrast to the existing landscape character. Wind turbines can be seen up to 20 kilometres away in clear weather but are difficult to perceive (Planisphere 2005). At 14 kilometres away, a single turbine is insignificant although a collection of turbines becomes more significant depending on the number of towers and the horizontal area they occupy.

The wind farm would be visible from a number of roads and large working properties and rural residential homes around the site. The highest visual impact area would be on the land along Black Range Road, Graces Flat Road and closer areas of the road to the Burrinjuck Dam. There will be views of the wind farm from the towns of Bowning and limited views from Yass, Bookham and Goondah. From other locations around the site, the wind farm will not represent a significant visual impact.

From the majority of view points, the visual impact is moderate to low, which is considered to represent an acceptable change in the landscape. The impacts from the east of the site have now been substantially be ameliorated by the removal of turbines in the current proposal from the eastern ridge. The difference in visual impact between the various layout options is marginal.

There are two existing houses and one proposed house that, without mitigation, would be impacted by shadow flicker; 'Linbrook' at the end of the Paynes Road (mornings), 'Grenville' along Sutton Grange Road (mornings) and proposed house along Black Range Road (evenings). The paint to be used on the blades and tower of the turbines will help to minimise blade glint.

The proponent would implement a number of measures to mitigate the visual impacts of the proposal as required, including automated shutdown of particular turbines during mornings/evenings to prevent shadow flicker, the protection of native vegetation, landscaping around dwellings and the substation, suitable tower and substation colour, and appropriate substation and access route siting.

**OPERATIONAL NOISE IMPACTS**

The noise levels generated by an operational wind farm are particular to turbine design, local topography and weather conditions. A specialist noise impact assessment was undertaken for the Conroys Gap wind farm proposal by Heggies Australia Pty Ltd (Attachment 7).

The proposal was assessed against the SA EPA Noise Guidelines for Wind Farms, the NSW EPA Industrial Noise Policy, and World Health Organisation (WHO) guidelines. A detailed computer noise model was used to predict wind turbine generator noise levels for three potential layouts:

- **Layout A**: 15 Repower MM82 turbines (2 MW)
- **Layout B**: 15 Vestas V90 turbines (1.8 MW)
- **Layout C**: 14 Suzlon S88 turbines (2.1 MW)

Each layout varies in terms of spatial configuration, turbine manufacturer and turbine size. The layouts have been consolidated in Figure 3.7. The layouts modelled were generally predicted to comply with all relevant noise criteria.

The worst case modeling was carried out using the Suzlon S88 wind turbine which is the noisiest of the turbines proposed. This worst case analysis was predicted to comply with WHO limits, and meet the SA EPA criteria at most locations. Location G42 (Riverview) and location G01 (Sutton Grange) are predicted to marginally exceed the SA EPA guideline criteria without mitigation, and would be expected to comply with the mitigation options proposed. Site-specific baseline monitoring would be required to confirm ambient noise conditions at these sites. This site-specific evaluation of impacts would consider final turbine selection and siting, house orientation and other factors.

If, following these assessments, exceedances are predicted to occur for facades that include noise sensitive uses, such as bedrooms, consideration would be given to additional mitigation options including moving or removing turbines; switching off turbines under specific weather conditions; using a quieter turbine; offering affected landowners acoustic insulation, mechanical ventilation (to remove the requirement for open windows) or structural acoustic treatments (such as improved glazing). Mitigation measures would determined in consultation with affected property owners.

The proponent will ensure that the final site layout and design (including selection of turbines) will meet the SA EPA criteria at all non-involved residence locations.

If SA EPA guidelines would be exceeded at any involved residence locations, the proponent intends to enter into noise agreements with affected landowners once the final turbine layout has been selected, prior to construction. The agreements would ensure that WHO guidelines would are met and adopt an adaptive management approach which could include the use of building treatments and turbine operation/management strategies if operational noise causes significant impact to the amenity of involved residents.

The proposal would not produce significant impacts in terms of tonality or infrasound, or substation noise emissions.

**TELECOMMUNICATION IMPACTS**

The potential for Electromagnetic Interference (EMI) to affect telecommunications services such as television and radio broadcasts, radio communications, mobile phone services and aircraft navigation was assessed.

### Radio and television broadcasts

The ACMA RadCom database lists several television and radio broadcasters operating in the Yass district. Five television stations broadcast from Canberra (Black Mountain). The specific impact on each residence is difficult to assess. Houses further than 5 kilometres from the site are unlikely to be affected. The proponent will undertake a monitoring program of houses within 5 kilometres of the wind farm to determine any loss in television signal strength, once the wind farm is operational. In the event that TVI due to the wind farm is experienced by existing receivers, Taurus Energy will put in place mitigation measures at each of the effected receivers in consultation and agreement with the landowners.

### Radio communications

While the Conroys Gap area is classified as a “Low Density Area” in terms of the number of radio communications licences, there are a number of licenses relevant to the site. These license holders operate a range of radio communications services, primarily fixed link microwave communication and mobile communication systems within a 25 kilometre radius of the proposed wind farm.

Licence holders were consulted and the turbine layout has been adjusted to eliminate possible issues raised by the Rural Fire Service. As a result of this modification and the exclusion zones established in planning the wind farm, no significant impacts are expected to occur to existing point-to-point links. In the event that any interference issues arise prior to or post construction, Taurus Energy will consult with the operator and undertake appropriate remedial measures, which may include modifications to or relocation of the existing antennae or the installation of an amplifier to boost the signal.

### Mobile phone services

Three mobile phone companies use base stations in the vicinity of the proposed wind farm. To avoid impacts to mobile phone services, Taurus Energy will implement a turbine set off distance for omnidirectional antennae of 100m from the tower and, for panel antennae, a 100m turbine set-off for 30 degrees either side of the line of sight from the panel.

At Taurus Energy’s request, Optus Mobile/Singtel Optus, Telstra and Vodafone each carried out independent investigations of the potential impact to their mobile phone systems. Telstra indicated that the proposal would have minimal effect on existing coverage. Vodaphone investigations are continuing. Optus identified a preference for an “unobstructed view towards the Hume Highway”. A small number of wind turbines may encroach into this zone. Optus has been notified of this and at the time of writing, a response had not been received.

As the layout satisfies Telstra’s requirements, it was concluded that there is only a very low risk (if any) that mobile communications may be affected in the area.

### Aircraft navigation

There is one radar installation in the vicinity of Canberra airport (Mt Majura). A secondary radar installation is located at Mt Bobbara. Provided wind turbines are not located in close proximity to transmitters they are not expected to cause any issues for aircraft navigation systems.

Taurus Energy commissioned Airservices Australia to conduct a study of the effects of the proposed Conroys Gap wind farm development on the operation of the Mount Bobbara Air Traffic Control (ATC) radar facility located 6 kilometres north east of Binalong, NSW. The Mt Bobbara radar is currently operating as the secondary radar to Mt Majura for the Canberra International Airport. The study concluded that critical coverage areas are unlikely to be impacted. If effects in critical areas do become apparent; mitigation strategies are available to reduce the operational impact by optimisation of the radar facility. The proponent will continue to liaise closely with Airservices Australia in order to ensure air safety is maintained and will ensure that the requirements of Airservices Australia and the Civil Aviation Safety Authority are met in the development of the wind farm.

#### BUSHFIRE HAZARD

Summer conditions in the Yass district can present a high bushfire hazard. The elevated position of the subject site may also increase the frequency of lightning strike. Factors mitigating fire risks at the site include the sparse and fragmented nature of woodland and forest remnants, the low density of human settlement and assets, the local presence of the Rural Fire Service (an appliance is currently kept on the Springvale property) and a grazing regime which keeps paddock fuels low.

Fire hazards during the construction phase would be managed using fire safe works procedures and by keeping appropriate fire fighting equipment on site when the fire danger is very high to extreme. The Rural Fire Service would be consulted in regard to the adequacy of bushfire prevention procedures to be implemented on site during construction, operation and decommissioning. The RFS and Council would also be consulted regarding safety, communication, site access and response protocols in the event of a fire incident originating in wind farm infrastructure, or from outside sources.

Fires caused by wind farm equipment failure are very rare in modern wind turbine designs. Turbines would automatically shut down if ambient temperatures exceed the safe operating range, or if components overheat. The turbines would also be fitted with lightning protection. The overall fire risk is assessed as low.

#### TRAFFIC IMPACTS

The Traffic Impact Report was prepared by Rodger Ubrihien of Bega Duo Designs, and provides a preliminary technical appraisal of the traffic and safety implications arising from the proposed wind farm and measures for minimising traffic impacts. The study examines the key routes to the proposal site from Yass.

The traffic impacts outlined in the Traffic Impact Study would be discussed with Yass Valley Council and the Roads and Traffic Authority. Traffic Control Plans and Oversize Vehicle Permits would be prepared and submitted to the Roads and Traffic Authority for all the operations of over size and over weight vehicles on all the public roads involved in the transport of materials to the site. Regular scheduled maintenance of gravel pavements such as grading, dust suppression and drainage control would take place during the construction period.

The Hume Highway and Paynes Road would carry the construction traffic for the project. The Hume Highway and junction onto Paynes Road is able to handle the increased traffic, however an overhanging tree would need to be trimmed on the verge of the Hume Highway on the southbound carriageway northeast of Paynes Road to increase the intersection sight distance.

The inside curve clearances, pavement, drainage structures and stock grids on Paynes Road require inspection and probable upgrading. The road would need widening at specific locations and a speed limit applied during the period of construction.

Following construction of the wind farm, the effects of 'shadow flicker' would need to be monitored from Black Range Road to determine the degree of impact on southbound motorists.

The Traffic Impact Study concludes that the adoption of the recommended measures for minimising traffic impacts outlined in the report should reduce the risk of traffic accidents to an acceptable level and minimise structural and environmental damage.

#### AVIATION IMPACTS

The nearest airfield providing instrument landings is Canberra airport, approximately 70km south east of the site. Yass airfield is approximately 20km ENE of the site, but is not classified for instrument landings. Small private airstrips are also present in the district. In addition to recreational and commercial flights, aircraft may pass over the study area during agricultural operations such as aerial spraying, or during electricity line inspections.

The proposed structures are not expected to represent hazards or obstructions to the Canberra airfield. The Yass airfield is also unlikely to be affected by the development. The private airstrips in the local area rely on visual rather than instrument based landings and as the turbines are clearly visible structures it is unlikely that the development would pose any additional hazard to the users of these airstrips.

Similarly, the highly visible turbine structures are not considered to be safety hazards to aerial agriculture operations. However, around 210 hectares of farmland may no longer be accessible for aerial spraying. This land is owned by involved landowners who would be compensated by way of lease agreements entered into with the proponent.

Consistent with the Civil Air Safety Regulations, the proponent has advised the Civil Aviation Safety Authority (CASA) of the Conroys Gap proposal. Taurus Energy is currently in consultation with CASA regarding their requirements for the marking of turbines at the site.

#### HERITAGE IMPACTS

The Conroys Gap area is assessed to be of low archaeological potential and sensitivity. The proposal would result in a low level of impact to the archaeological resource in the proposal area. The proposal may be distantly visible from some of the heritage places gazetted under the LEP (ACT Government 2004), particularly places located to the north, near Bookham (8 kilometres from the site) and Bowning (9 kilometres from the site). This visual impact is not expected to significantly affect the heritage values or experiences currently available at the sites.

The proposal is unlikely to be significantly visible from National Estate heritage places or from their near approach routes. Heavy construction vehicles would not pass through the main street of Yass or close to built heritage items.

#### CUMULATIVE IMPACTS

There are a number of wind farms operating, approved for construction or proposed in the Southern Tablelands region, with potential for further wind farm development in the region. The Conroys Gap wind farm proposal is the first for the locality west of Yass. The closest wind farm proposals are at Gunning, around 55 kilometres to the east, and the Murrumbateman area, approximately 35 kilometres to the south-east. The separation between the sites (at least 25-30 minutes travel time) should be sufficient to avoid any substantial accumulation of intrusions on the visual environment for Hume Highway and Barton Highway road users.

The visual and noise impacts of the wind farm in combination with the impacts from other existing developments and disturbances are also not considered to be significant.

Visits from migratory or nomadic species are expected to be infrequent and sporadic. The site is not likely to be located on a major migratory route. Other wind farms in the region are located well outside local raptor breeding territories and foraging ranges. The cumulative impacts on mobile fauna are not expected to be significant. The project is considered unlikely to produce significant additional hazards for fauna, in combination with existing obstacles and hazards.

#### DECOMMISSIONING

The lease agreements for the placement of the wind turbines are 20-30 years, with an option to extend. At the end of this period, the turbines may be maintained or replaced during a potential recommissioning phase. The wind farm infrastructure would be removed at the end of its operational life, and the development site rehabilitated and revegetated. There are risks to human safety and visual and environmental values if the infrastructure is not removed, or removed incorrectly.

Individual wind turbines not used to generate electricity for a continuous period of 12 months would be removed unless extenuating circumstances apply. Written evidence would be provided to the Director General, that the lease agreement(s) with the site landowners have adequate provisions to meet the decommissioning requirements, and that the site would be restored to a similar condition as existed before the development.

#### LOWER PRIORITY ISSUES

Lower priority issues include climate and air quality, water and catchment values, soil and landforms and existing land use and management. Risks and impacts to these values are likely to be low, and readily manageable using standard best practice and additional specific prescriptions outlined in the EA.

## Conclusion

The EA has identified and assessed the significance of environmental impacts associated with the proposal to construct and operate a wind farm at Conroys Gap. The Conroys Gap locality is a moderate-high relief rural area with a long history of extensive grazing, but with a recent trend toward large lot residential subdivision.

Key issues relating to the proposal include the presence in the wider study area of threatened flora, fauna and communities, the presence at the subject site of raptors and raptor hunting habitat, and the presence of roads, recreation areas and residences within potential noise and visual impact zones.

The impacts of the proposal on physical values (air quality, soil and water) would be readily manageable using standard best-practice methods. The vegetation that would be impacted by the proposal has low conservation significance and the impacts would not be significant. All bird and microbat species recorded at the site and most likely to be affected by the proposal are widespread and not considered threatened.

Based on experiences at operating wind farms elsewhere in Australia, blade collisions by birds and bats are expected to be rare. A dedicated monitoring program, coupled with adaptive management would be implemented to account for residual risks to bird and bat species, including the Wedge-tailed Eagle.

The Assessments of Significance conclude that the proposal is not likely to have a significant impact on a threatened species, population or ecological community listed under the TSC Act or the EPBC Act.

The visual landscape is substantially modified by farming practices and contains many built elements; there are no areas where the wind farm would create unacceptable contrast. Visual impacts would be acceptable and manageable using a range of mitigation measures.

Operational noise emissions would generally meet all relevant criteria. Under one particular layout option, noise levels at two residences may exceed the criteria. This would require site-specific assessment if this turbine configuration is to be used. Impacts to these residences would be manageable using a range of mitigation measures.

Studies conducted overseas and elsewhere in Australia, including a study commissioned by the proponent into the effects of the Crookwell I wind farm on land values, suggest that the proposed wind farm would not have a significant impact on local land values and development potential. Impacts on aviation are not likely to be significant and potential interference to telecommunications is likely to be readily mitigatable. The Conroys Gap wind farm proposal is sufficiently distant from similar proposed and existing wind farms to avoid cumulative noise, visual and biodiversity impacts.

The planning and design of the Conroys Gap proposal has been informed by past experiences of wind farms in Australia and overseas. The proposal has been progressively adapted and refined in response to the findings of the specialist assessments. This EA provides a series of impact avoidance and mitigation measures which have bearing on the design and planning, construction and operational phases of the project.

The proposal offers clear climate change benefits by reducing the current reliance on coal for electricity generation. In Australia, a third of total greenhouse gas emissions are produced during the generation of electricity, the vast majority from coal-fired power stations. Greenhouse gas emissions from these sources are increasing rapidly in New South Wales. The wind farm would reduce greenhouse gas emissions by 90,000 to 99,000 tonnes of CO2 per annum, or a cumulative effect of 2.70 to 2.97 million tonnes of $CO_2$ over the life of the project.

The State's electricity demand continues to grow, and new electricity sources will be required by 2008 to meet this demand and avoid power outages and blackouts (Transgrid 2005). Wind power provides reliable and decentralised electricity production.

For the local community, the proposal offers economic benefits. The proposal would inject over $10 million into the local economy. An estimated 50 jobs would be provided during construction and 5 jobs during the operational phase of the wind farm. The wind farm would also provide an opportunity to increase local tourism.

Assuming implementation of the impact avoidance and mitigation measures outlined in the EA, the proposal is not considered likely to significantly affect the environment in terms of cultural heritage, social, economic or biodiversity impact. Negative impacts relating to noise, visual impact, disturbance to recreation opportunities and biodiversity risks would be localised and restricted to the 30 year lifespan of the project. These impacts are considered to be outweighed by the broader benefits of wind power generation.

Based on the social and environmental benefits accruing from the proposal from reduced dependence on fossil fuels, and the assessed impacts on the environment, it is considered that the development would be sustainable within context of the principles of Ecologically Sustainable Development.

# 2. INTRODUCTION

## 2.1. About this Environmental Assessment

This Environmental Assessment (EA) has been prepared by **ngh**environmental on behalf of Taurus Energy Pty Ltd to assess the potential environmental impacts associated with the development of a wind farm at Conroys Gap, on the Southern Tablelands of New South Wales.

The proposal involves the construction, operation and decommissioning of wind turbines, electrical connections and substation, a control and facilities building, a powerline and road access works. The area of the development footprint would be approximately 7 hectares. The wind farm would have a capacity of up to 30 megawatts, and an operational life of up to 30 years.

At the end of its operational life, the wind farm could be either decommissioned or recommissioned using new or renovated infrastructure. This EA incorporates the decommissioning option. Recommissioning of the wind farm would require a further assessment and approval process, when design and other details are known.

The Environmental Assessment:

- describes and justifies the proposed wind farm project;
- identifies statutory assessment and approval requirements in relation to the proposal;
- identifies and assesses the major environmental, cultural and social values of the proposal area;
- identifies and assesses the level of significance of the potential impacts and risks associated with the proposed works;
- identifies measures to manage identified risks, and avoid or mitigate potential impacts.

The wind farm proposal contains a number of possible layouts and turbine types. Where the impacts vary between layouts, these impacts are defined and assessed separately for each layout.

The EA is intended to meet the assessment requirements of the recently introduced Part 3A provisions of the *Environmental Planning and Assessment Act 1979* and the Major Projects State Environmental Planning Policy 2005 (refer section 5).

The EA draws together a number of specialist studies undertaken to assess the proposal, covering visual impacts, noise impacts, land value impacts, traffic impacts, archaeology and biodiversity. The findings of these studies have been incorporated into the EA, and the study reports are included as Attachments.

## 2.2. The proponent

Taurus Energy is a NSW wind power development company. Their stated objectives are to identify suitable sites for small to medium sized wind farms (20MW to 40MW) and to obtain planning approvals, design electrical transmission connections and to build, own and operate the wind farms.

Taurus Energy commenced operations in mid-2002, and was incorporated in April 2003. Taurus Energy is a proprietary limited company registered in NSW. In July 2005, Taurus Energy announced the acquisition of a majority of its shares by renewable energy company Voltwerk AG from Hamburg, Germany. Voltwerk is a subsidiary of Conergy AG.

Under the new ownership, Taurus Energy will continue to develop its existing portfolio of small to medium scale wind farm sites in NSW and will expand its activities to include solar energy among other renewable technologies. Taurus Energy aim to do this in a way which supports the development of local communities, and which supports the development of the wind energy industry in Australia. Currently, Taurus Energy has development approval to construct and operate one 30MW wind farm at Snowy Plains, approximately 30km north-west of Berridale, NSW.

## 2.3. Regional context

### 2.3.1. Social and economic values

The Conroys Gap study area is located in the Yass Valley Local Government Area (LGA). Yass Valley LGA covers approximately 3,970 square kilometres, has a population of 12,938 and includes the town of Yass and villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. Within its boundaries, there is one National Park, five Nature Reserves and one State Conservation Area (Yass Valley Council 2005).

The region has a long history of agriculture, particularly wool production, with diversification now occurring into the horticultural industries. Residential numbers in Yass Shire have consistently risen over the 20 years between the 1981 and 2001 censuses (ACT Government 2004). There were 3,816 separate houses in Yass Shire at the time of the 2001 census. Residential numbers in Yass Shire have consistently risen over the 20 years between the 1981 and 2001 censuses (ACT Government 2004).

Population is increasing by around 2.5% per year, although the average age of the population is increasing (ABS 2002). Population density is around 0.03 persons per hectare (or one person for every 29.43 hectares). The average population density across all 17 NSW Local Government areas in the Region is one person for every 41.58 hectares (ACT Government 2004). Most people work in the agriculture/forestry/fisheries, retail trade, and property and business services sectors (ABS 2002).

Along with a strong agricultural base, the region benefits economically from the proximity to Canberra, the Hume Highway transport corridor, which bypasses all of the towns, and rail connections to the capitals.

### 2.3.2. Natural values

The Conroys Gap site is located in the South Eastern Highlands Bioregion of the Interim Bioregionalisation of Australia (IBRA 5.1) (Thackway and Cresswell, Environment Australia 2000), within the Murrumbateman sub-region (Morgan 2000). The Bioregion extends from Orange in the north, south into Victoria and includes most of the ACT. It has a total area of about 8.7 million hectares, or approximately 6.11 per cent of the state (NPWS 2005).

The Bioregion covers the dissected ranges and plateaux of the Great Dividing Range. The Murrumbateman sub-region is an undulating plateau with rounded hills and peaks, entrenched meandering streams with chain of pond tributaries. Soils are derived from fine-grained sediments and metasediments, with minor areas of coarse acid volcanics (DEC 2005). The Bioregion and sub-region typically support grassy woodland habitats on flats and low hills and dry shrubby forests on higher hills and ranges (NPWS 2005)

The box-gum woodlands and natural temperate grasslands have been heavily cleared and fragmented by agricultural activities, are poorly represented in reserves and are listed as Endangered Ecological Communities. Lower elevation wetlands and riparian forests are also extensively depleted. About 726,530 hectares or 14.86 per cent of the bioregion is conservation reserves.

The proposal site also occurs within the Southern Tablelands region, which has been defined by the NSW and ACT Governments for the purposes of biodiversity protection and conservation planning (Fallding 2002). Of the remnant vegetation that remains in the Southern Tablelands region, 1% is grassland, 3% is grassland-woodland mosaic, 9% is box-gum woodland, 21% is dry forest, 12 % is wet forest and 0.5% is riparian forest. Box-gum woodlands occupied around 23% of the region prior to European settlement. 9% of the region currently carries this community, in varying condition. Sites with high biodiversity value are rare, isolated and fragmented. A large proportion of grassland and woodland remnants are on private lands. 30 flora species and 54 fauna species in the region are listed as threatened (Fallding 2002).

# 3. DESCRIPTION OF THE PROPOSAL

## 3.1. Site of the proposal

### 3.1.1. Location and extent

The Conroys Gap proposal site is located on farmland north and south of Black Range Road, approximately 17 kilometres west of Yass, New South Wales (Figure 3.1). The site extends over around 7 kilometres, oriented in a north-south direction.

Figures 3.1-3.3 illustrate the site location, property boundaries, landholdings and existing house locations near the proposed development. Figures 3.6 – 3.8 show the proposed location of wind farm infrastructure at the site.

The area of the development footprint would be approximately 7 hectares.

### 3.1.2. General site description

The study area is characterised by undulating to hilly terrain, with broken, generally north-south oriented ridgelines. There are no major watercourses present at the subject site. Several small or intermittent watercourses drain the site northwards to the Jugiong Creek system and south to Lake Burrinjuck. There is little natural tree cover, particularly in lowland areas.

The tenure of land at the subject site is private freehold. The land is currently used for commercial agriculture (sheep and cattle grazing) and farm residences. The proposal would directly involve four properties.

### 3.1.3. Land use and tenure

The subject site is located on land in private freehold tenure, currently used for commercial agriculture (sheep and cattle grazing) and farm residential use. The proposal would directly involve four private properties, consisting of Lots 183 and 189 of DP 753596 owned by Andrew and Tarina Walker, Lots 207, 208 and 298 of DP 753596 owned by Kerry and James Payne, Lots 53, 60, 79, 80, 81, 82 and 167 of DP 753633 owned by Donald and Marjorie Payne and Lots 94, 99 and 104 of DP 753633 owned by John and Teresa Kaveney. Land tenure within the study area is illustrated on Figure 3.3.

## 3.2. General description of the proposal

This section describes the wind farm project in detail, and provides the scope of works involved during the construction, operation, and decommissioning phases.

The proposal would generate up to (but less than) 30 MW and would involve the construction, operation, and decommissioning of:

- Up to 15 wind turbines, each with three blades up to 46m long mounted on a tubular steel tower up to 80m high;
- Electrical connections between wind turbines using a combination of underground cable and overhead concrete pole power lines;
- A substation and transmission connection linking the wind turbines to the existing TransGrid 132kV transmission system located on the site;
- An onsite control room and equipment storage facilities; and,
- Access roads around the site, and minor upgrades to access via Payne's Rd and the crossing of Black Range Rd, for installation and maintenance of wind turbines.

Additional temporary construction infrastructure will be required during the construction and decommissioning phases.

Turbine layouts have been developed for the site based on the following turbine options:

**Option A** – 15 turbines, 2 MW class, 80m hub height, 77-82m blade diameter

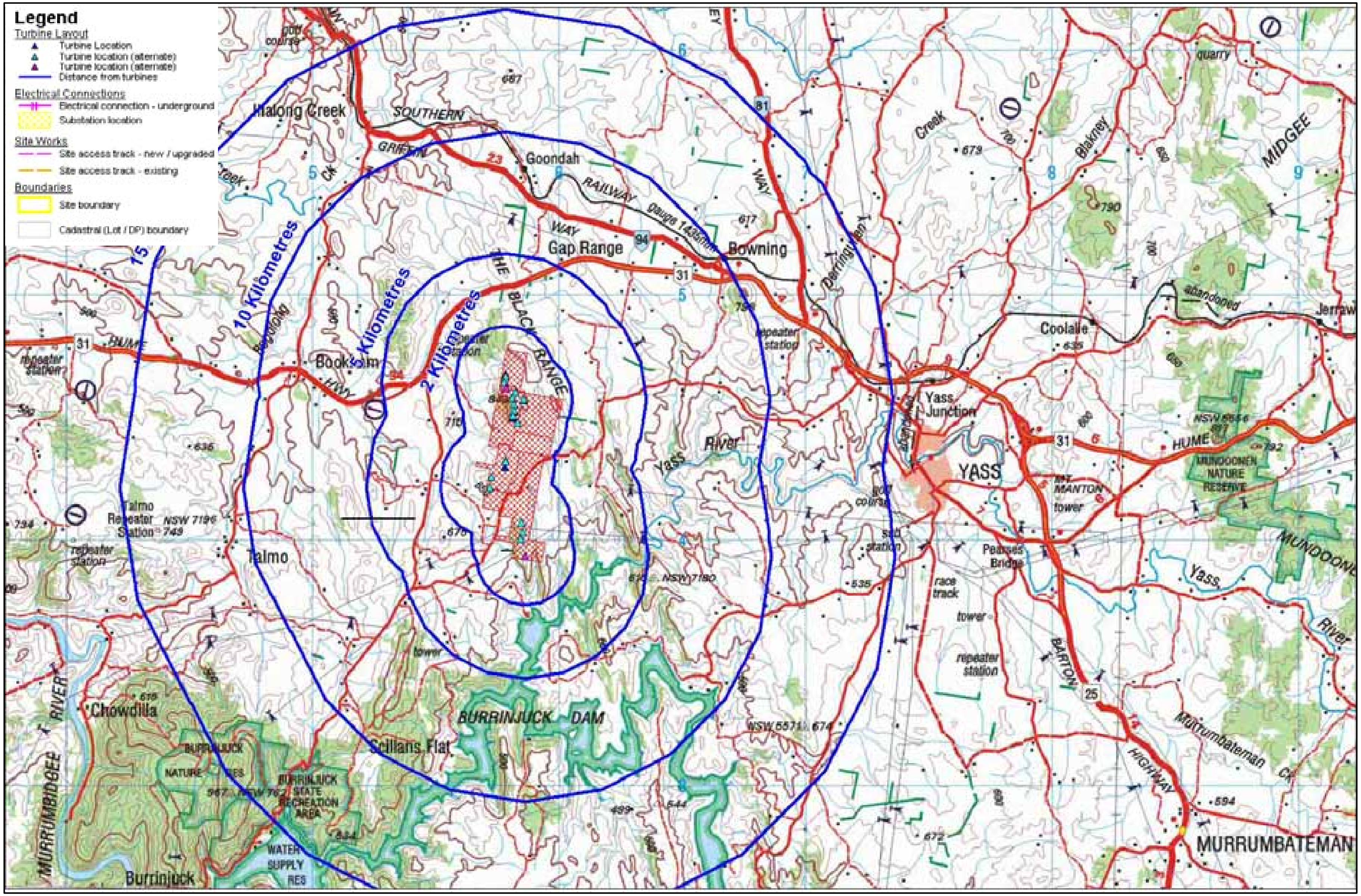
**Option B** – 15 turbines, 2 MW class, 80m hub height, 87-92m blade diameter

A variety of turbines are available within each option, as discussed in Section 3.3. The specific turbine selection would be carried out through a competitive tender process after development approval has been received.

Where possible, the analysis contained within this Environmental Assessment is based on the highest impact caused by any of these turbines / layouts. The detailed investigations of each layout are contained in the specialist reports attached in the appendices.

Figures 3.1-3.4 illustrate the site location, property boundaries, landholdings and existing house locations near the proposed development.

The project description is based on the current status of planning. In particular, any site layouts are based on the current proposal which may change to a minor degree due to unexpected issues arising in relation to ongoing biodiversity assessment; archaeological assessment; geology; wind regime; wind turbine availability; and transmission connection design issues.




## Figure 3.1 Site location

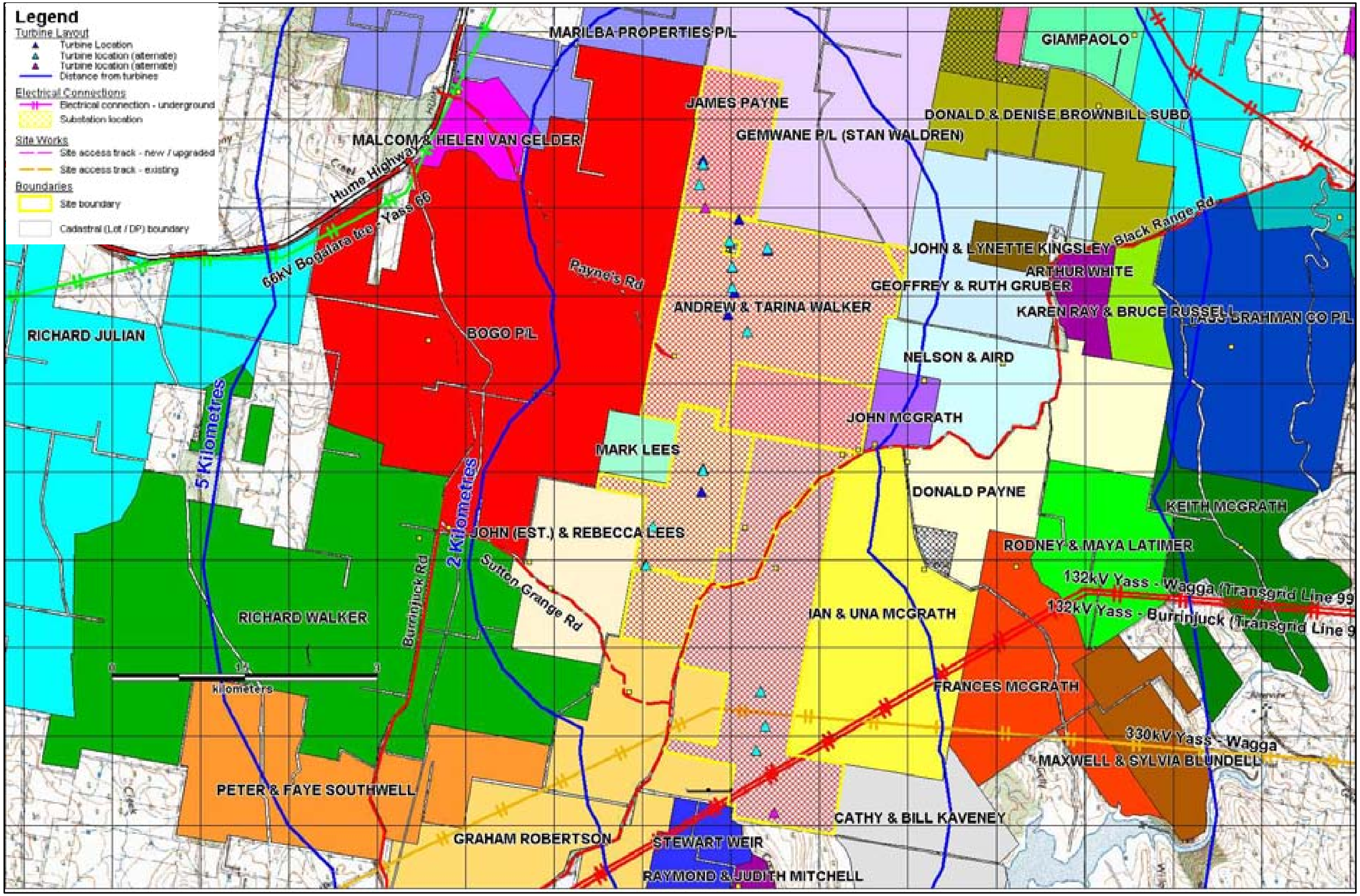



**Figure 3.2 Landholdings**

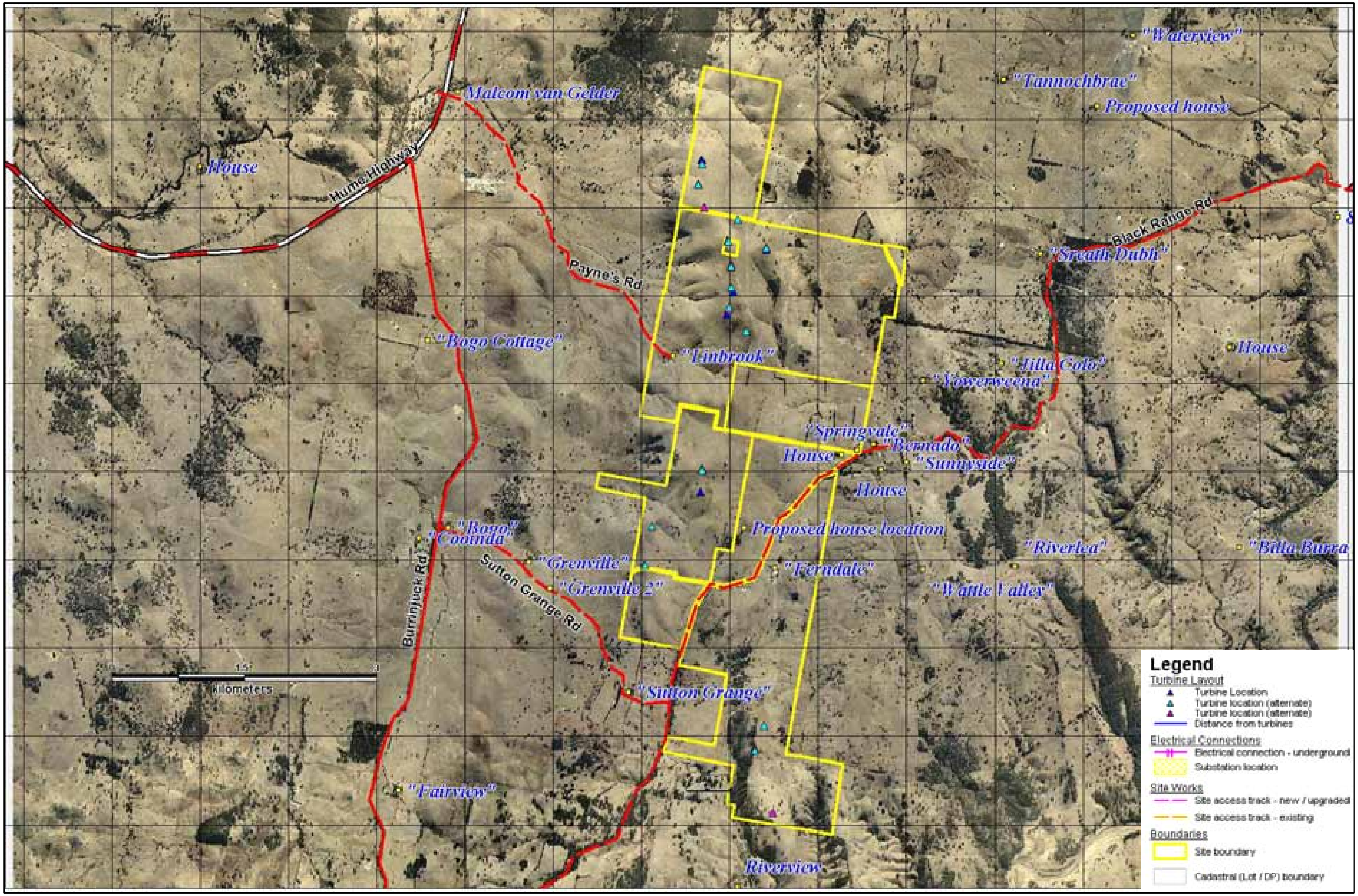



**Figure 3.3 Proposal site boundaries and nearby house locations**

# 3.3. Wind farm infrastructure

## 3.3.1. Wind turbines – general description

Each wind turbine would be a three bladed type of the "up-wind" design; that is, facing up into the wind and in front of the tower. The wind turbine would have a diameter of 77 to 92 metres and a hub height of up to 80 metres, with the blade tip at its apex up to 126 metres above ground level. Hardstand areas required beneath each turbine would be up to 30 metres by 30 metres (900m$^2$).

Blades would be made of fibreglass attached to a steel hub, and would include lightning rods for the entire length of the blade.

Each wind turbine would have a rated power capacity of between 1.5MW and 3.0 MW, depending on turbine selection. Further details of specific wind turbines are outlined in Section 3.3.3.

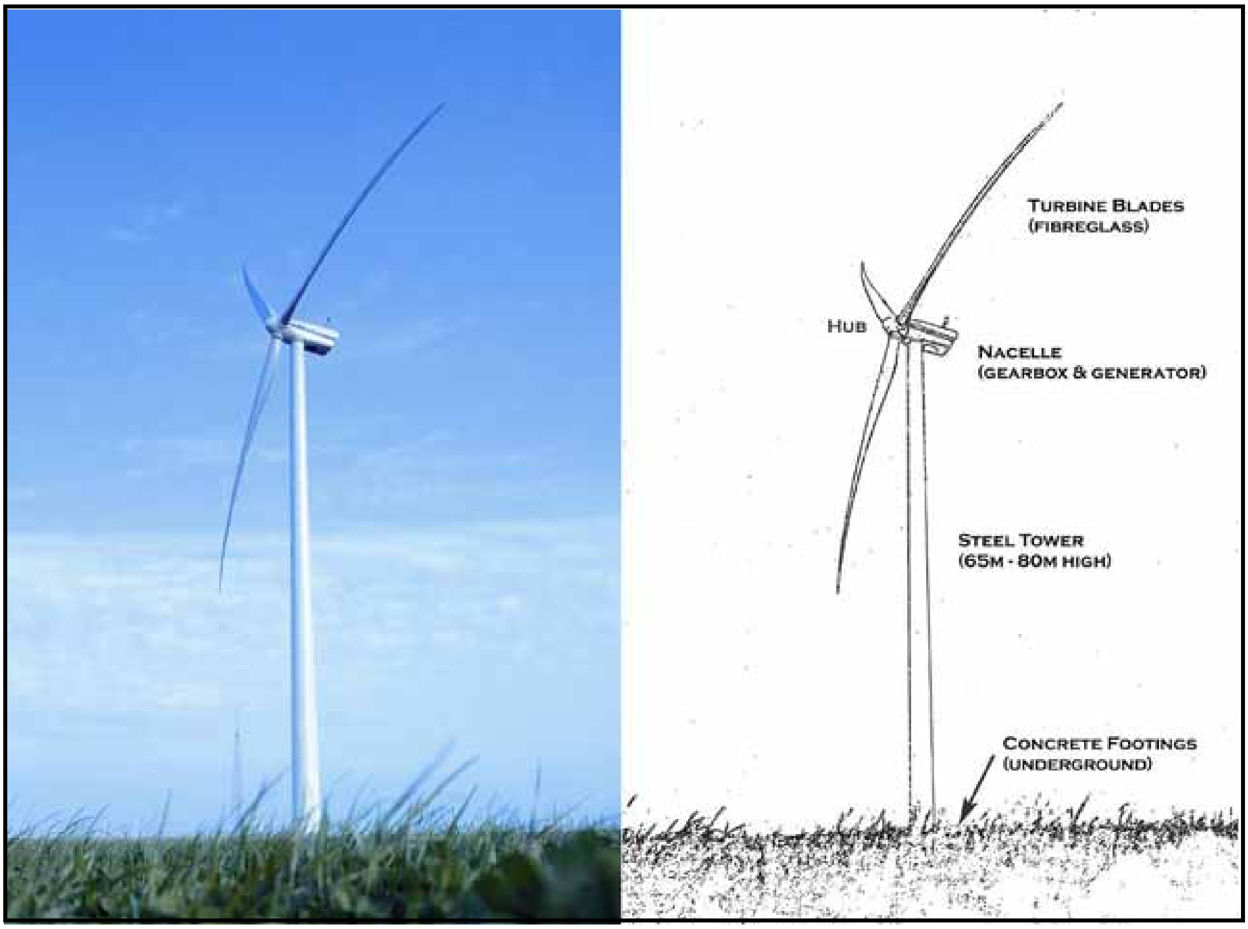



**Figure 3.4 Typical 90m diameter wind turbine installed on an 80m tower**

*Photo courtesy Vestas International*

### NACELLE

The nacelle is the housing at the top of the tower enclosing the generator, gearbox, and control gear including motors, pumps, brakes and electrical components. This control gear ensures that the wind turbine always faces into the wind, and adjusts blade angles to maximise power output and minimise blade noise. The nacelle also houses a winch or winches to assist in maintenance equipment or smaller replacement parts to the nacelle.

The nacelle design takes into account acoustic considerations to minimise noise emissions from mechanical components.

### TOWER

The tower is a tubular steel tower of up to 80 metres high, tapering from around 5 metres at the base to around 3 metres at the top. Exact dimensions will depend on the wind turbine design selected. The tower is constructed in up to four sections, each section bolted together via an internal flange. Within the tower are the power and control cables, and access ladder to the nacelle (with safety climb system).

### FOOTINGS

The tower would be seated in a reinforced concrete footing. Various designs of footing are under consideration, based around a gravity footing (where subsoil geology is less stable) and a rock-bolted footing (where subsoil geology provides good bedrock). A combination of these footing designs may be used on the site depending on the geology at each turbine location.

### TRANSFORMER

Each wind turbine generator would produce power at typically 690V, and up to 1,000V. This voltage is then stepped up at each wind turbine to either 22,000V or 33,000V for reticulation around the site. The transformer for each wind turbine would be located either within the base of the tower, in the nacelle, or adjacent to the tower as a small pad-mount transformer, depending on the specific wind turbine model selected. The transformer would be either a dry-type transformer, or would be suitably bunded.

### LIGHTNING PROTECTION

Each wind turbine would have a lightning protection system installed. This system includes lightning rods through each wind turbine blade, an earth mat built into the foundations of the wind turbine, and lightning protection around the various electronic components within the wind turbine.

### OBSTACLE LIGHTING

The turbines may have aircraft warning lighting which would comprise a red flashing beacon on the top of the nacelle to meet the requirements of the Civil Aviation Safety Authority (CASA). CASA draft guidelines for aviation warning lighting for a group of wind turbines require that sufficient wind turbines should have red obstacle beacons to indicate the extent of the group. The interval between beacons should not exceed 900m. Accordingly, it is expected that 4 to 5 turbines in the proposed project would require aircraft warning beacons.

### FIXED OR VARIABLE SPEED MACHINES

Wind turbines can be fixed speed or variable speed machines, that is, the turbine blades would either rotate at a constant speed (when operating) or a variable speed depending on wind speeds. Variable speed machines have better performance over a wider range of wind speeds, provide higher quality power to the electricity grid, and help reduce wind turbine noise levels at low speeds. However, they are more expensive to install.

It is likely that variable speed machines would be used in this wind farm, with a rotational speed in the range of 5 to 25 revolutions per minute (RPM) depending on wind conditions. This rotational speed is slower than the existing New South Wales wind farms at Blayney and Crookwell which operate at a fixed speed of 25-30 RPM.

### WIND TURBINE OPERATION

Each wind turbine would have its own individual control system, and would be fully automated. Start-up and shutdown (including safety shutdowns) are fully automated, with manual interruption available via onsite control systems and remote computer.

Generally, wind turbines would commence operation at around 3 – 5 metres per second (11 – 18 kilometres per hour) and gradually increase in production to their maximum capacity, usually at around 12 – 15 metres per second (44 – 54 kilometres per hour). Once at this maximum capacity, the wind turbine would control its output by altering the pitch of the wind turbine blades. Under high wind conditions in excess of 25 metres per second (90 kilometres per hour) the wind turbine would automatically shut down to prevent damage. It would continue measuring the wind speeds during this state via an anemometer mounted on the nacelle, and would restart once wind speeds drop again to a suitable level.

Various operating constraints can be programmed into the control system to prevent operation under certain conditions. For example, if operational issues are identified such as excess noise or shadow flicker under certain conditions, these conditions can be pre-programmed into the control system and individual wind turbines automatically shut down whenever these conditions are present. For example, the noise control systems can be programmed such that if the wind is blowing from a certain direction at a certain wind speed, the wind turbines can be switched off. Likewise, wind turbines can be switched off at a certain time of day during a period of the year should the sun angles cause shadow flicker on nearby properties.

It should be noted that noise and shadow flicker are not expected to be an issue, as these impacts can be minimised in the design process. However, this ability within the control system would allow adjustment of wind turbine operation modes for unforeseen outcomes.

### 3.3.2. Wind turbine selection

#### BACKGROUND TO TURBINE SELECTION

Wind farms are a highly capital-intensive business, with around 90% of the long term costs of a wind farm being related to its construction and financing. Likewise, revenues are directly linked to energy production, which is basically fixed by the turbine selection and siting carried out in the design phase.

For this reason, to keep generation costs down and to ensure the projects financial viability, it is essential that the appropriate wind turbine is selected for a site, and that a competitive approach is used between manufacturers to minimise the capital costs of the project.

At this stage, the specific wind turbine model and manufacturer has not been selected for this project.

Various international wind turbine manufacturers have products available that are suitable for the Australian market and for this site. These wind turbine suppliers include Vestas (Denmark), RE Power (Germany), Gamesa Eolica (Spain), Suzlon Energy (India), GE Wind (US), and Enercon (Germany).

While all of the turbines under consideration meet the general description in Section 3.3.1, each wind turbine model is quite different in its design parameters, and each manufacturer also offers a number of similar wind turbine models which are optimised for different wind speed conditions. Even small changes in wind speeds or minor modifications to turbine locations can impact a turbine's suitability for a site, and energy production at a site.

Accordingly, the final turbine selection can only be carried out under a competitive tendering process once this development application has been determined and the final approval conditions are known.

#### WIND TURBINES UNDER CONSIDERATION

Tables 3.1 and 3.2 show a list of wind turbines currently under consideration for the site, together with key parameters of these turbines. Final wind turbine selection would be carried out based on commercial considerations within the approval conditions stipulated by the Department of Planning.

The turbines fall into two similar types:

- **Type A** turbines have a generating capacity ranging from 1.5 MW to 2.0 MW. These turbines have a hub height of 78m to 80m, and a blade diameter of 77m to 83m, meaning a blade tip height of 118m to 121m.

- **Type B** turbines have a generating capacity ranging from 1.8 MW to 3.0 MW. These turbines have a hub height of 78m to 80m, and a blade diameter of 87 to 92m, meaning a blade tip height of 121.5m to 126m.

The different characteristics of these turbine types require different turbine layouts. In particular, the spacing of turbines is related to the blade diameter, so where a Type A turbine may require a crosswind / downwind spacing of 240m/400m, a Type B turbine would require a crosswind/downwind spacing of 270m/450m. This would mean a larger area of the site is required for the wind farm layout, and different turbine locations have been assessed for some turbines as outlined in Figure 3.6 and the notes in relation to that figure.

In addition, even within each type the turbines will have slightly different characteristics in terms of physical size, energy production, and acoustic impacts.

#### SELECTION OF REPRESENTATIVE WIND TURBINES

This Environmental Assessment, and the related specialist studies, is based on the selection of a turbine which is representative of each turbine type. The turbines selected are:

**Type A – RE Power MM82**. This turbine is demonstrated to be cost competitive in Australia, through its recent selection for Wind Power Pty Ltd's Wonthaggi wind farm in Victoria. As the largest wind turbine within this class it is expected to represent the highest impact case from a visual impact perspective.

**Type B – Vestas V90 1.8MW and Suzlon S88 2.1MW**. These turbines are demonstrated to be cost competitive in Australia, producing a high capacity factor due to the increased ratio of rotor diameter (90m and 88m) to generator capacity (1.8MW and 2.1MW). The blade diameter and noise profile are typical of the turbines in this class. The Suzlon S88 was recently selected for AGL's Hallet Hill wind farm in South Australia. As one of the noisier turbines within this class, it is also expected to represent the highest impact case from an noise perspective.

These representative turbines have been used for preparation of:

- optimised wind turbine layouts for each turbine type (Section 3.3.3)
- estimates of energy production (and greenhouse gas reduction) for turbines representing both Type A and Type B (See Project Justification)
- photomontages, Zone of Visual Influence, and Shadow Flicker analysis for the Visual Impact analysis, which are based on Type B turbines as these have the highest visual impact (See Visual Impact Analysis report)
- noise propagation assessment for the Acoustic analysis based on the representative turbines of both Type A and Type B (see Acoustic Impact Analysis report).

These turbines have been selected as they are the most indicative of the range of turbines under consideration. Final assessment of noise will be calculated prior to construction based on the final turbine selection and layout, and the results of this provided to the Department of Planning. Taurus Energy will ensure that these layouts meet the SA EPA Guidelines (for non-involved houses) or WHO guidelines (for involved houses) as appropriate.

### Table 3-1 Wind turbines under consideration - Type A

| Turbine Supplier | Turbine Model (MW Capacity) | Hub Height | Blade Diameter | Blade Tip Height | Rotor Speed | Generator Type | Noise (dB(A) at 8m/s) |
|---|---|---|---|---|---|---|---|
| **RE Power** | **MM82 (2.0MW)** | **80m** | **82m** | **121m** | **variable 8.5-17.1rpm** | **Double fed induction machine** | **103.4** |
| Vestas | V82 (1.65MW) | 78m | 82m | 119m | fixed 14.4rpm | Asynchronous | 101.7 |
| Vestas | V80 (2.0MW) | 78m | 80m | 118m | variable 6-19rpm | Asynchronous with Optispeed | 105.3 |
| GE Wind | 1.5xle (1.5MW) | 80m | 82.5m | 121.25m | variable 10.2-18.7rpm | Double fed induction machine | 104.0 |
| GE Wind | 1.5sl/sle (1.5MW) | 80m | 77m | 118.5m | variable 11-20.4rpm | Double fed induction machine | 102.7 |
| Gamesa | G83 (2.0MW) | 78m | 83m | 119.5m | variable 9-19rpm | Double fed induction machine | 106.3 |
| Gamesa | G80 (2.0MW) | 78m | 80m | 118m | variable 9-19rpm | Double fed induction machine | 104.8 |
| Enercon | E82 (2.0MW) | 78m | 82m | 119m | variable 6-19.5rpm | Direct drive synchronous annular generator | 104.0 |

### Table 3-2 Wind turbines under consideration - Type B

| Turbine Supplier | Turbine Model (MW Capacity) | Hub Height | Blade Diameter | Blade Tip Height | Rotor Speed | Generator Type | Noise (dBA at 8m/s) |
|---|---|---|---|---|---|---|---|
| **Vestas** | **V90 (1.8MW)** | **80m** | **90m** | **125m** | **Variable 8.8-14.9rpm** | **Asynchronous** | **104.7** |
| **Suzlon*** | **S88 (2.1MW)** | **80m** | **88m** | **124m** | **limited variable** | **Asynchronous** | **106.3** |
| RE Power | MM92 (2.0MW) | 80m | 92m | 126m | variable 7.8-15rpm | Double fed induction machine | 105.0 |
| Gamesa | G87 (2.0MW) | 78m | 87m | 121.5m | variable 9-19rpm | Double fed induction machine | 105.3 |
| Vestas | V90 (3.0MW) | 80m | 90m | 125m | variable | Double fed induction machine | 102.0 - 109.2** |

** The Suzlon S88 has also been assessed in the acoustic report as it is the noisiest turbine in the 2MW range and therefore shows the greatest impact from an acoustic perspective.*

*** The Vestas V90 has multiple noise control modes, 109.2dB(A) is the noise level under the maximum (noisiest) noise control mode. Operating in reduced noise modes incurs a significant reduction in energy production (e.g. a 12% reduction for the 104.2dB(A) mode, and 22% reduction for the 102dB(A) mode).*

### 3.3.3. Wind turbine layouts

**PREPARATION OF WIND TURBINE LAYOUTS**

Taurus Energy has prepared a number of wind farm layouts for the various wind turbines under consideration before arriving at the layouts proposed in this document. These layouts were prepared by wind energy consultants Garrad Hassan Pacific Pty Ltd.

To prepare these layouts, Taurus Energy provided Garrad Hassan with key site parameters, including:

- Property boundaries
- Aerial photography of the site (for production of vegetation maps)
- High resolution topography of the site (2m contour)
- Wind speed data collected on site
- Location of residences in the vicinity of site
- Results of background noise assessment including proposed noise limits at residences
- Information on general constraints within the site (including biodiversity and heritage constraints, boundary and residence proximity constraints, and EMI constraints)
- Information on EMI constraints cause by the location of the communications tower on site and related microwave links
- Operating parameters of selected representative wind turbines

Garrad Hassan then prepared optimised wind turbine layouts for each representative turbine using a variety of specialised software packages including WaSP and Windfarmer™, as follows:

- Preparation of wind speed correlation at the monitoring mast location (comparison of measure period with long term Bureau of Meteorology wind monitoring sites) to determine likely long-term wind speed characteristics
- Preparation of a wind speed profile across the site based on this long term wind speed and the site physical parameters (topography, vegetation)
- Optimisation of wind turbine location based on this wind speed profile to maximise wind energy production while meeting all constraints (including biodiversity, heritage, acoustic limits on neighbouring residences, EMI interference, and proximity constraints)
- Calculation of likely long term (~30yr) wind energy production at each turbine
- Calculation of likely maximum wind gust conditions to determine turbine suitability.

The results of the wind speed profile are shown in Figure 3.5. This demonstrates the significant variability of wind speed across the site, which will help to explain the layouts proposed for each turbine type.

The results of the wind energy production calculations are provided in the Project Justification.

The proposed wind turbine locations under these options are shown in Figure 3.6. The layout has undergone a preliminary review to determine that the layout is able to be constructed. However, minor relocation of specific turbines may be required after the results of final geotechnical investigations at each turbine location are completed. These geotechnical investigations can only be carried out once consent conditions are known and a turbine supplier has been selected.

The layout is based on using 15 turbines. In the event that final turbine selection requires less turbines to be installed to meet the 30MW maximum project capacity, those turbines with the lowest energy yield would be removed. The number of turbines would be 14 in the case of the Suzlon s88, or 10 in the case of the Vestas V90 3.0MW turbines.

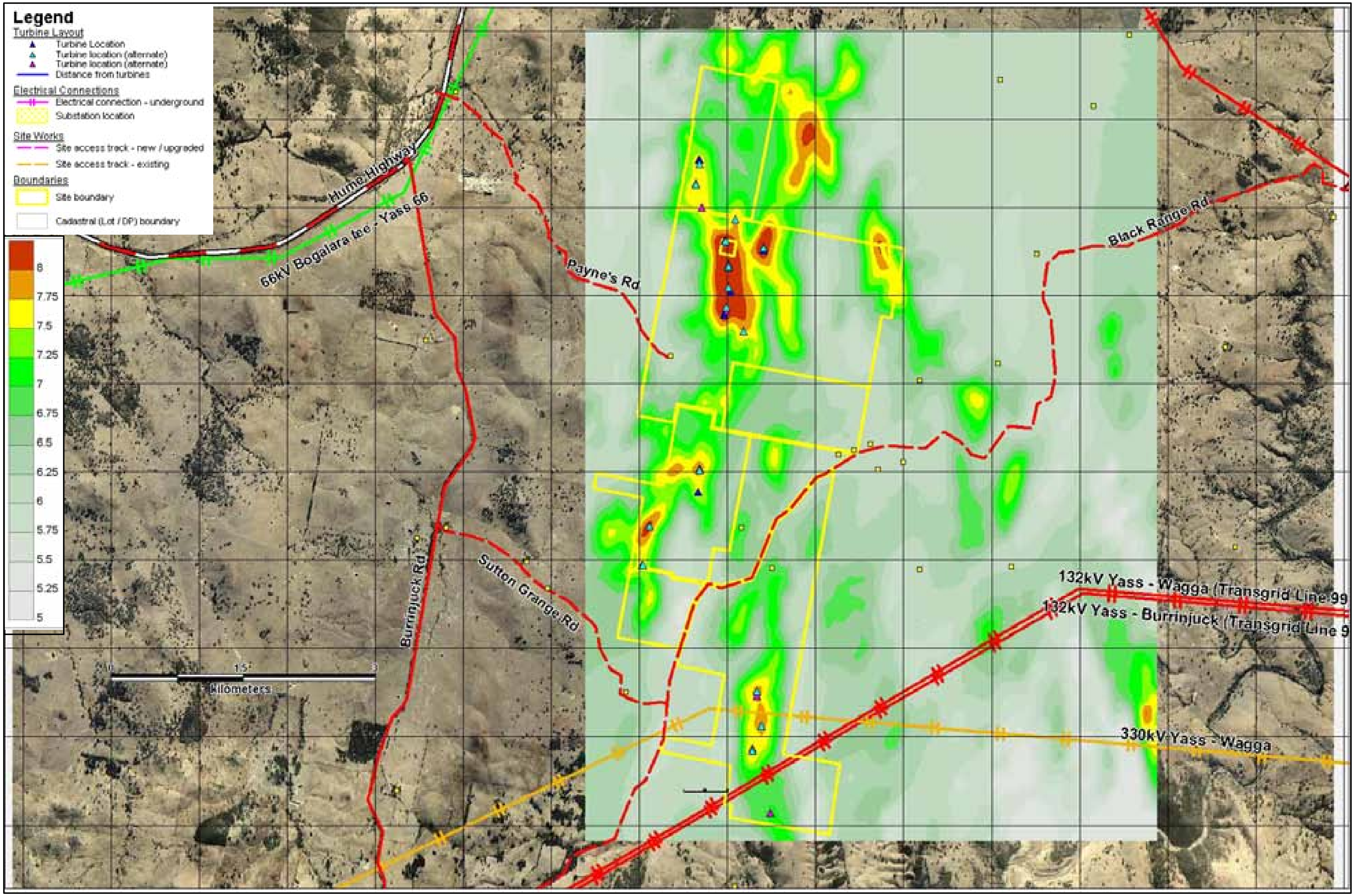



**Figure 3.5 Wind speed profile (in metres/second) across the site (analysis prepared by Garrad Hassan)**

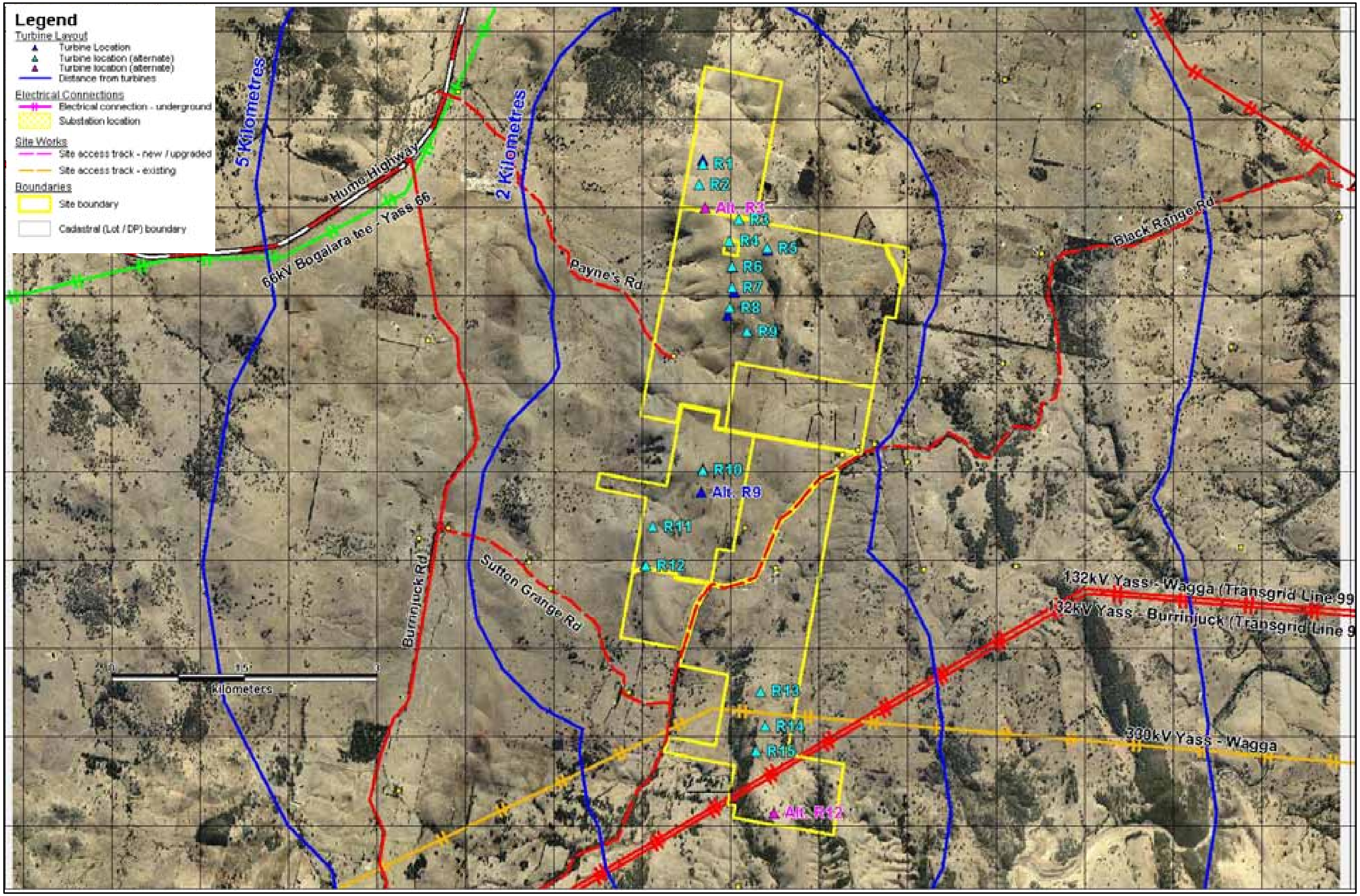



**Figure 3.6 Wind turbine layout (combined)**

In understanding the layouts and variations in Figure 3.6 the following points are of use:

- The turbine locations marked as light blue triangles and labelled R1 to R15 are expected locations based on Type A turbines, this layout was prepared using the REPower MM82 2.0MW turbine;
- The turbine locations marked as dark blue triangles are expected turbine locations for Type B turbines; this layout was prepared using the Vestas V90 1.8MW turbine. In most cases these turbines are in similar locations to turbines R1 to R15, though it can be seen that turbines near R1, R7 and R8 have moved slightly to allow for the larger turbine spacing required;
- The turbine location marked Alt. R9 is an alternate location for the turbine R9, required for Type B turbines due to the larger turbine spacing required;
- The turbine locations marked Alt.R3 and Alt. R12 are alternate locations for turbines R3 and R12 respectively, to be used where a specific turbine's noise characteristics would be unable to meet the required noise limits using the standard layout.

### 3.3.4. Electrical connections

#### INTRODUCTION

To export power from the wind farm, it is necessary to electrically connect each wind turbine to the NSW electricity grid. The onsite electrical works would include:

- A site substation to step the voltage up from reticulation voltage to transmission voltage of 132,000V, suitable for connection to TransGrid's Yass-Wagga Wagga 132kV transmission line which crosses the site;
- Onsite power reticulation cabling (underground and overhead) at either 22,000V or 33,000V to connect wind turbines to the control room and site substation;
- Onsite control and communications cabling; and,
- An onsite Control building housing control and communications equipment.

#### SITE SUBSTATION AND 132KV CONNECTION

A substation is required to convert power from on-site reticulation voltage of 22kV or 33kV to a transmission voltage of 132kV suitable to connect into TransGrid's transmission system. It would also include all necessary ancillary equipment such as control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation.

The substation area will be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. The ground will be covered partly by crushed rock and partly by concrete pads for equipment, walkways and cable covers, and will have an earth grid extending outside of the boundary of the security fence.

The fenced substation will occupy approximately 4,900 metres$^2$ (70 metres by 70 metres) and the contiguous control building will occupy around 50 metres$^2$ (10 metres by 5 metres). The buildings and fence will be ringed by gravel hardstand and concrete areas free of vegetation. A further perimeter area within 25 metres of the substation and control room of mixed native-exotic pasture will be managed as an Asset Protection Zone (APZ) to maintain low fuel levels. The APZ is based on topography, vegetation and structural vulnerability, and is consistent with the minimum specifications for grasslands contained in the Planning for Bushfire Protection guidelines issued by the NSW Rural Fire Service (2001).

The indicative location of the overhead powerline is shown on Figure 3.7. The proposed locations of the substation, control building and associated Asset Protection Zone are indicated in Figure 3.8.

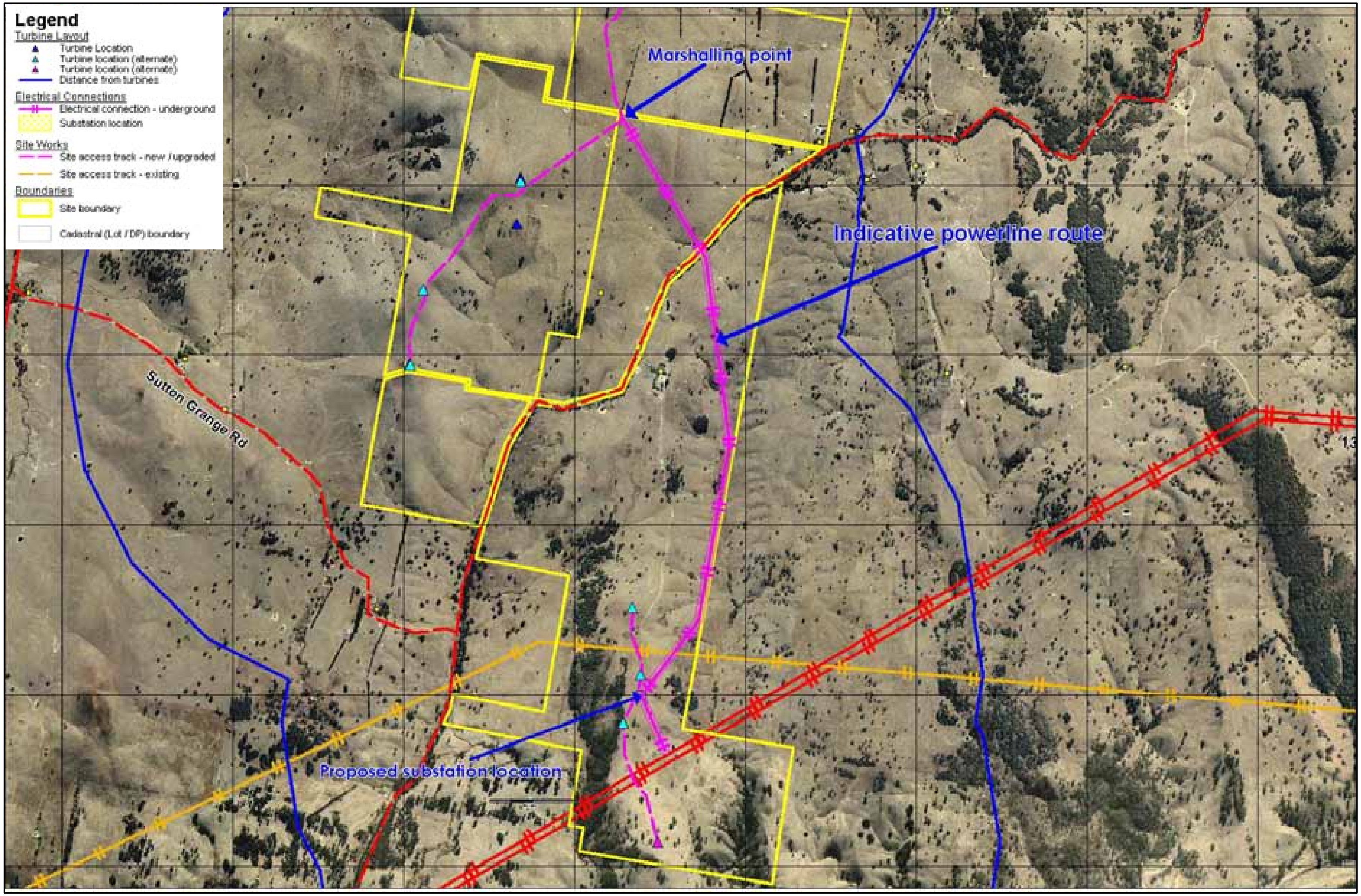



**Figure 3.7 Indicative powerline route**

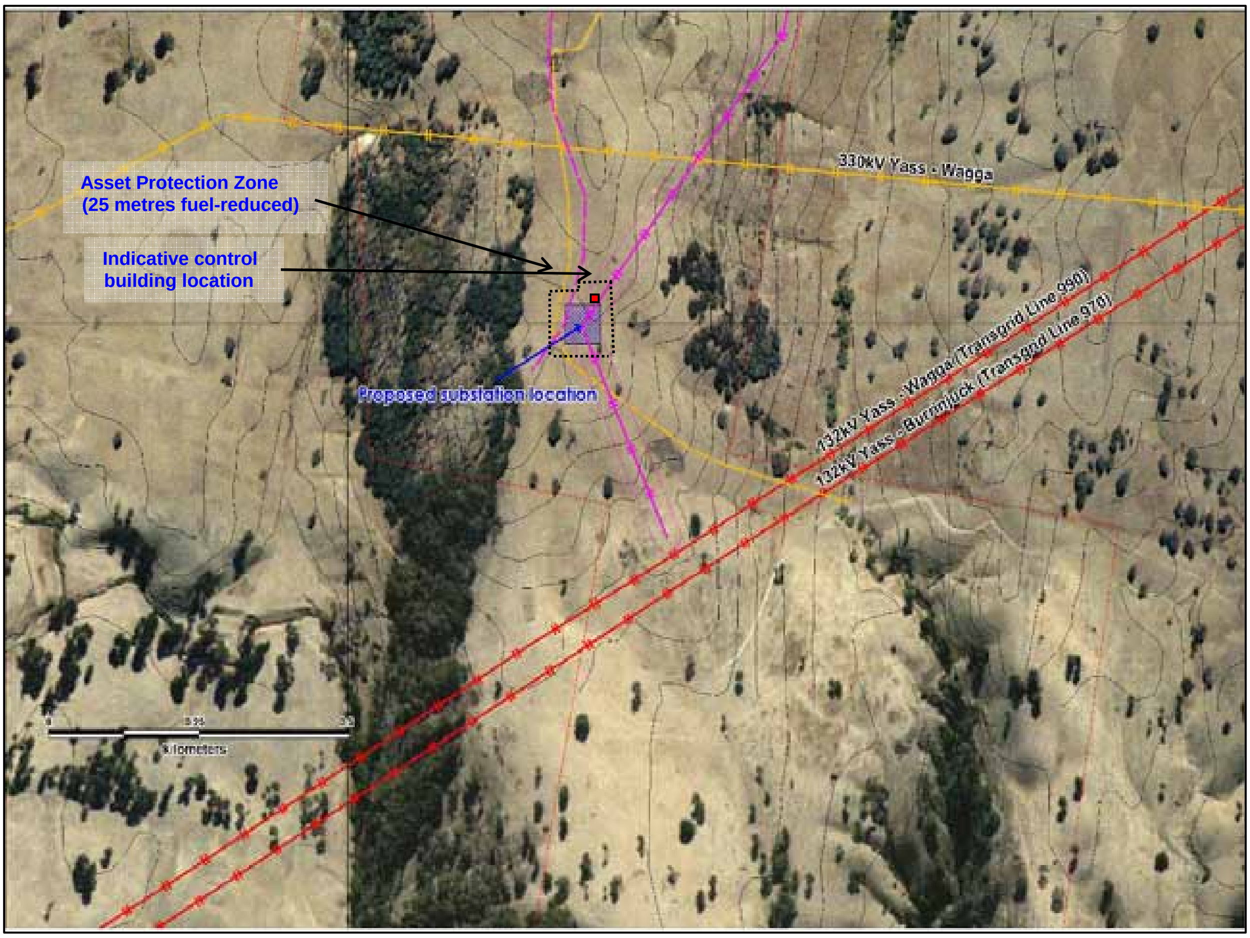



**Figure 3.8 Proposed substation and control building location**

This location has been selected to minimise environmental disturbance of the site; to reduce cabling lengths and therefore reduce costs and environmental impacts; to minimise stock management issues for current farm use; to reduce the need for tree clearance for the 25 metre Asset Protection Zone and to reduce visual impacts and ground disturbance of the site.

Figure 3.9 shows a typical substation of the size proposed for this project. This is a photograph of the 15MVA Eastern Star Gas Generator substation at Narrabri in NSW. While only operating at 15MVA and 66,000V, the proposed 132kV 30-40MVA substation would be similar in physical size and layout to this substation. Please note that the substation is the area within the wire boundary fence shown, the cubicles and building to the bottom left of this photo are related to the gas generator and would not be required at the wind farm site.

The substation would include a 30 – 40MVA power transformer. This transformer is likely to be of the oil-cooled variety, and therefore may contain considerable quantities of oil. Provision would be made in the design of the substation for containment of any oil which may leak or spill.

It is likely that minor alterations would be required to the existing transmission line to allow connection of the new cabling. This may include the construction of new concrete or wood power poles at the connection point.

**Figure 3.9  Typical single-transformer substation**

*Photograph courtesy of Country Energy*

### CONTROL BUILDING

A control building would be built onsite to house instrumentation and control equipment and communications equipment.  This building would also house routine maintenance stores, a small work area, and amenities for staff.

The control building would be of concrete slab on ground construction with steel frame, metal or brick walls, a non-reflective sheet steel (colorbond) roof, and would include rainwater collection and storage for domestic use.  A composting or septic toilet system would be installed for staff use. It is likely that the control building will be air-conditioned.

A telephone connection to the Control building would be required to allow remote monitoring and control of the wind farm.  This connection could consist of multiple buried telephone lines or a satellite connection.  It is possible that a microwave link may be required by Transgrid for substation control, in this event this would be subject to a license application to the Australian Communications and Media Authority.

Standard 240 Volt / 415 Volt power would also be installed at the control building.

The control building will be located in the vicinity of the site substation, and is expected to be a joint facility for control of the substation as well as the wind farm. The precise location of the control building will be determined in consultation with Transgrid. The control building will occupy around 50 metres$^2$ (10 metres by 5 metres). A perimeter area within 25 metres of the substation and control room will be managed as an Asset Protection Zone to maintain low fuel levels.

Figurev 3.8 shows the proposed location of the control building and associated fuel-reduced Asset Protection Zone.

#### ONSITE ELECTRICAL RETICULATION

Within each wind turbine, or in the adjacent pad-mount transformer, the power voltage is stepped up from generation voltage to either 22,000 Volts (22kV) or 33,000V (33kV) for reticulation around the site. The selection between these voltages is a commercial consideration; power line easements, cable trench design, and reticulation routes are identical.

Each wind turbine must be connected together at reticulation voltage, and then connected to the Site Substation. These connections are to be made using a combination of underground and overhead cabling.

Cable trenches would, where possible, be dug within the onsite roads to minimise any related ground disturbance. Short spur connections would come off a main cable run which would approximately follow the main road access route on site. Underground cables would require a trench of approximately 1 – 1.5 metres deep and 0.5 – 1 metre wide.

Approximately 4km of new 22kV or 33kV overhead power line would be required to connect the substation to the northern turbine groups. Overhead 22kV or 33kV lines would require an easement of 20 metres, and would be located to minimise clearing of trees, and to reduce visibility from neighbouring houses. Powerlines would be mounted on single wood or concrete poles approximately 17 - 22 metres high, spaced approximately 100 – 200 metres apart (depending on terrain), and coloured to blend in with the surroundings.

The routes for power reticulation would be finalised taking into account the ease of excavation of cable trenches, and with an effort to minimise impacts on areas with sensitive biodiversity or heritage; to minimise clearing of trees; and to minimise erosion issues resulting from construction.

#### CONTROL CABLING

In addition to the power reticulation cabling, control and communications cabling is required from the Control building to each wind turbine, and to the Site Substation. This control cabling would be installed using the same method and route as the power cabling above, that is, strung from the same poles as overhead lines, or dug in the same cable trench as underground cables.

Control cables would consist of twisted pair cables, multi-core cables or optical fibres, and would be used for central and remote control of individual wind turbines; substation controls; monitoring of weather data and equipment; and communications to offsite control centres where required.

### 3.3.5. Site civil works, roads, and access

#### ACCESS ROUTE

Access routes to the site are expected to be via the Hume Highway, to Payne’s Rd and onto site using a new track on the “Linbrook” property.

In addition, a temporary new crossing will be required across Black Range Rd near the “Ferndale” property to allow access to the southern part of the site.

Every effort would be made to ensure vehicles:

- Are minimised in size, length, and number
- Travel with appropriate regard to other road users
- Travel at times which minimise traffic noise impacts to surrounding residents.

It is anticipated that minor road works would be required on Payne’s Road and the Black Range Road crossing, specifically, grading of the surface and removal of a small number of encroaching branches.

Access may require construction of new gates or stock grids, and removal of a small number of trees may be required.

### ACCESS TRACKS

Onsite access tracks for construction and operation would be unsealed formations up to 6m in width, and are required to the base of each wind turbine location and the location of the site substation and control building.

The main access tracks would be located approximately as indicated in Figure 3.10. From the main access tracks, side tracks would be taken to each wind turbine location by the shortest reasonable route.

At each wind turbine base, a firm hardstand area would be required to provide a level and stable base for cranes necessary for construction. New gates and possibly new or realigned fences may also be required to protect stock during the construction phase.

Once the construction has finished, any tracks not used for normal farming practice or turbine maintenance would be spread with recovered topsoil and allowed to grow over or planted with appropriate grasses. Likewise, hardstand areas would be spread with recovered topsoil and allowed to grow over or planted with appropriate grasses.

Every effort would be made to:

- Minimise the number and length of necessary access tracks
- Locate access tracks along the route of existing farm tracks
- Locate where clearing of existing native vegetation would be minimised
- Locate where impact on sensitive biodiversity or heritage areas would be minimised
- Construct with due regard to erosion, sediment control and drainage.

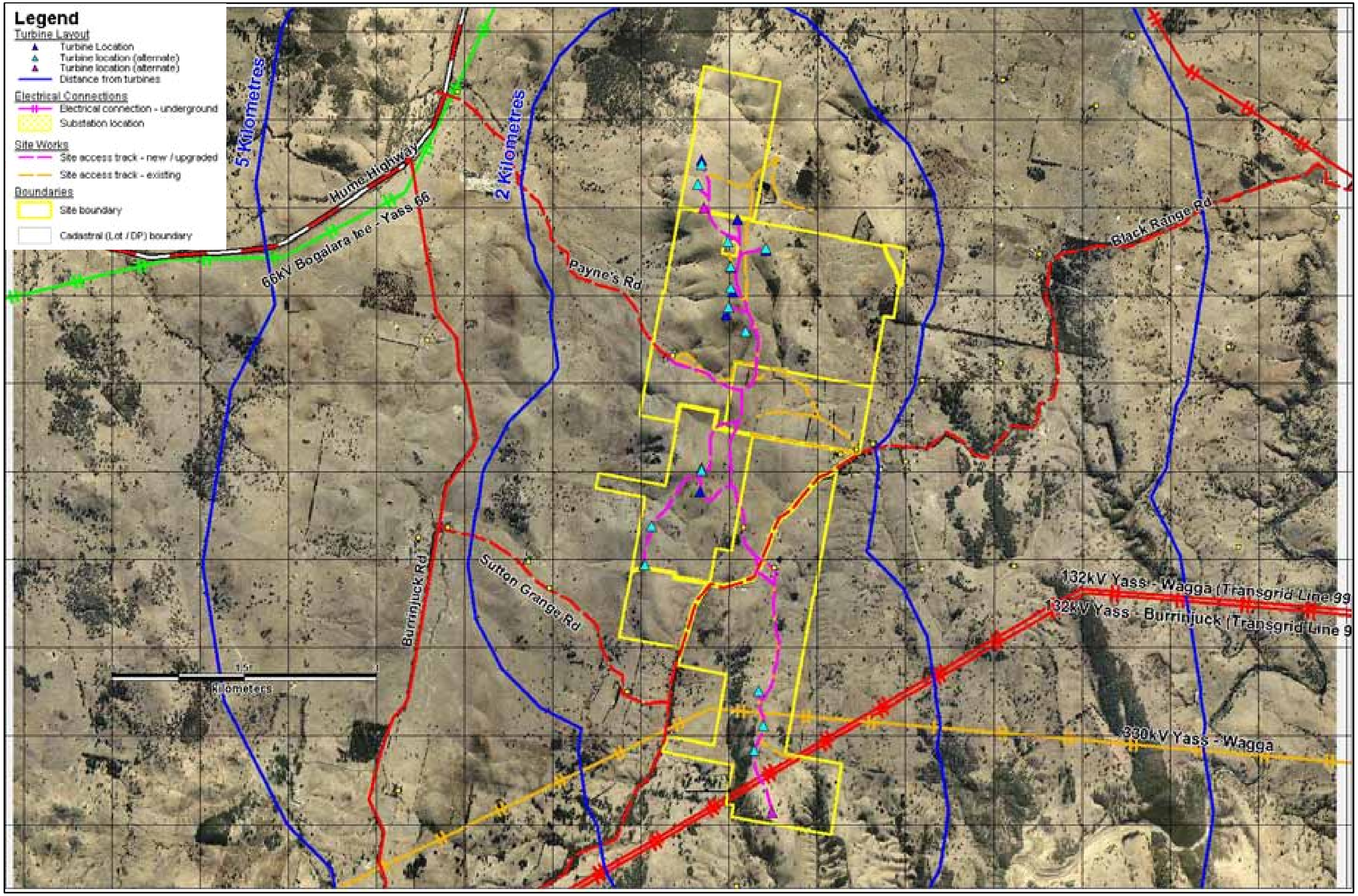



**Figure 3.10 Civil works and roads**

### 3.3.6. Wind monitoring equipment

Taurus Energy is establishing a new 65m high lattice tower wind monitoring mast to assess wind speeds at the site (not subject to this Development Application). It is proposed to continue operation of this mast to allow ongoing performance monitoring of the site. Data from this mast is also used for the acoustic noise assessment.

Pending final wind turbine placements, it may be necessary to move this existing wind monitoring mast to a different location within the site, to replace the wind monitoring mast with a shorter or taller wind monitoring mast, or to install an additional wind monitoring mast to assist with control and operation of the site.

### 3.3.7. Other site services

Operating staff would be responsible for removal of all other wastes at the site; no waste management services would be required.

## 3.4. Construction facilities and staging of works

### 3.4.1. Phase 1: Construction of the wind farm

The construction phase of the wind farm would occur over a 3-6 month period and would include such activities as:

- Transport of people, materials and equipment to site
- Civil works for access track construction, footings and trenching for cables
- Establishment, operation and removal of concrete batching plant and/or rock crushing equipment onsite, if required
- Installation of wind turbines using large mobile cranes
- Construction of substation and onsite power reticulation lines and cables
- Temporary site offices and facilities
- Restoration and revegetation of site on completion.

Construction would commence with the upgrading of roads and all other site civil works, including preparation of hardstand areas, and laying of cables. This would be followed by preparation of concrete footings, which must be cured for many weeks prior to construction of wind turbines.

Wind turbine construction can be relatively fast once the footings are prepared, with wind turbines installed at a rate of 2 – 4 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub.

The necessary substation construction and grid connection works would be carried out in parallel.

The commissioning phase would include pre-commissioning checks on all high-voltage equipment prior to connection to the Transgrid transmission system. Once the wind farm electrical connections have been commissioned and energised, each wind turbine is then separately commissioned and connected and put into service.

On completion of construction, the site would be revegetated and all waste materials removed from the site. Any temporary road realignments would be restored and revegetated.

**WIND TURBINE CONSTRUCTION AND INSTALLATION**

Installation of the wind turbine blades would require establishment of a level (<1% gradient) and stable hardstand area at the base of each wind turbine. This hardstand area would support cranes used for the major component lifts, and could have an area of up to 30 metres by 30 metres. It is also necessary to have a delivery area for the various components adjacent to the hardstand area, in most cases it is expected that the access road could be used as this delivery area.

Installation of the wind turbine blades would also require cleared areas at the base of each wind turbine to manoeuvre the wind turbine blades. Generally, the three blades are connected to the hub on-ground, and the whole wind turbine lifted as one piece. There is some scope to avoid damage to or removal of native vegetation during this stage by careful positioning of the blades to avoid trees and shrubs, this would be carried out wherever possible.

The wind turbines would be anchored using large concrete gravity footings or smaller concrete footings bolted to rock, as determined by geological parameters. Some blasting of rock may be required to excavate footings, dependent on the geological properties of the rock and design of the footing. Should controlled blasting be required, it would be carried out in accordance with all relevant statutory requirements.

### ROCK CRUSHER

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades. For this purpose, it is possible that a mobile rock crusher would be used onsite.

### CONCRETE BATCH PLANT

Concrete for the proposed wind farm may be sourced as pre-mix concrete delivered from plants in Yass, or from a project batch plant established on or near the site.

The possible batch plant does not form part of the proposal. If required, this development would be assessed independently. Details of the possible location and nature of a batch plant are provided in this assessment for information and context at this stage.

An on-site batch plant would involve an level area of up to 50 metres by 75 metres onsite to locate the loading bays, hoppers, cement and admixture silos, concrete truck loading hardstand, water tank, and stockpiles for aggregate and sands. Depending on the final location, the site may include an in-ground water recycling / first flush pit to prevent dirty water escaping onto the site, and would be fully remediated after the construction phase.

If required, the batch plant would be located on an existing clear and level area of the site. The likely location is at the Bogo Quarry near the junction of Hume Highway and Payne’s Road, shown in Figure 3.11. Access to the quarry is via Payne’s Road, and aggregate and sands for producing the concrete could be sourced from this quarry which would minimise additional truck movements.

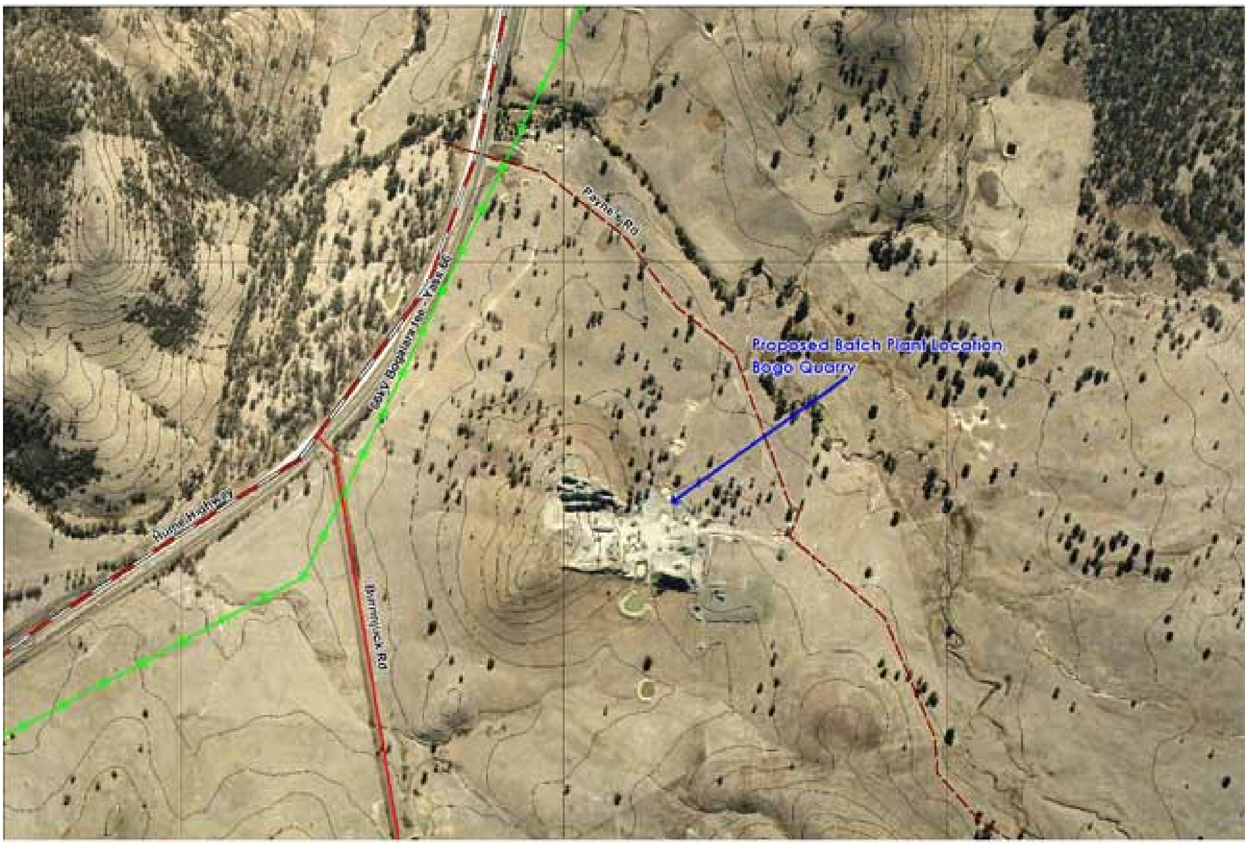



**Figure 3.11 Possible concrete batch plant location**

Sands and aggregate could be sourced from existing sand and gravel pits within the local area (e.g. Bogo Quarry), or from excavation of footings. Every effort would be made to source clean sands and aggregates to prevent transport of weeds to site. Where possible, sands and aggregates used would be similar in colour to materials already found on site.

In the event that an on-site batch plant is required, water would most likely be sourced from an existing bore on the Linbrook property. It is possible that, depending on water levels, water from existing dams on the property (or at the Bogo Quarry) could be used, or water trucked in from off site.

## 3.4.2. Phase 2: Wind farm operation

Once installed, the wind farm would operate for an economic life in the order of twenty to thirty years. The economic life would depend on various considerations including the increasing costs of maintenance; requirements for major repair work; and cost and efficiencies of possible replacement wind turbines.

During the operation phase, while the wind farm operates unattended, the wind turbines and other equipment would require regular maintenance, and it is possible that at some stage some equipment may require major repair or replacement. In addition, during the initial operating years, operator attendance may be more regular while the wind farm operation is being fine-tuned and optimised.

#### ROUTINE MAINTENANCE

To maintain the wind farm operating in a safe and reliable manner, it would require regular inspection and operation on an as needs basis. This would generally be carried out using standard vehicles.

In addition, regular maintenance is required, generally at 3, 6 and 12 monthly intervals. This does not require use of major equipment, and could be carried out in a normal utility or small truck and would not require any additional works or infrastructure.

Each turbine requires around 8 days of maintenance per annum, which means that the maintenance crew is likely to be on site in most weeks of the year.

#### MAJOR REPAIRS

It is possible that major unexpected equipment failures could take place during the life of the wind farm. While wind turbines and electricity connections are designed for a 20 - 30 year life, failures can occur due to a number of factors including lightning strike (either onsite on the wind turbines or offsite on the transmission line) and damage to key components (such as transformers or gearboxes).

Most repairs can be carried out in a similar manner to routine maintenance, with some exceptions:

- Replacement of wind turbine blades, if necessary, would require bringing new blades to site and installation of these blades using large cranes. The requirements are similar to the construction phase, and the access tracks established for construction may need to be brought into operation again, although helicopters may sometimes be used for one-off replacements.
- Replacement of wind turbine generators or gearboxes would require a crane and low loader truck to access the site
- Replacement of the substation transformer would require a low loader truck to access the site.

#### SITE MONITORING PROGRAM

A site monitoring program would be established to determine additional impacts of the wind farm. The monitoring program would assess noise impacts from the operational wind farm as well as biodiversity impacts, given the paucity of information available on the impact of wind farms on Australian birds and bats. As well as providing information able to be used to minimise the operational impacts of the Conroys Gap Wind Farm on birds and bats, it would be a source of information for other wind farms in Australia.

Monitoring of the wildlife impacts of the wind turbines would occur at regular intervals during the initial phase of operation. This could be carried out using a standard vehicle and would not require any additional works or infrastructure.

### 3.4.3. Phase 3: Wind farm decommissioning

The life of the wind turbines is 30 years at which point the wind turbines would be replaced, overhauled or removed from the site. It is expected that a special purpose company would own and operate the wind farm over its life. A provision will be made in that company's accounts to ensure sufficient funds are set aside over the life of the project to cover the cost of the eventual project decommissioning.

Decommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines. All underground footings and cable trenches would remain in situ, all other equipment would be removed from site. No concrete batching plant or materials delivery would be required, therefore the decommissioning period would be significantly shorter and with significantly less truck movements than the construction phase.

The scrap value of turbines and other equipment is expected to be sufficient to cover the majority of the costs of their dismantling and site restoration.

## 3.5. Site restoration

To ensure that areas disturbed during construction and decommissioning/recommissioning are rehabilitated appropriately as soon as practicable after works, a site restoration plan would be prepared in advance which would set out protocols for restoration works. This measure is included in the proponent's Statement of Commitments, discussed in section 3.7 and presented in Attachment 3.

In general, the following principles would be employed:

### 1. Site Preparation

Site preparation aims to provide the best possible conditions for plant root growth (Parr-Smith *et al.* 1998). This is achieved by improving soil and subsoil texture by softening and aeration, providing adequate water and nutrients and removing competition from weed species.

Noxious species would be sprayed with an approved herbicide before work begins to minimise the spread of weeds. Two or three sprayings may be required. Topsoil would be separated from underlying subsoil as it is excavated. All excavated material would be placed on a geotextile fabric to prevent damage to underlying vegetation. The topsoil would be respread over the disturbed area to act as a seed bank, providing nutrients for the proposed plantings and/or seeding.

Sods of native species and non-invasive exotics need to be carefully removed, stored and cared for, requiring regular watering and replacement as soon as possible. A root base at least 15cm deep is required, sods would not be so large that they require more than one person to lift, and the above ground growth of shrubs would be trimmed to allow the root mass to support new growth. If sods cannot be replaced within a week, they will require nursery-like conditions to preserve them.

### 2. Stabilisation

Stabilising the disturbed trench easements would prevent erosion, reduce the impact of frost, wind, water runoff and raindrop action and would provide a final surface for revegetation.

Stabilisation would occur immediately after the completion of construction or progressively as sections are completed. Disturbed areas would be stabilised using organic erosion control matting or mulch.

### 3. Revegetation

Revegetation is the process of establishing plants on a stabilised site (Parr-Smith *et al.* 1998). The sites would be revegetated progressively as works are completed.

Species composition would depend on each site. In areas that are predominantly native, native species should be sown. Sterile annuals can be sown initially to stabilise the site. These provide a temporary cover crop whose lifecycle increases the survival rate of the native vegetation that is subsequently planted.

Species of local provenance are unlikely to be available to purchase as tube stock. An order must be placed 6-9 months before they are required to plant to ensure enough time to source, germinate and grow the stock. Local wallaby grass straw may provide ideal mulch containing viable local seed, if harvested at the correct time of year and oversown.

### 4. Monitoring

On-going monitoring and maintenance is required following rehabilitation. This step can require a greater level of resources than the initial establishment of native vegetation, depending on the response of the ecosystem to the actions described above. It is an essential step as techniques that work well at one site may prove inadequate at another site, leaving soil denuded and vulnerable to erosion.

Maintenance would involve replacement of dead or missing plants, protection from grazing animals if necessary, removal of weeds and watering through dry periods. Mulch may need to be replaced when it breaks down or where there is insufficient plant groundcover.

## 3.6. Development timelines

Until the Development Approval has been received, it is not possible to finalise the additional agreements required to reach financial close on the project and commence construction. Once Development Approval has been granted, the proponent must negotiate and enter into:

- ✓ Final Lease and Easement agreements with landowners;
- ✓ Grid Connection Agreements with Transgrid;
- ✓ Turbine Supply agreements with an appropriate firm;
- ✓ Construction Agreements with appropriate firms;
- ✓ Power Purchase Agreement with an appropriate energy retailer;
- ✓ Finance Agreements with appropriate equity and debt providers;
- ✓ other agreements as required.

It is expected that it would take at least one year to finalise these agreements and thereby reach Financial Close. In particular, it should be noted that negotiations to enter into a Power Purchase Agreement cannot practically commence until the development approval has been received. However, the market for power purchase agreements is variable and there is no guarantee over the timing of availability of power purchase agreements. Likewise, the availability of turbines is subject to international market pressures and some delays may occur.

Accordingly, the proponent is not able to commit to a fixed timetable for development. Our expectation is that financial close would be reached and construction would commence within 5 years of receiving the development approval.

An indicative timetable for development from financial close (FC) is shown in Table 3.3.

**Table 3-3 Indicative project development timetable**

| | **Time Required** | **Time Elapsed from Financial Close** |
|---|---|---|
| Financial close | --- | FC |
| Construction lead-times | 6 months | FC + 6 months |
| Construction: Site Preparation | 3 months | FC + 9 months |
| Construction: Turbine Erection / Commissioning | 3 months | FC + 12 months |
| Commercial Operation | | FC + 12 months |
| Construction: Site Remediation | 6 months | FC + 18 months |
| Project Operation | 20 – 30 years | FC + 21 – 31 years |
| Project Decommissioning + Site Remediation | 12 months | FC + 22 – 32 years |

## 3.7. Associated development and future implications

The wind farm would require an inspection and maintenance regime, involving regular visits to the site using light vehicles. Landholders may also be involved in inspecting and maintaining the turbine sites to monitor bird mortalities, manage vegetation and control introduced fauna.

The proponent will enter into a Grid Connection Agreement with Transgrid to allow connection of the system to the NSW electricity grid.

The proposal includes the decommissioning of the wind farm at the end of its productive life (expected to be around 30 years). At this time, the wind farm would be removed and the site rehabilitated. Any proposal to replace and recommission the wind farm would be subject to a further assessment and approval process.

## 3.8. Statement of commitments

### 3.8.1. Development of the commitments

Under the Part 3A reforms, proponents of major projects are required to provide a Statement of Commitments on how they propose to manage the project to minimise and avoid impacts. Taurus Energy submitted a preliminary Statement of Commitments to the Department of Planning in its Project Application for the Conroys Gap wind farm.

The commitments have been developed into a more comprehensive set of environmental impact avoidance and mitigation measures, which also incorporate:

- specific recommendations contained in the specialist biodiversity, archaeological, traffic, visual and noise assessment reports;
- measures identified during the preparation of this Environmental Assessment;
- measures generated by consultation with the community and government agencies; and
- the requirements of a range of standards and guidelines, including Department of Planning Conditions of Approval Database for Part 3A Projects (DoP 2005), the Guidelines for the Planning, Construction and Maintenance of Tracks (DLWC 1994), Guidelines for the control of erosion and sedimentation in roadworks (RTA), EPA guidelines relating to noise and water pollution control, and Fisheries NSW guidelines relating to drainage line and creek crossings.

Avoidance and mitigation measures have been developed for the design, construction, operation and decommissioning phases of the project.

The avoidance and mitigation measures are identified for each key subject area in sections 7 and 8 of this EA, including soil and water, vegetation, fauna and habitat, visual impacts, noise impacts, heritage, transport and human health and safety. The measures are consolidated in Attachment 3. Some rationalisation has been applied in this consolidated list of measures to minimise repetition.

The measures cover general best practice measures applicable to a wide range of projects, and specific measures tailored to the environmental context and nature of the wind farm proposal.

### 3.8.2. Implementation of the commitments

The impact mitigation and avoidance measures would be implemented as part of a Project Environmental Management Plan (PEMP), comprising a Construction Environmental Management Plan (CEMP) and an Operation Environmental Management Plan (OEMP). The EMP would comply with the State Government's Guideline for the Preparation of Environmental Management Plans (DIPNR 2004).

An outline of the PEMP is provided at Attachment 4. In addition to the measures, the PEMP would include performance indicators, timeframes, implementation and reporting responsibilities, communications protocols, a monitoring program, auditing and review arrangements, emergency responses, induction and training and complaint/dispute resolution procedures.

Where required, sub-plans would be developed as part of the PEMP covering specific issues such as erosion and sedimentation, vegetation and weed management, community liaison and complaint management etc. Provision would also be made for post-works soil and rehabilitation auditing, and post-construction weed assessments.

The CEMP, incorporating the avoidance and mitigation measures would be applied in the field as part of contractors' EMPs.

### 3.8.3. Monitoring

The OEMP would contain specific monitoring provisions for noise and visual impacts as required and operational impacts on birds and bats.

The OEMP would contain details of a three-tiered monitoring program for bird and bat mortalities and habitat utilisation impacts, comprising the first six months of operation, the first two years of operation and an indefinite period thereafter (refer section 7.2).

Monitoring methods and data standards for dead bird searches, indirect disturbance impact assessment and habitat avoidance studies would be based on protocols in the Interim Standards for Assessing the Risks to Birds from Wind Farms in Australia (Brett Lane and Associates 2005).

### 3.8.4. Adaptive management

The OEMP would employ adaptive management in response to monitoring results and other inputs. The wind farm infrastructure and design allows a degree of flexibility to address any unforeseen impacts on biodiversity or social values.

Specific management responses would be determined by the nature and extent of impacts, but could include adjustments or enhancements to turbine and associated infrastructure, periodic shutdown, vegetation screening and other impact mitigation measures, or indirect compensatory measures such as contribution to community resources and services and off-site habitat protection or enhancement.

In the case of bird and bat mortality, threshold mortality rates for threatened or sensitive bird and bat species would be determined for each of the three monitoring periods. The thresholds would trigger a management response, which would vary depending on the nature and extent of the impact. Similarly, significant impacts on habitat utilisation (reflected for example in declining breeding success) could trigger a mitigation response.

# 4. PROJECT JUSTIFICATION

## 4.1. The viability of wind power

### 4.1.1. International wind power development

Wind farms are an increasingly important source of electricity generation worldwide. Internationally, by the end of 2004, the total capacity of wind energy was more than 47,000 megawatts which amounts to over three times the total capacity of power generation in New South Wales. About 72% of the total worldwide capacity has been installed in the last 5 years (AWEA 2005).

Wind power technology has evolved rapidly through an R&D stage in the 1980's, through rapid expansion and consolidation in the industry in the 1990's and is now a mature, advanced energy technology. As the technology has developed, the cost of wind power has been reduced. In some regions, wind farms are already competitive with alternate energy sources such as fossil fuels.

Current worldwide wind capacity (MW) is shown in Tables 4.1 and 4.2.

**Table 4-1 Worldwide wind power at end 2005 (WWEA 2006)**

| Region | Installed Capacity 2005 (MW) | Installed Capacity 2005 in % | Installed Capacity 2004 (MW) | Installed Capacity 2004 in % |
|---|---|---|---|---|
| **Europe** | 40.932 | 69,4 | 34.758 | 72,9 |
| **Africa** | 252 | 0,4 | 240 | 0,5 |
| **Americas** | 10.036 | 17,0 | 7.367 | 15,5 |
| **Asia** | 7.022 | 11,9 | 4.759 | 10,0 |
| **Australia/Pacific** | 740 | 1,3 | 547 | 1,1 |
| **World** | **58.982** | **100,0** | **47.671** | **100,0** |

**Table 4-2 Worldwide wind power capacity - top 20 countries (WWEA 2006)**

| Country/region | New Capacity Installed in 2005 (MW) | Total Capacity Installed at end 2005 (MW) |
|---|---|---|
| 1. Germany | 1,798.8 | 18,427.5 |
| 2. Spain | 1,764.0 | 10,027.0 |
| 3. USA | 2,424.0 | 9,149.0 |
| 4. India | 1,430.0 | 4,430.0 |
| 5. Denmark | 4.0 | 3,128.0 |
| 6. Italy | 452.4 | 1,717.4 |
| 7. United Kingdom | 465.0 | 1,353.0 |
| 8. China | 496.0 | 1,260.0 |
| 9. The Netherlands | 141.0 | 1,219.0 |
| 10. Japan | 143.8 | 1,040.0 |
| 11. Portugal | 500.0 | 1,022.0 |
| 12. Austria | 213.0 | 819.0 |
| 13. France | 371.2 | 757.2 |
| 14. Canada | 239.0 | 683.0 |
| 15. Greece | 100.3 | 573.3 |
| 16. Australia | 193.0 | 572.0 |
| 17. Sweden | 57.9 | 509.9 |
| 18. Ireland | 157.1 | 496.0 |
| 19. Norway | 0.0 | 270.0 |
| 20. New Zealand | 0.1 | 168.2 |

According to a media statement released 1 February 2006 by the European Wind Energy Association (EWEA), the EU cumulative wind power capacity increased by 18% to 40,504 MW by the end of 2005, up from 34,372 MW at the end of 2004. In Europe alone, 6,183 MW of wind power capacity were installed in 2005, representing a wind turbine manufacturing turnover of some €6 billion.

In this same media statement Prof. Arthouros Zervos, President of EWEA stated:

> *"With the installation of a record 6,183MW in 2005, wind energy has achieved the European Commission's 40,000MW target for 2010, five years ahead of time. This underlines the technology's ability to deliver fast and vast amounts of clean energy."*

This strong growth in recent years has led the European Union to review its projections for wind power capacity. Figure 4.1 shows that the EU projections to 2010 have recently been increased, from the original 40,000MW to a new expectation of over 72,000MW in Europe.

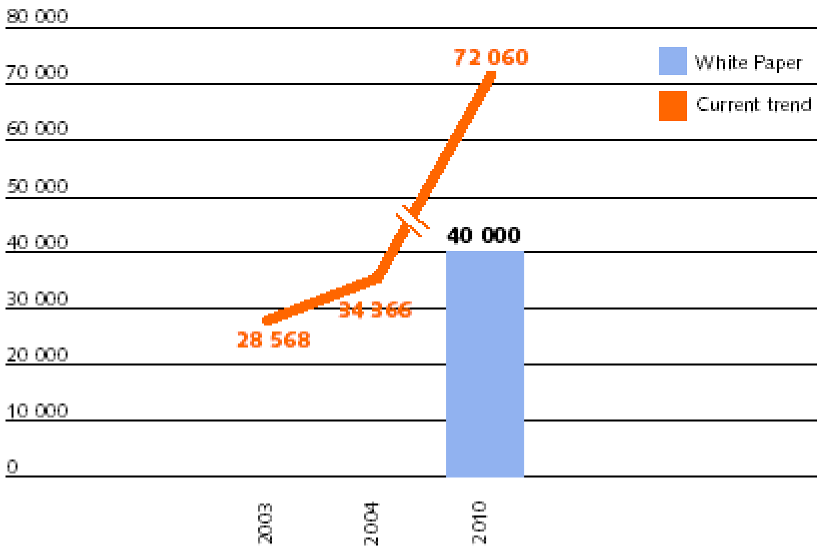



**Figure 4.1 European Union wind power capacity projections (EC 2006)**

Other markets are growing strongly in addition to this rapid growth in the European Union.

China has the potential to be world's biggest wind energy market by 2020, doubling its current wind energy target for 2020 to 20,000MW (Hydro Tasmania 2006).

In the USA, 2,500MW new capacity was installed in 2005 with over 3,000MW expected in 2006 and similar growth in 2007 (AWEA 2006b).

In many countries, even with already strong growth, governments are implementing policies to further accelerate the adoption of wind and other renewables for electricity generation. In a media statement in December 2005, the United Kingdom's Energy Minister, Malcolm Wicks stated:

> *"As an island nation, we would be foolish not to exploit to the full all the natural resources that affords. Research from Oxford University recently confirmed that Britain has the best wind resource in Europe, providing most energy during peak daytime and winter periods. I am wedded to increasing the amount of energy we source from this and other forms of renewables. This year, there's been record growth in the industry and our drive to reach our 10 per cent target by 2010 is undiminished."*

The European Wind Energy Association (EWEA) summarises many of the drivers for increased government support for wind as part of a balanced energy policy:

> *"Wind energy is a significant resource; it is safe, clean, and abundant. Unlike conventional fuels, wind energy is an indigenous supply permanently available in virtually every nation in the world, delivering energy security benefits of eliminating fuel costs and long term fuel price risk, and avoiding the economic, political and supply risks of dependence on imports from other countries. Wind power has no resource constraints; the fuel is free and endless." (EWEA 2005).*

### 4.1.2. Wind power in Australia

In Australia, the cost of wind energy is more than the cost of coal-fired electricity at the wholesale level. Wind farms are viable because of the Federal Government's Mandatory Renewable Energy Target (MRET). MRET requires electricity retail companies (such as Country Energy) to purchase a percentage of their power from renewable energy sources.

This proposed wind farm will provide renewable energy which is eligible for Renewable Energy Certificates under the Federal Government's scheme. The full costs of MRET have already been taken into account by electricity retail companies in power prices set by them. Therefore, the wind farm will not increase prices for NSW residents or businesses. In fact, it will reduce the costs of production by reducing transmission losses to the region.

Many people in Australia do not acknowledge the government support that coal-fired generators have received over many years, and believe that schemes such as MRET are unwarranted. MRET was established in legislation to assist the development of this new industry in Australia, and to reduce greenhouse gas emissions from power generation. By doing so, MRET (and wind farms) will provide a base for cheaper and cleaner power into the future.

### 4.1.3. Viability of this project

The Conroys Gap wind farm would be developed by a private company. Accordingly, it is necessary for the project to provide an adequate financial return. The commercial viability is driven primarily by capital costs and the related cost of financing such projects. While the energy in the wind is free, the energy produced must make sufficient return to cover the high up-front costs of building the wind farm.

In the case of this project, the commercial viability is supported by relatively low cost transmission line connections (from using the existing line on site) together with good wind speeds which have been measured on the site.

A number of elements included in this proposal, such as the installation of power lines underground, result in increased project costs to the proponents, and these higher costs have been accepted where they result in a project which is still commercially feasible.

## 4.2. Public attitudes towards wind farms

The proposal would promote renewable energy and thereby limit greenhouse gas emissions associated with energy production and is in line with Federal and State government promotion of renewable energy, including:

- The Commonwealth Government support for renewable energy provision through the National Greenhouse Strategy (NGS) and the Mandatory Renewable Energy Target (MRET);
- The NSW government supports renewable energies through programs of the Sustainable Energy Development Authority (SEDA) which has been incorporated into the Department of Energy, Utilities and Sustainability (DEUS), the NSW Greenhouse Gas Abatement Scheme and the NSW Greenhouse Office.

- Increased consumer demand for electricity generated from renewable sources is apparent in the national 'Green Power' accreditation program which sets environmental and reporting standards for renewable energy products offered by electricity suppliers.

State and Federal governments have been shown to support wind farms for their ability to produce renewable energy while reducing greenhouse gas emissions.

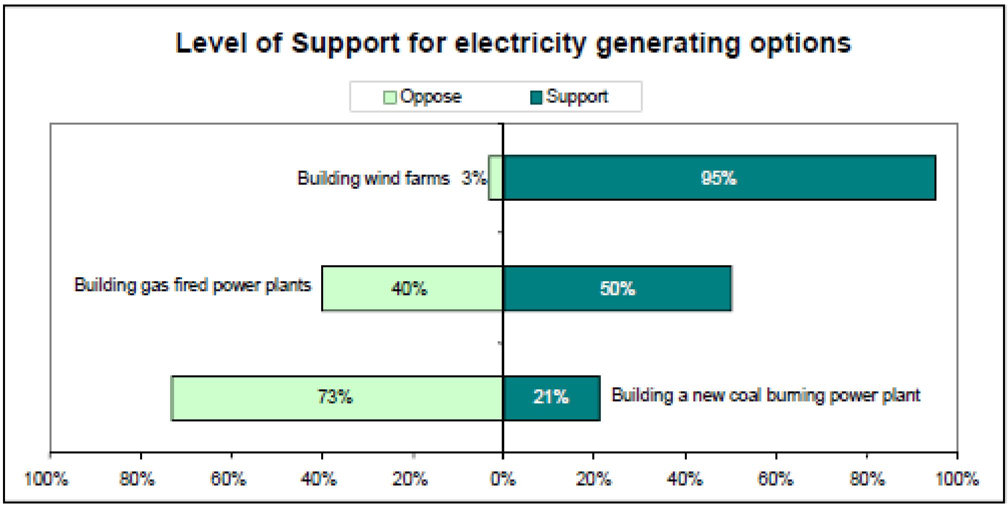
This support is in line with broader community attitudes towards power generation, greenhouse gas emissions, climate change, and renewable energy generation.

A telephone survey of 1027 participants was carried out in August 2003 by the Australian Research Group Pty Ltd on behalf of the Australian Wind Energy Association (ARC 2003).

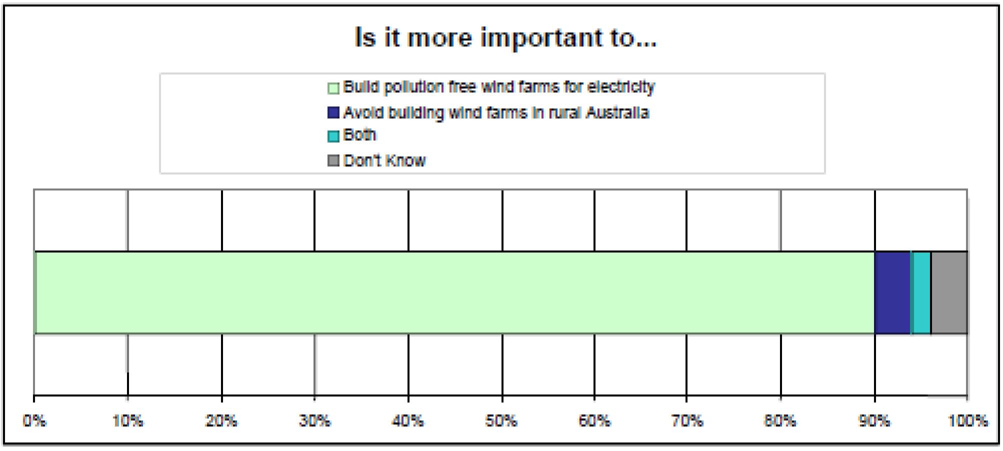
This report found strong support for renewable energy, and wind farms in particular:

- 94% of respondents thought that a target to increase the contribution of clean energy from renewable sources was a good (32%) or very good (62%) idea. Furthermore, less than 3% considered the current target to be too high or much too high;
- 80% said they would be more likely (53%) or much more likely (27%) to think John Howard was doing a good job as Prime Minister if he increased the amount of electricity generated by non-polluting means such as solar or wind energy;
- The majority of respondents are prepared to pay more for cleaner energy;
- A substantial majority of respondents (76%) said that they were prepared to pay 5% more on electricity bills for 10% more clean energy when faced with the option of having cheap electricity at any cost;
- The renewable energy sector has substantial community support. 88% of respondents want the Government to increase support to the renewable energy sector compared with only 26% wanting to see an increase in support to the fossil fuel sector;
- Very strong support exists for building wind farms. 95% support (27%) or strongly support (68%) building wind farms to meet Australia's rapidly increasing demand for electricity;
- 91% think it is more important to build wind farms for electricity than avoid building them in rural Australia;
- Greenhouse pollution is an issue of considerable concern. 59% would be more likely or much more likely to think that John Howard was doing a good job as Prime Minister if he signed the Kyoto Protocol;
- For 71% of respondents, reducing Greenhouse pollution outweighs protecting industries that rely on reserves of fossil fuel.

Interestingly, respondents residing in the city were as likely as those in regional/outer metro areas to support building wind farms however, city respondents were more likely than regional/outer metro respondents to strongly support this electricity option (72% and 64% respectively).




The clear majority (91%) of respondents indicated that building pollution free wind farms for electricity is more important then avoiding building wind farms in rural Australia (4%).




The Conroys Gap Wind Farm proposal is fully self-funding, producing no drain on the public purse. The project maximises use of existing resources (wind, power line, road access) while being remote from high population centres, thereby minimising adverse social impacts.

## 4.3. Broad scale benefits

### 4.3.1. Greenhouse gas emission reduction

#### Climate Change

There is increasing evidence that greenhouse gas emissions result in the warming of the earth's surface and have associated adverse impacts on weather patterns and natural ecosystems. According to the David Suzuki Foundation,

> *"Rising average temperatures do not simply mean balmier winters. Some regions will experience more extreme heat, while others may cool slightly. Flooding, drought, and intense summer heat could result. Violent storms and other extreme weather events could also result from the increased energy stored in our warming atmosphere." (DSF 2006).*

The foundation goes on to list the following general impacts of climate change:

- **Extreme Weather**: Climate change will increase the potency of storms, floods, droughts and other weather disasters.
- **Water Impacts**: Climate change will seriously affect water resources around the world, which will in turn affect food supply, health, industry, transportation, and ecosystem integrity.
- **Imperilled Ecosystems**: Ecosystems around the world will be damaged by climate change. (In Australia, particularly sensitive ecosystems include the Great Barrier Reef and the alpine areas including the Snowy Mountains)
- **Global Meltdown**: Alpine glaciers, arctic ecosystems and ice sheets are all at risk of succumbing to climate change, with global impacts.
- **Health**: Climate change threatens the health of future generations through increased disease (such as malaria), fresh water shortages, worsened smog, and more.
- **Economic Risks**: Rapid climate change poses incalculable economic risks for the future, which far outweigh the economic risks of taking action today.

In relation to this last point, the insurance industry is one of the first to notice these direct economic impacts. According to the David Suzuki Foundation, before 1988, the global insurance industry never had claims for more than US $1 billion in any single natural disaster. Yet between 1988 and 1996, 15 such events occurred, and a number of insurance companies closed down in the wake of these disasters.

According to the Munich Reinsurance Corporation of Canada, "*Economic losses caused by natural catastrophes are likely to bring home the effects of climate change more and more dramatically as time goes by.*"

In addition, the cost to business of adapting to climate change will be significant, and the longer this adaptation is delayed the more significant and more severe will be the impact. The regional impacts of climate change are discussed in Section 4.4.3.

### GREENHOUSE GAS REDUCTION FROM THIS PROJECT

According to the Australian Greenhouse Office, stationary (i.e. non-transport) energy supply is the largest and fastest growing sector in terms of greenhouse gas emissions in Australia. The stationary energy sector accounted for 48 per cent of total emissions in 2002. Emissions from electricity generation make up nearly 70 per cent of stationary energy emissions. Between 1990 and 2002 emissions from electricity increased by 53 Mt CO2-e, an average of 2.9 per cent a year. (AGO 2005)

Therefore in Australia, 33 percent of total greenhouse gas emissions are produced during the generation of electricity. Within the electricity sector in NSW, approximately 90% of electricity is generated by fossil fuel power stations, primarily coal fired power stations. Greenhouse gas emissions from electricity generation in New South Wales grew by 44% between 1990 and 2002 (NSW Govt 2004).

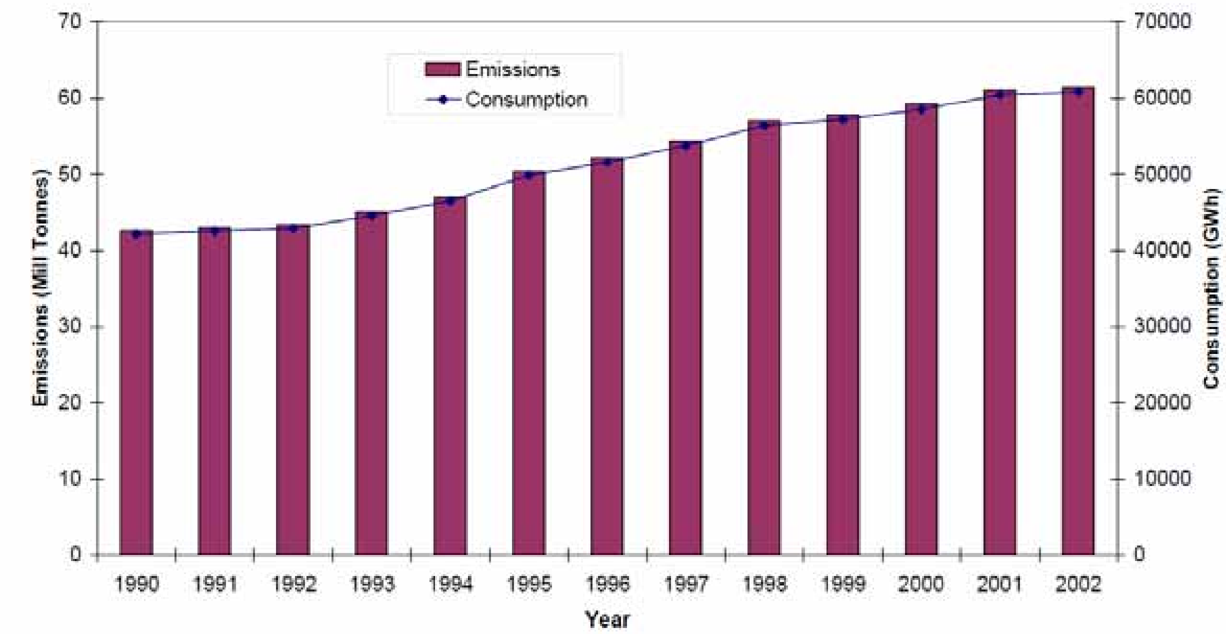



**Figure 4.2 Greenhouse gas emissions from NSW power stations (NSW Govt 2004)**

The nature of the NSW power system, and the dominance of coal as the fuel source mean that Fossil fuel power stations are also the “marginal generator”. The zero fuel cost of renewable energy (such as smaller hydro, biomass and wind power) means that these renewable energy sources are dispatched whenever generation is available, and coal fired power stations are reduced or increased in output to match the overall system generation with the required load. Although the Snowy Hydro is capable of supplying a very large amount of power, it can generally only do this for very short periods in order to maintain the water levels in its dams.

Accordingly, each megawatt-hour of electricity generated by a renewable energy generator (e.g. the Conroys Gap Wind Farm) will reduce coal fired generation by approximately 1 megawatt-hour. This may not mean that existing coal fired power stations are shut down, but it does mean that less coal is burnt in these power stations and therefore greenhouse gas emissions are reduced.

The most recent greenhouse gas emissions coefficient for the NSW electricity system is the NSW Annual Pool Value for 2004 of 0.981 Tonne CO2e/MWh (NSW Greenhouse Office 2005). This figure has been growing rapidly in recent years as shown in Table 4-3. A straight line progression of these figures would predict a value of 1.000 Tonne CO2e/MWh in 2006.

This means that for each megawatt-hour of electricity consumed in the NSW electricity pool, approximately 1,000 kilograms of greenhouse gases are emitted, primarily from coal fired power stations.

The proposed wind farm would represent a renewable, non-greenhouse gas producing method of electricity generation to meet increasing demand. Every megawatt-hour of electricity generated by the wind farm will prevent one megawatt-hour of electricity being generated at a coal fired power station, as well as preventing losses within the electricity transmission system.

This means that for each megawatt-hour of electricity generated by the proposed wind farm, the emission of at least 1,000 kilograms of greenhouse gases is avoided.

**Table 4-3 NSW electricity system greenhouse gas coefficients (NSW Greenhouse Office 2005)**

| Year | Total NSW emissions (tCO2-e) | Total NSW Sent Out Generation (MWh) | Annual Pool Value[a] tCO2-e/MWh |
|---|---|---|---|
| 1999 | N/A[b] | N/A[b] | 0.901 |
| 2000 | N/A[b] | N/A[b] | 0.889 |
| 2001 | N/A[b] | N/A[b] | 0.905 |
| 2002 | N/A[b] | N/A[b] | 0.921 |
| 2003 | 63,431,793[d] | 66,800,866 | 0.950 |
| 2004 | 65,979,036[d] | 67,276,401 | 0.981 |
| 2005 | TBA | TBA | TBA |

For comparison, a typical vehicle using 10 litres of petrol per 100 kilometres and driving 20,000 kilometres per annum would have a greenhouse gas emission of approximately 250g/km, or an annual emission of around 5 tonnes (Aust Govt 2006).

Section 4.4.1 outlines the energy production of the Conroys Gap Wind Farm, which is expected to be between 90,000 and 99,000 MWh per annum over its 30 year life.

**The wind farm will reduce greenhouse gas emissions by 90,000 to 99,000 Tonnes of CO2e per annum, or a cumulative effect of 2.7 to 3.0 Million Tonnes of CO2e over the life of the project.**

**This is the equivalent reduction in greenhouse gas emissions of taking 18,000 to 19,800 typical cars off our roads for 30 years.**

# 4.4. Regional benefits

## 4.4.1. Public electricity generation

### ENERGY PRODUCTION OF CONROYS GAP WIND FARM

Taurus Energy requested wind engineering consultants Garrad Hassan to prepare a wind energy assessment and electricity generation calculation based on the various turbine layouts proposed for the site. The assessment calculated likely energy generation in the typical annual wind regime, and then subtracted the various on-site losses (e.g. in cabling and the substation) to produce an estimate of the sent-out electricity generation for a typical year.

These studies show energy production (on a sent – out basis) for the Conroys Gap Wind Farm in the range of 90,000 MWh to 99,000 MWh per annum. It should be remembered, this calculation is based on a predicted typical year, with variations around this average of in the order of 15-20% likely for any single year.

Domestic electricity consumption in NSW was 7,399 kWh on average in 1999, growing from 6,983 kWh on average in 1990 (DEUS 2000). Continuing this growth rate, we can estimate a figure of approximately 7,800 kWh on average for 2006.

**On this basis, production of electricity from the Conroys Gap Wind Farm of 90,000 to 99,000 MWh per annum would equate (on an annual average basis) to the annual electricity consumption of approximately 11,500 to 12,700 average NSW homes.**

Given the relatively small scale of this project, it would not cause one of NSW's 2,640 megawatt coal fired power stations to be permanently closed down. However, every megawatt-hour of electricity produced from the proposed wind farm will mean a megawatt-hour of electricity is not required from fossil fuel power stations. This in turn reduces fossil fuel required to provide power, which reduces greenhouse gas emissions.

### EMBODIED ENERGY IN WIND FARMS

Wind power is a clean, renewable form of energy, which during operation produces no carbon dioxide (CO2) emissions. While some emissions of these gases will take place during the design, manufacture, transport and erection of wind turbines, enough electricity is generated from a wind farm within a few months to totally compensate for these emissions. When wind farms are dismantled (usually after 20-25 years of operation) they leave no legacy of pollution for future generation (AWEA 2006a).

The Danish Wind Turbine Manufacturers Association prepared a lifecycle analysis (LCA) of wind turbine manufacture which investigated the manufacturing, construction, installation, operation and decommissioning impacts of wind turbines. This particular study investigated a 600kW on-shore and 1.5MW off-shore wind turbine, and found in both cases an energy payback period of less than 4 months (when scrapping of the equipment is taken into account). Given the lifetime of a typical wind farm being 20-30 years, this means that the wind turbines generate approximately 60-90 times the energy used in their construction over their life (DWTMA 1997).

### INTERACTION WITH THE ELECTRICITY NETWORK

On a regional level, wind farms address the increasing demand for electricity in New South Wales, the loss of efficiency during transport (by generating electricity more locally) and provides renewable and clean source of electricity to the region.

Wind farms are an economically viable means to generate electricity and have many environmental benefits, when compared to currently available alternatives. In New South Wales a combination of hydro-power generators and coal-fired generators supply the population's power needs. Even with the considerable scale of the Snowy Mountains Hydro-Electric Scheme, coal-fired power generators supply around 90% of New South Wales electricity consumption.

Growth in electricity demand will soon exceed current electricity supply during peak times. According to Transgrid's Annual Planning Statement 2005, additional generation is likely to be required by 2008 to provide for New South Wales electricity supply needs. Accordingly, New South Wales requires additional electricity generators to be built to meet this demand, and to avoid power outages and blackouts.

Wind power provides a reliable and dependable electricity production. While on a day to day basis wind power output fluctuates with wind speed, on an annual basis output variation is small, and generally within 15-20% of long term average. This is in contrast with hydro power, for example, where output of some power stations can drop to zero output during drought years.

The hourly fluctuations in wind speed, and therefore wind power output, are not significant in relation to the existing fluctuation of loads within the electricity system.

Figure 4.3 shows the daily NSW electricity demand for a 24 hour period in February 2006. Figure 4.4 shows a similar effect on an annual scale.

This shows a daily variation of approximately 6,000 MW, or 200 times the maximum possible output available from the proposed 30 MW wind farm.

The existing electricity system in NSW is more than strong enough to cope with output fluctuations of the wind farm. At this scale of development, energy storage is not required for the wind farm.

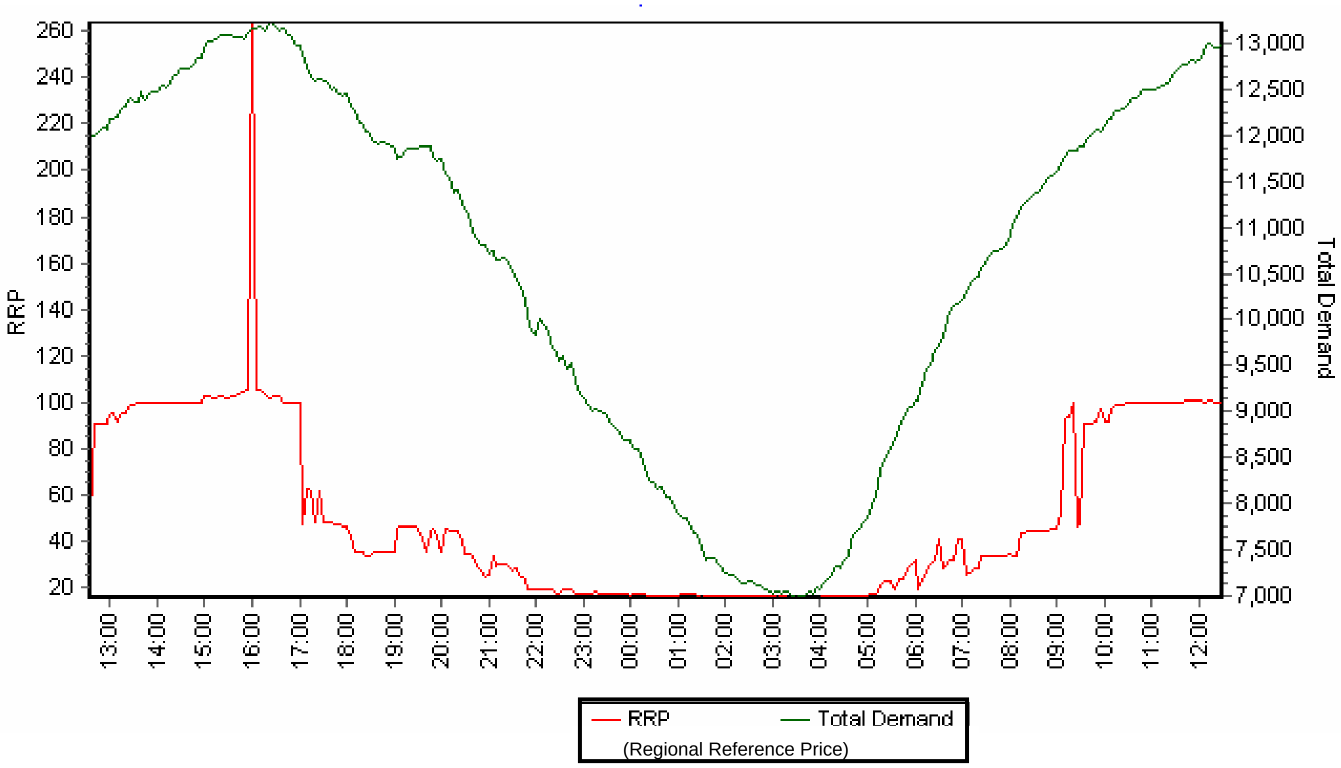



**Figure 4.3  Typical daily variation in electricity demand (NEMMCO 2006)**

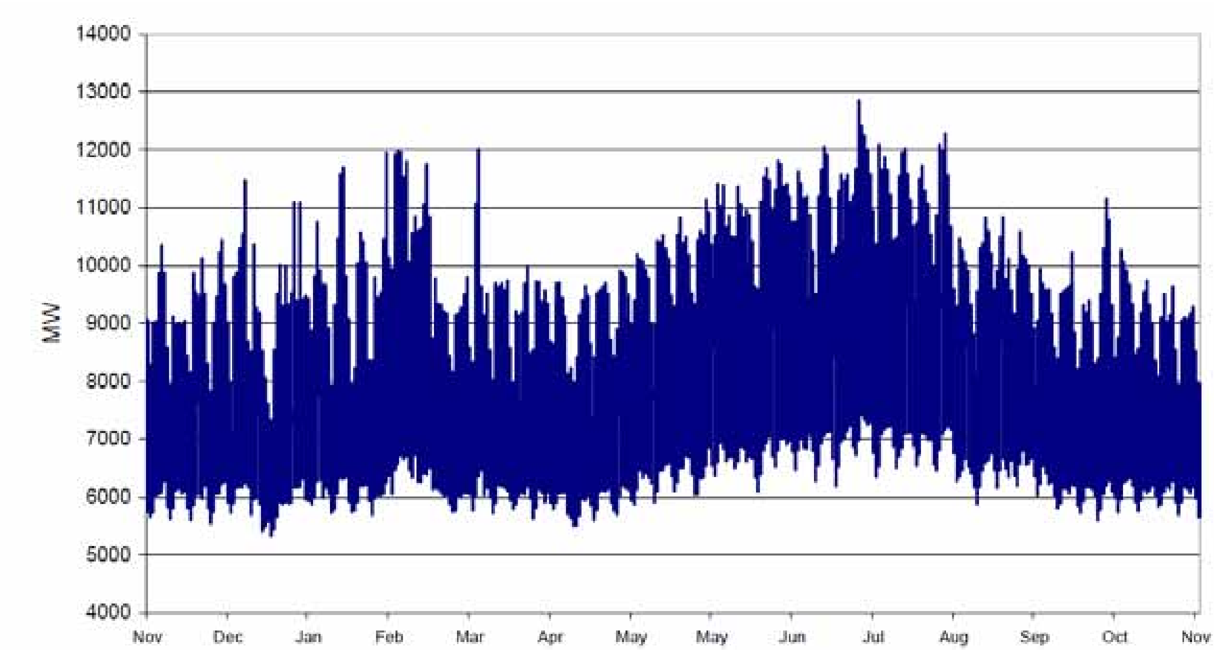



**Figure 4.4  Variation in NSW electricity demand 2003/04 (NSW Govt 2004)**

In addition to their own electricity production, wind farms also reduce transmission line losses that arise from the long distances that power must be transmitted to supply regional locations. This reduces the overall cost of power supply in New South Wales, and further reduces greenhouse gas emissions.

### 4.4.2. Energy security

In addition to broad environmental benefits, the development of wind energy in Australia has security implications as a stable and renewable energy source.

Wind farms offer a diversification of the existing electricity supply infrastructure which helps to mitigate risks of power station failures; of acts of terrorism; and of price risks from fossil fuels which are tied strongly to international energy prices.

A single coal fired power station in NSW can generate up to 2,640MW, or approximately 20% of the total NSW generation capacity. Any kind of outage or failure of such a power station, whether cause by fault or terrorism, would have a significant impact on the operations on the electricity system and thereby the economy as a whole.

In addition, fossil fuel prices are being pushed to record levels. For example, the price of oil has more than tripled since 2001, reaching an all-time high of almost US$70/barrel in this last summer. The prices of fossil fuel energy used for power generation, in particular gas, is strongly linked to international markets.

Gas is recognized as being likely to be the fuel of choice for future NSW power generation capacity. According to ABARE, there are currently proposals for 7 new power stations in NSW, with operational dates up to 2013, and a total capacity of 4,380MW. Six out of seven of these projects are gas-fired power stations, with the remaining power station coal fired and making up 34% of new capacity (ABARE 2005).

The supplemental use of wind power, with its free fuel cost, helps to decouple electricity prices from international oil and gas markets.

Corin Millais, CEO of the European Wind Energy Association, summarises the situation well:

> *"Wind power has zero fuel price risk, zero fuel costs and extremely low operation and maintenance costs. In addition, wind provides total protection from carbon costs, and zero geo-political risk associated with supply and infrastructure constraints or political dependence on other countries. Wind power has no resource constraints; the fuel is free and endless. Unlike conventional fuels, wind is a massive indigenous power source permanently available. Wind power stations can be constructed and deliver power far quicker than conventional sources." (Millais 2006)*

In addition, climate change is also likely to reduce security within the electricity network. Research carried out by CSIRO on behalf of the NSW Government notes four potential risks of climate change (NSW Govt 2004):

- Increased risks of storm, lightning and bushfire damage to electricity infrastructure
- Reduced water availability for cooling inland power stations
- Increased peak electricity demand for air conditioning due to the increased number of extremely hot days
- Reduced operational capacity of electricity networks at times of high temperatures, making more investment necessary to expand capacity to cater for demand

This wind farm will help to reduce climate change, and will provide a small local distributed power station to serve the regional community, it will provide a marginal but positive effect on energy security.

### 4.4.3. Reduced impacts of climate change

Section 4.1.3 outlines the greenhouse gas emission reductions available from this project. This section discusses the impacts of climate change if greenhouse gas emissions are allowed to continue on current projections and without mitigation available from this and similar projects.

Climate change, better known by its misnomer "global warming", is a scientifically proven result of human-induced greenhouse gas emissions, leading to an increased instability of climatic systems, significantly changed weather patterns worldwide, and a general warming of the globe.

Recent research by the CSIRO for the NSW Government shows the likely impacts to NSW of climate change may include (NSW Govt 2004):

- A 70% increase in drought frequency by 2030, leading to less rain and less water for farms, cities, power stations and rivers;
- Major costs to farmers of managing impacts such as reduced water availability, increased hail damage, and the spread of tropical pests;
- Increased risks to buildings and infrastructure from storms, bushfires, floods and lightning strikes;
- Higher insurance premiums, more restricted insurance coverage and the withdrawal of cover from the highest risk areas;
- An increase in the number of extremely hot days each year;
- Extinctions of threatened animals and plants; and
- Threats to human health from heat stress, mosquito born diseases and injuries from storms and floods.

Various scientists have assessed the likely impacts of climate change in Australia, captured in a report titled "Climate Change: An Australian Guide to the Science and Potential Impacts", prepared for the Australian Greenhouse Office 2003. (AGO 2003) This incorporated major contributions from CSIRO, Griffith University, Sydney University, Australian National University, Monash University and others.

The climate change report highlights current scientific expectation of the impacts of climate change in Australia. Vulnerabilities of New South Wales include floods, droughts and forest fires.

Projected adverse impacts on Australian agriculture, as a consequence of reduced local production capacity and increased production in positively affected northern hemisphere countries are particularly relevant to agricultural economies such as the Goulburn-Yass region.

Chapter 4.3 of this report outlines the largely negative impacts in Australia of climate change on pastoral activities; on cropping and agriculture; on fisheries; on forestry; on drought; and on pests, parasites and pathogens. It goes on to discuss the effects on sustainability of the industry in the presence of global markets (AGO 2003).

### 4.4.4. Additional environmental benefits

#### WATER USE IN POWER STATIONS

Fossil fuel fired power stations used significant levels of potable water in their operations, primarily for cooling water (in cooling towers) and for boiler make-up water.

Any reduction in the use of fossil fuel fired power stations will lead to a reduced demand on Australia's finite sources of potable water. This in turn will free up water for more productive uses, and is also likely to have longer term benefits to river quality and thereby water quality.

The NSW coal fired power stations have the following potable water requirements per annum:

**Table 4-4 Water consumption in NSW coal fired power stations**

| Company | Power Station | Potable Water Consumption |
|---|---|---|
| Macquarie Generation | Liddell (Hunter River / Lake Liddell) | 25,000 ML/y |
| Macquarie Generation | Bayswater (Hunter River / Lake Liddell) | 36,000 ML/y |
| Eraring Energy | Eraring | 1,500 ML/y |
| Delta Electricity | Wallerawang and Mt Piper (Fish River & Cox's River) | 22,000 ML/y |
| Delta Electricity | Munmorah & Vales Point | 1,000 ML/y |
| **TOTAL** | | **84,500 ML/y** |

Source: company websites

This is equivalent to approximately 15% of Sydney's annual water consumption.

Based on an annual energy generation from these power stations 64,209 GWh (ABARE 2005), this equates to approximately 1.316 kilolitres per MWh generated.

**The Conroys Gap Wind Farm is likely to reduce water consumption in NSW by 118 to 130 million litres of potable water per annum.**

### POLLUTION FROM FOSSIL-FUEL FIRED POWER STATIONS

The generation of electricity from fossil fuels also releases significant levels of contaminates and pollutants into the atmosphere, both through airborne and waterborne releases.

In his overview of worldwide wind generation, Paul Gipe & Associates state:

> "*The direct generation of a unit of electricity, whether from wind or water, offsets the combustion of three units of fossil fuel in a conventional power plant. Every megawatt-hour produced by a wind turbine offsets the emission of 0.5 to 1 tonnes of carbon dioxide from conventional sources. Wind generation also offsets up to 7 kilograms per megawatt-hour of sulfur oxides, nitrogen oxides and particulates from the fuel cycle for coal, including mining and transport, 0.1 kilogram per megawatt-hour of trace metals, such as mercury, and more than 200 kilograms per megawatt-hour of solid wastes from coal tailings and ash. The amount of pollutants offset depends upon the mix of fossil fuels, nuclear power, and hydro-electricity used in the existing fuel cycle. Wind generation offsets more air pollutants from utilities dependent on coal than those burning natural gas.*" (Paul Gipe and Associates 1999)

In Australia, the National Pollutant Inventory identifies the emissions from electricity supply sector, primarily fossil fuel fired power generation. These are shown in Table 4.6 which highlights that the industry is a major emitter of heavy metal compounds, carbon monoxide, oxides of nitrogen, and sulfur dioxide.

## Table 4-5 National Pollutant Inventory 2004-05, electricity supply sector (NPI 2006)

| Substance | Total Emissions (kg/year) | Emissions to Air (kg/year) | Emissions to Land (kg/year) | Emissions to Water (kg/year) |
|---|---|---|---|---|
| Acetaldehyde | 13,000 | 13,000 | | |
| Ammonia (total) | 250,000 | 200,000 | | 54,000 |
| Antimony & compounds | 1.1 | 1.1 | | |
| Arsenic & compounds | 2,800 | 2,300 | 1.2 | 530 |
| Benzene | 1,200 | 1,200 | | |
| Beryllium & compounds | 3,000 | 3,000 | 0.30 | 16 |
| Boron & compounds | 850,000 | 830,000 | | 16,000 |
| 1,3-Butadiene (vinyl ethylene) | 21 | 21 | | |
| Cadmium & compounds | 760 | 700 | 0.45 | 58 |
| Carbon monoxide | 65,000,000 | 65,000,000 | | |
| Chlorine | 370 | 340 | | 31 |
| Chromium (III) compounds | 5,200 | 4,700 | 0.40 | 500 |
| Chromium (VI) compounds | 860 | 710 | 0.0025 | 150 |
| Cobalt & compounds | 1,900 | 1,800 | 2.7 | 48 |
| Copper & compounds | 19,000 | 17,000 | 4.1 | 1,500 |
| Cumene (1-methylethylbenzene) | 1,100 | 1,100 | | |
| Cyanide (inorganic) compounds | 7,100 | 7,100 | | 0.47 |
| Cyclohexane | 20 | 20 | | |
| Ethylbenzene | 1,800 | 1,800 | | |
| Fluoride compounds | 3,200,000 | 3,100,000 | 12 | 39,000 |
| Formaldehyde (methyl aldehyde) | 170,000 | 170,000 | | |
| n-Hexane | 23,000 | 23,000 | | |
| Hydrochloric acid | 49,000,000 | 49,000,000 | | |
| Lead & compounds | 7,700 | 7,500 | 0.34 | 200 |
| Magnesium oxide fume | 3.5 | 3.5 | | |
| Manganese & compounds | 32,000 | 27,000 | 26 | 5,400 |
| Mercury & compounds | 1,100 | 1,100 | 0.069 | 11 |
| Nickel & compounds | 6,800 | 6,400 | 16 | 400 |
| Oxides of Nitrogen | 510,000,000 | 510,000,000 | | |
| Particulate Matter 10.0 um | 45,000,000 | 45,000,000 | | |
| Polychlorinated dioxins and furans | 0.048 | 0.048 | | |
| Polycyclic aromatic hydrocarbons | 1,700 | 1,700 | | |
| Selenium & compounds | 11,000 | 11,000 | | 98 |
| Sulfur dioxide | 630,000,000 | 630,000,000 | | |
| Sulfuric acid | 5,700,000 | 5,700,000 | | 20,000 |
| Toluene (methylbenzene) | 3,100 | 3,100 | | |
| Total Nitrogen | 24,000 | | | 24,000 |
| Total Phosphorus | 5,000 | | | 5,000 |
| Total Volatile Organic Compounds | 3,200,000 | 3,200,000 | | 210 |
| Xylenes (individual or mixed isomers) | 1,100 | 1,100 | | |
| Zinc and compounds | 12,000 | 10,000 | 3.6 | 1,700 |

These figures are total emissions over all power stations in Australia.

The emissions do not occur because a power station exists; they occur because of the use of fossil fuels while the power station is operating and generating power. Any reduction in fossil fuel use will also reduce the level of pollutants released each year into the environment.

By way of an example, in the financial year 2004-05 Macquarie Generation's Bayswater coal-fired power station consumed over 8 million tones of coal and 4,000 tonnes of fuel oil to produce 16,867 GWh of electricity (Macquarie Generation 2005). The per-MWh emissions of sulfur dioxide, oxides of nitrogen, carbon dioxide and particulate matter are shown in Table 4.7.

**Table 4-6 Power station emissions per unit (Macquarie Generation 2005)**

| | |
|---|---|
| **Environmental Performance** | |
| **Regulatory Compliance** | |
| NSW EPA Licences: | 4 |
| Other NSW Government Licences: | 4 |
| Breaches notified: | Nil |
| **Coal consumed** | |
| Bayswater | 8,053,677 tonnes |
| Liddell | 4,944,137 tonnes |
| **Non-coal fuel consumption** | |
| **Biomass** | |
| Liddell | 70,237 tonnes |
| Coal replaced by biomass | 40,607 tonnes |
| Coal replaced since August 1999 | 230,695 tones |
| Electricity produced from biomass since August 1999 | 449,350 MWh |
| Annual average production | 74,892 MWh |
| **Oils** | |
| Liddell (Supplementary Fuels Program) | 17,777 tonnes |
| Liddell ( Boiler start-up) | 10,376 tonnes |
| Bayswater (Boiler start-up) | 4,004 tonnes |
| **Air Emissions** | |
| Sulfur dioxide | 5.67 kg/MWh (Bayswater) |
| | 4.54 kg/MWh (Liddell) |
| Oxides of nitrogen (expressed as NO2) | 2.46kg/MWh (Bayswater) |
| | 2.59 kg/MWh (Liddell) |
| Particulate matter | 0.022 kg/MWh (Bayswater) |
| | 0.07 kg/MWh (Liddell) |
| Carbon dioxide | 904.6 kg/MWh (Bayswater) |
| | 990 kg/MWh (Liddell) |
| **Water Management** | |
| Water diverted (Hunter River) | 43,694 ML |

Source: Macquarie Generation 2005.

**Using these figures, the Conroys Gap Wind Farm would prevent the emissions to atmosphere of:**

**- 510,000 to 561,000 kilograms of sulfur dioxide;**

**- 221,000 to 243,000 kilograms of nitrogen oxides**

**- 1980 to 2180 kilograms of particulates**

## 4.5. Local benefits

### 4.5.1. General benefits to community

The local community would gain a marginal benefit from those regional benefits contained in Sections 4.2 and 4.4, in particular:

- Reduced greenhouse gas emissions
- Increased energy security
- Viable source of electricity to help meet growing demand
- Reduced impacts of climate change
- Improved environmental performance and sustainability of power generation

A significant part of the local economy is based on or around agricultural pursuits. The negative economic impacts of climate change are likely to be felt much more considerably in the local area than in urban areas of NSW, therefore the benefits of this project are also likely to be significantly weighted in favour of the local community.

### 4.5.2. Community Fund

The proponent intends to set aside funds on an annual basis during the operation period to provide long terms benefits to the local community.

The Community Fund will be established to provide for local environmental benefits and local community facilities to the benefit of the local community. Worthy projects could include:

- Landcare
- Weed and pest management
- Local sporting facilities
- Local public services (e.g. libraries)
- Community parklands
- Academic scholarships
- Rural Fire Service support
- Event sponsorship
- Road improvements
- Local heritage management.

The proponent will provide $25,000 per annum into the Community Fund during the period of operation of the wind farm.

The structure of the fund is to be determined, and could involve management by or joint management with the local Council and/or local community representatives. The proponent will seek local input into the structure of the fund.

### 4.5.3. Jobs, investment and economic benefit

Over the life of the wind farm, it will inject in excess of $10 Million into the local economy from the wind farm construction and operations. This economic injection will come from:

- use of local contractors (where possible) in construction of the wind farm;
- use of local services (food and accommodation, fuel, general stores etc) during the construction period;
- ongoing use of these local services during the operation of the wind farm;

- lease payments to local landholders;
- provision of ongoing local jobs in operating and maintaining the wind farm.

It is estimated that the project would provide approximately 50 jobs during construction and 5 jobs during the operational phase of the wind farm.

In addition to these direct benefits, the project provides an opportunity to increase tourism, if this is desired by the community. This also would increase use of local services on an ongoing basis. While initial interest in the wind farm is likely to be higher than ongoing interest, the close presence of the Hume Highway will bring new visitors to the region on a regular basis and the wind farm could be used as an additional attraction to secure visitors to the local townships.

The project will also bring economic benefits through the Community Fund. The services provided through this fund will largely be met from within the local community, who will also be well served by the outcomes of the fund.

The general benefits to the community identified in Section 4.5.1 will also have direct and substantial economic implications, due to the heavy reliance within the area on agricultural pursuits.

### 4.5.4. Locally produced power

Section 4.4.1 confirmed that production of electricity from the Conroys Gap Wind Farm of 90,000 to 99,000 MWh per annum would equate (on an annual average basis) to the annual electricity requirement of approximately 11,500 to 12,700 average NSW homes.

There is true equity in the people of the local area hosting a power station that more or less balances their electricity consumption, and does this using local renewable energy resources.

## 4.6. Consideration of alternatives

Proposal options considered include altering the size and location of the wind farm, as well as the size and locations of individual wind turbines onsite.

### 4.6.1. Comparison with other forms of electricity generation

Wind is one of the cheapest forms of renewable energy available in Australia, which can be demonstrated by its dominant share of the MRET target.

Wind farms offer significant environmental benefits over fossil fuel power stations. During the operating life of a windfarm, it will produce:

- no greenhouse gas emissions;
- no air or water born pollutants such as nitrous oxides, sulfur oxides, heavy metals or particulates;
- no water use;
- no waste products (nuclear or otherwise) which require long term disposal.

Wind power is also a relatively safe technology. In over 20 years of electricity generation with more than 100,000 machines installed worldwide, no member of the public has ever been injured in the operation of a wind farm. Since the early 1970's the wind energy industry has experienced 14 worker fatalities worldwide, directly or indirectly during wind farm construction or related accidents. All of these deaths could have been prevented if today's safe work practices had been adopted (AusWEA 2004).

According to the Construction, Forestry, Mining and Energy Union (CFMEU), mining is the most dangerous occupation in Australia. Coal miners for example have a 1 in 28 chance of being killed over their 40 year working life. Figures obtained from the International Labour Organisation (ILO) show that miners account for 1 per cent of the global workforce yet contribute seven per cent of global work fatalities (Westwick-Farrow Pty Ltd 2006).

## 4.6.2. Selection of wind farm location

### BACKGROUND TO SITE SELECTION

Appropriate sites for wind farms are very rare in New South Wales. Appropriate locations for wind farms are found where:

- wind speeds are not only high but consistent;
- vegetation cover is low and not sensitive;
- housing in the immediate vicinity is relatively sparse;
- high voltage transmission lines are available nearby;
- reasonable road access is available to site;
- relevant landowners are interested in allowing wind turbines on their land.

While many believe that coastal winds in NSW are stronger, in New South Wales the most suitable sites occur at various locations along the Great Dividing Range which helps to accelerate the more consistent westerly winds at levels close to the ground.

Taurus Energy has investigated various regions around NSW for their wind farm potential.

Taurus Energy commenced these investigations by identifying windy regions using the SEDA Wind Atlas (SEDA 2006). After identifying wind farm potential in the Bombala, Eucumbene, Yass, Goulburn and Guyra regions, Taurus prepared high resolution broad scale wind maps (approx 50km by 50km) for each region. This map was prepared using the software tool WindScape™ developed by CSIRO, which estimates wind speeds every 100m over large areas based on topographic, vegetation and weather data.

These wind maps were then analysed using MapInfo™ GIS with extensive overlays covering national parks and state forests; vegetation cover; road access; and transmission line access.

Once specific sites were identified, more detailed investigation of local house locations and property ownership was carried out, and landowners contacted to gauge their interest in a possible wind farm.

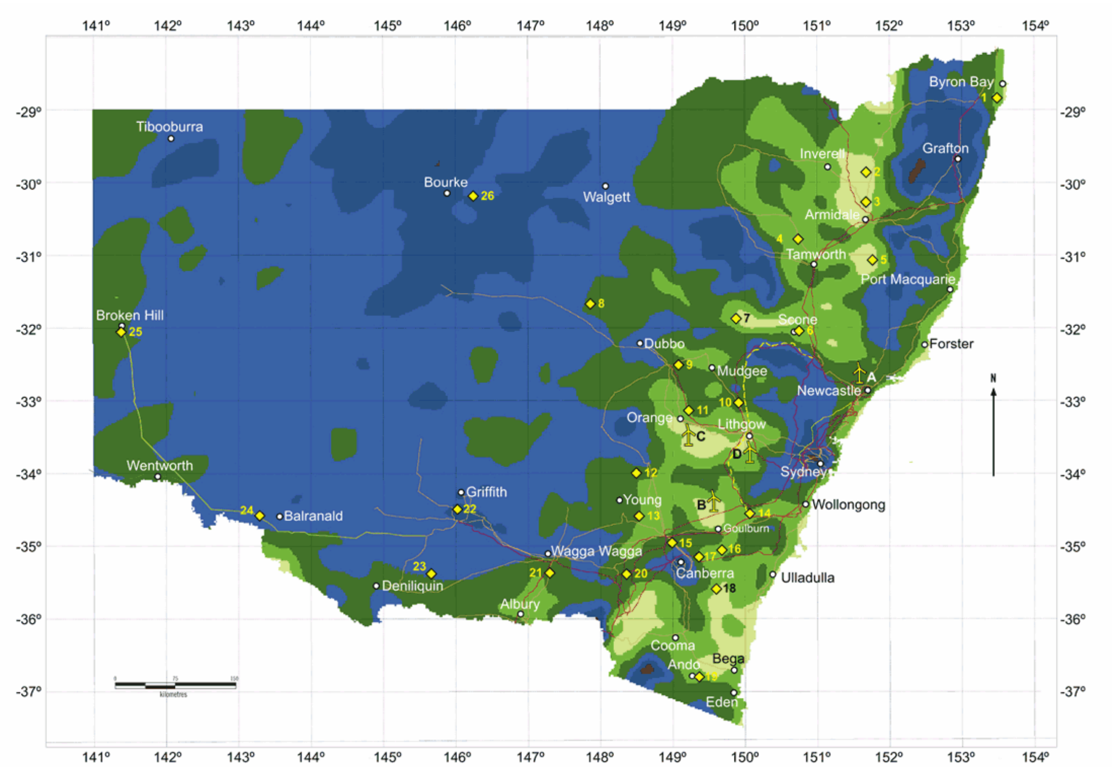



**Figure 4.5 SEDA Wind Energy Atlas (SEDA 2006)**

#### THE CONROYS GAP SITE

The Conroys Gap site was initially assessed by an unrelated wind farm prospecting company (New Energy Partners P/L) which had entered into agreements with the relevant landowners.

After a review against the site selection approach above, this site was acquired by Taurus since it represents a limited number of locations which met the required criteria. The site has:

- high wind speeds, among the highest in New South Wales;
- sparse vegetation and largely modified vegetation communities;
- relatively low population in immediate area;
- good road access to site (located adjacent to the Hume Highway);
- existing electricity transmission line on site (132kV Wagga – Yass transmission line);
- interested property owners for the relevant properties.

Taurus Energy commenced development of the site in August 2005, purchasing the existing interests of New Energy Partners P/L. New Energy Partners P/L is no longer involved in the project.

The site has a 50m tall wind monitoring mast that was installed in 2004, to confirm expected wind speeds onsite. Wind data has been correlated against existing long term monitoring towers in the area (i.e. Goulburn Airport AWS, operated by the Bureau of Meteorology) to predict a long term wind speed and wind direction profile for the site.

The wind monitoring has demonstrated that there is sufficient wind resource to develop a medium scale wind farm at the proposed site.

### 4.6.3. Scale of the proposed wind farm

Wind farms are comprised of multiple wind turbine generators. The more wind turbines located in a wind farm, the higher its energy production.

Most wind farms currently proposed in New South Wales are greater than 50 megawatts, with more than 25 wind turbines each.

These large scale wind farms (greater than 30 MW output) can have much larger visual and acoustic impacts on the surrounding landscape. Large wind farms require greater transmission line capacities, often meaning that new transmission lines need to be built over many kilometres. They also require greater amounts of excavation and machinery access to install, maintain and decommission, leading to increased truck movements and local disturbance.

Given the increased level of impacts that result, Taurus Energy does not believe that a large wind farm is appropriate for the Conroys Gap site. Accordingly, it has proposed a wind farm design with a maximum of 30 megawatts output, and with a maximum of 15 wind turbines.

Table 4.8 places the proposed development along-side other proposals for New South Wales.

**Table 4-7: Wind Farm Proposals – Goulburn/Yass Region, NSW**

| Project, Project Location | Proponent (Status) | Project Capacity | No. of Turbines | New Powerlines to connect to grid |
|---|---|---|---|---|
| Crookwell 1 WF, near Crookwell | Delta Electricity (Operational) | 4.8MW Built 1997 | 8 | New 66kV substation, on site |
| Gunning WF, near Gunning | Delta Electricity (DA Approved) | 64MW | 32 | 14km, 132kV, aerial |
| Crookwell 2 WF, near Crookwell | Gamesa Energia (DA Approved) | 100MW | 50 | New 330kV substation, on site |
| Woodlawn WF, near Tarago | Wind Energy JV (DA Approved) | 50MW | 25 | Not specified |
| Taralga WF, near Taralga | RES Southern Cross (DA Approved) | 100MW | 50 | Not specified, >30km high voltage |
| Conroys Gap WF, near Yass | Taurus Energy (Proposed) | <30MW | 15 | <4km 22kV or 33kV aerial, on site |
| Cullerin Range WF, near Gunning | Taurus Energy (Proposed) | <30MW | 15 | New 132kV substation, on site |
| Evandale WF, near Goulburn | Taurus Energy (Proposed) | <30MW | 15 | ~10km 22kV or 33kV aerial |
| Spring Range WF, near Murrumbateman | ACTEW Corporation (Proposed) | unknown | 10 - 15 | Unknown |
| Molonglo Range WF, near Queanbeyan | EHN (Oceania) (Proposed) | Up to 120MW | Up to 60 | 3-10km, aerial |

Sources: Company websites, media releases and published Environmental Impact Statements.

### 4.6.4. Size of the proposed wind turbines

Wind turbines come in various sizes, from small 10 kilowatt wind turbines used for individual houses, to 5 megawatt wind turbines used offshore in Europe, with potential to supply up to two thousand houses from each wind turbine. These large turbines can have blade diameters and hub heights of well over 100 metres each, with tip heights exceeding 150 metres.

There is a trade-off between the number of wind turbines and the size of wind turbines to provide commercial volumes of electricity from a site. The smaller the wind turbine, the larger the number of wind turbines would be required for a viable project.

Increasing the size and reducing the number of wind turbines has a number of benefits:

- Reduced visual impact (see discussion in the Conroys Gap Wind Farm: Visual Impact Assessment specialist study)
- Reduced environmental impacts of construction through less footings, hardstands, road areas etc
- Reduced cost of wind power per unit of output

Taurus Energy proposes to use mid-sized wind turbines, with each wind turbine having a hub height of up to 80m and blade diameter of up to 92m. This reduces the number of wind turbines onsite to a maximum of 15 for a viable project, and significantly reduces the environmental impacts from construction and visual impacts in operation.

### 4.6.5. Electricity transmission connection options

Various options for connection to the electricity transmission system have been considered.

Connection to the local 11kV powerlines was ruled out immediately, as these powerlines do not have the capacity to connect more than one or two wind turbines.

Connection to the local 66kV powerline to the north of the site was ruled out after an investigation revealed insufficient transfer capacity was available in these powerline to connect 30 megawatts without significant line upgrade (from the site into Yass, a distance of some 15km) at a significant cost.

Connection to the 330kV powerline to the south of site was considered. Such a connection would involve a major substation in a key transmission line link to the Yass substation which would provide an order of magnitude more transfer capacity than is required for the wind farm. This option was ruled out primarily on cost.

Connection to the 132kV Yass – Burrinjuck powerline crossing the southern end of the site was considered. This powerline is nearing the limit of its generation connection capacity due to the connection of the recently upgraded Burrinjuck hydro power station. While network configurations could be altered to allow connection, this option is not preferred from a system security perspective.

Connection to the 132kV Yass – Murrumburrah powerline to the east of site was considered. Such a connection would involve a new transmission line crossing the flats between the Hume Highway and Black Range Rd, an area which has recently seen a growth in subdivisions. This option is possible, but not preferred due to the visual intrusion to a number of existing and proposed residences.

Connection to the 132kV Yass – Wagga powerline crossing the southern end of the site is proposed. This powerline has existing capacity in excess of the 30 megawatts required, and crosses the wind farm site adjacent to the southern group of turbines, and some 4km from the northern group of turbines. A new 132kV substation would be located in the vicinity of the existing powerline, and a new 22kV or 33kV powerline would connect the northern most turbines to this new substation along a route which can be primarily screened from existing residences.

The preferred option minimizes the visual impacts of the substation and connecting powerlines, reduces potential biodiversity impacts cause by construction of a short length of powerline, and reduces cost of the overall project.

## 4.7. Modifications to the Conroys Gap wind farm proposal

The location of individual wind turbines onsite and elements of the construction, operation and decommissioning phase are being informed by a range of specialist studies. These include wind speed parameters, acoustic and visual assessment (from residences and nearby recreational areas), Aboriginal archaeology, flora (including threatened species and communities as well as total amount of vegetation cover) and fauna (including threatened species, migratory species and habitat values of the site).

The final proposal has been designed to reduce adverse impacts upon social and environmental parameters while taking advantage of the landscape features that could most effectively contribute to the supply of greenhouse gas emission-free sustainable energy generation.

In particular, the following improvements have been made since the initial concept was developed and presented at the first Open House in November 2005:

- All proposed turbines have been removed from the eastern most ridge of the proposal where the existing wind monitoring tower is located. This change will move the wind turbines a further 1.5km from properties to the east of the site, reduce any possible noise impacts in this area, and reduce the visual impacts to the existing and proposed subdivisions in this area. The removal of these turbines would also remove the potential to directly impact on the Box-Gum Woodland Endangered Ecological Community and threatened flora and fauna habitat in the intervening McCullums Creek valley.
- Turbine locations have been adjusted to minimise noise impacts on surrounding residences and to ensure that the relevant noise limits are achieved at all residences.
- Access to site via the Black Range Rd has been relocated to access site via Paynes Rd. This will have a significant reduction in traffic movements and construction noise effecting houses bordering on Black Range Rd.

- A substation location has been identified to the south of the site, and a powerline corridor has been identified which can be primarily screened from existing residences.
- The concept of a Community Fund has now been incorporated into this proposal to broaden the benefit of this proposal within the local community.
- A commitment to offer visual screening to affected landowners in the vicinity of the wind farm has been incorporated into the final proposal.

## 4.8. Reversibility of the proposal

The proposal would not substantially alter the vegetation, soil or water quality on the site. In the short-term, mitigation measures will be required during construction to ensure that the spread of weeds, soil erosion and water quality decline are not exacerbated by the proposal. Impacts on fauna contain a greater degree of uncertainty, requiring rigorous monitoring to characterise the impacts of the operational wind farm. Impacts on the visual landscape would be ongoing during the operational phase of the wind farm. The Environmental Assessment outlines the measures that would be implemented to protect the environment and minimise both environmental and social impacts of the proposal.

The reversibility of the proposal is also an advantage in mitigating potential impacts of the operational wind farm. If bird or bat strike, shadow flicker or noise are found to be greater than anticipated by this assessment, there is scope to shut down individual turbines temporarily in order to reduce the impact during sensitive periods (for example, migration times). Temporarily shutting down turbines is a strategy that may be recommended by post-construction fauna and/or shadow flicker monitoring. Implementation of this strategy will depend on the specifics of the identified impacts and cannot be committed to in advance. Taurus Energy commits to implementing this strategy, should post-construction monitoring deem it necessary.

At the end of the proposal's life (25-30 years if not recommissioned) the infrastructure would be removed from the site. The concrete footings and access trails would remain however, all other soil disturbance would be rehabilitated and revegetated where appropriate. The landforms, land use and visual character of the site would them be returned to its pre-existing state. As there is no significant tree clearing or cut and fill operations involved in the project, the site could be substantially returned to its current state.

# 5. PLANNING CONTEXT

## 5.1. Local Government instruments and policies

### YASS VALLEY LOCAL ENVIRONMENTAL PLAN 1987

The proposal is located in Yass Valley Local Government Area. Yass Valley Local Government Area was created in February 2004 out of Yass Shire (in its entirety) and parts of Gunning and Yarrowlumla shires. The Yass Valley Local Environmental Plan 1987 (LEP) establishes the framework for development control within the local government area. It contains a planning scheme establishing specific land use zones which guide Council planning and development approval decisions. Each zone carries specific planning objectives which must be considered by the determining authority in the assessment of development applications. Figure 5.1 shows the land use zoning affecting the proposal site.

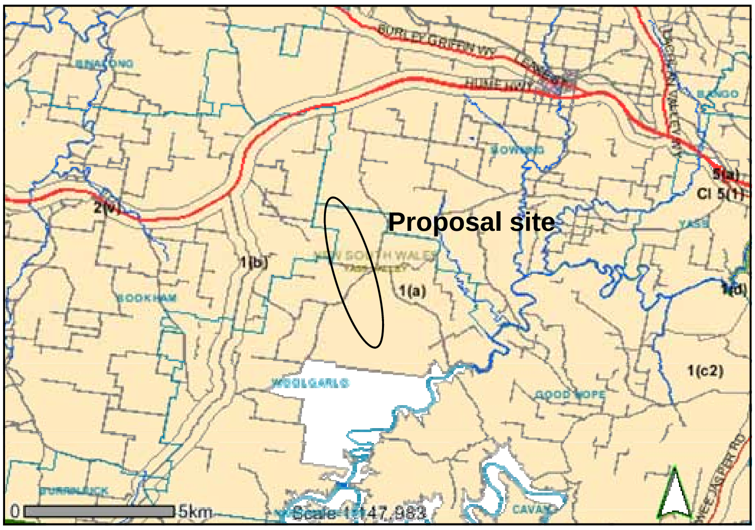



**Figure 5.1 LEP zoning in the study area (from iplan, DoP 2005a)**

The proposal site is located in No 1(a) Rural Agriculture Zone. Under the LEP, the objective of this zone is to set aside certain land for agricultural purposes and purposes incidental thereto. Agriculture (with some exceptions), dams and forestry developments are permitted without consent. Industries (other than extractive industries, home industries or rural industries) are prohibited. Development for other purposes requires development consent.

'Industries' in the LEP is defined in the Environmental Planning and Assessment Model Provisions 1980 and the Factories, Shops and Industries Act 1962, and does not include wind farms (Paul De Szell, Yass Valley Council pers. comm.). The Model Provisions contain a specific definition of 'generating works', which would encompass the proposal; 'a building or place used for the purpose of making or generating gas, electricity or other forms of energy'. The wind farm proposal is therefore not prohibited under the LEP, but would require development consent.

Permissability under the LEP is important because, although Major Projects are approved by the Minister and planning instruments (other than State Environmental Planning Policies) do not apply, the Minister cannot approve projects which are not critical infrastructure projects, and which would (but for Part 3A) be prohibited under a planning instrument.

In addition, the Minister is to take into consideration the provisions of any environmental planning instrument that would have (but for Part 3A) substantially governed the carrying out of the project. The Minister would therefore have regard to the provisions of the Yass Valley LEP in assessing the Conroys Gap wind farm proposal. The Yass Valley Council is currently revising the LEP.

Yass Valley Council is also developing guidelines for a Development Control Plan (DCP) for the development of wind farms in the Shire. The DCP will incorporate elements of the Upper Lachlan and Goulburn Mulwaree Councils' DCPs relating to wind farms (Yass Tribune 2006). The Council is also preparing a new DCP covering rural and urban lands and commencing a community-based strategic planning process to manage change in the LGA (Yass Valley Council 2005).

## 5.2. State Government legislation and policy

### 5.2.1. Planning legislation and policies

**PART 3A APPROVAL PROCESS**

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the main statute for environmental planning and development control in NSW. The Act establishes three principal types of statutory planning instrument; State Environmental Planning Policies (SEPP), Regional Environmental Plans (REP) and Local Environmental Plans (LEP). In assessing a development activity, Clause 111 applies a duty to determining authorities to consider 'to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. The Act specifies a range of matters to consider, including threatened species, populations and ecological communities declared under the *Threatened Species Conservation Act 1995*.

Part 3A of the EP&A Act provides a coordinated assessment and approval regime for all Major Projects that require the approval of the Minister for Planning (previously dealt with by Parts 4 and 5 of the Act). The associated Major Projects SEPP 2005 defines wind power developments with a capital cost of $30 million dollars or more as Major Projects. The proposed Conroys Gap wind farm would have an estimated capital cost of $50 million and therefore would be considered a Major Project for the purposes of Part 3A.

Projects approved under Part 3A of the EP&A Act do not require authorisations under the:

- *Fisheries Management Act 1994* (sections 201, 205 or 219, stop work orders);
- *Heritage Act 1977* (Part 4 or section 139);
- *National Parks and Wildlife Act 1974* (section 87, consent under section 90, interim protection and stop work orders);
- *Native Vegetation Act 2003* (section 12);
- *Rivers and Foreshores Improvement Act 1948* (Part 3A);
- *Rural Fires Act 1997* (section 100B);
- *Water Management Act 2000* (sections 89, 91);
- *Threatened Species Conservation Act 1995* (interim protection and stop work orders);
- *Protection of the Environment Operations Act 1997* (environment protection notices);
- *Local Government Act 1993* (orders under section 124).

The objectives and requirements of this legislation would however be considered by DoP during its assessment of the project.

Under Part 3A, the proponent of a major project first submits a Project Application for the approval of the Minister for Planning. For more complex projects, the Department of Planning (DoP) convenes a Planning Focus Meeting of state agency and local government representatives to consider the scope and level of assessment of key issues. The Director-General of DoP then issues the proponent with requirements for the Environmental Assessment, indicating the issues to be addressed, the level of assessment required and consultation requirements. The proponent is also required to include a Statement of Commitments relating to environmental management and impact mitigation as part of the development application.

After an Environmental Assessment (EA) has been prepared and accepted by the Director-General, it is placed on public exhibition for at least 30 days during which time submissions from the community, local government and state agencies are accepted. Following this statutory consultation period, the Director-General may require the proponent to respond to comments, revise the proposal or revise the Statement of Commitments.

Consistent with the Part 3A process, the assessment of the Conroys Gap wind farm proposal was preceded by an issues scoping exercise to identify and prioritise issues related to the project. A Planning Focus Meeting was held at the proposal site on 11 November 2005 to assist with this process, involving representatives from Yass Valley Council, Department of Planning (DoP), Department of Environment and Conservation, Department of Agriculture, Southern Tablelands Rural Fire Service and Country Energy, as well as the proponents and **ngh**environmental.

A Project Application identifying and prioritising issues relating to the project was submitted to the DoP in January 2006. The DoP responded with a series of Director–General's Requirements for the Environmental Assessment (refer below). A Consultation Plan was also implemented during the development of the project, involving media releases, website information, direct contacts and two Open House consultation sessions at Yass.

### 5.2.2. DoP Director-General's Requirements for assessment

This EA meets the Department of Planning (DoP) Director-General's Requirements issued for the assessment of the project (Attachment 2). The Requirements indicate the issues to be addressed, the level of assessment required and consultation requirements. The Requirements are itemised in Table 5.1 with an indication of where in the EA they are addressed.

**Table 5-1 Director-General's requirements for assessment**

| Director General's Requirements | EA section |
|---|---|
| **GENERAL** | |
| The EA must be prepared to a high technical and scientific standard and must include:<br>• an executive summary;<br>• a description of the proposal, including construction, operation and staging;<br>• an assessment of environmental impacts, with particular focus on the key assessment requirements specified below;<br>• a justification of the proposal with consideration of benefits and impacts;<br>• a draft Statement of Environmental Commitments;<br>• certification by the author that the information is neither false nor misleading.<br>The EA should consider the following documents:<br>• Draft NSW Wind Energy EIA Guidelines (Planning NSW 2002);<br>• Draft Murrumbidgee Catchment Action Plan. | **Section 1**<br>**Section 3**<br>**Sections 7, 8**<br><br>**Section 4**<br>**Section 3.6**<br>**Attachment 1**<br>**Section 5, elsewhere in EA as required** |
| **KEY ASSESSMENT REQUIREMENTS** | |
| **Project Justification**<br>The Environmental Assessment must include a clear demonstration of quantified and substantiated greenhouse benefits, taking into account the proposal's capacity factor and identification of sources of electricity that could be realistically replaced and the extent of the replacement.<br>The EA should also identify the socio-economic benefits of the proposal, including benefits to the local community. | **Section 4** |
| **Visual Impacts**<br>Comprehensive assessment of the landscape character/values of the affected areas and the visual impact of the proposal on this landscape and on the existing and approved residences, particularly within 2 km of the turbines.<br>Consideration should be given to the Australian Wind Energy Association and Australian Council of National Trust's draft issues paper Wind Farms and Landscape Values.<br>The assessment must also discuss/provide impact of blade "flicker" and blade "glint" on existing and approved residences and road users (including road safety matters) within 2 km of the turbines; "flicker vertigo" issues; proposed mitigation measures, including screening, turbine layout and location; photomontages of the proposal taken from strategic vantage points. | **Section 7.3.4 and specialist assessment (Attachment 8)** |

| Director General's Requirements | EA section |
|---|---|
| **Flora and Fauna**<br>The Environmental Assessment must address impact on critical habitats, threatened species, populations, ecological communities, and their habitats listed under the Threatened Species Conservation Act 1995 and the Fisheries Management Act 1997; impact on birds and bats from strikes and alteration to movement patterns from the turbines and transmission lines. Assessment should consider the Australian Wind Energy Association's publication Assessing the Impacts on Birds – Protocols and Data Set Standards (an outline of an adaptive management program should be provided); vegetation clearing during construction and maintenance.<br>The threatened species assessment must generally be in accordance with the DEC's Guidelines for Threatened Species Assessment. Where ecological offsets or compensation is proposed (eg compensatory habitat or rehabilitated areas), appropriate details of each offset option must be included in the Environmental Assessment, including implementation measures for each offset option. | **Section 7.2 and specialist assessment (Attachment 6)** |
| **Archaeology/Cultural Heritage**<br>The Environmental Assessment must address the potential impact on Aboriginal heritage values and items and must generally be in accordance with the DEC's Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation. | **Section 7.3.11 and specialist assessment (Attachment 9)** |
| **Operational Noise**<br>Comprehensive assessment of the noise impacts associated with the proposal (including 'infrasound') to be undertaken in accordance with DEC's Industrial Noise Policy and Wind Farms – Environmental Noise Guidelines, South Australian Environment Protection Authority (February 2003). If any Noise Agreements with residents are proposed for areas where noise criteria cannot be met, sufficient information should be provided to enable a clear understanding of what has been agreed, and what criteria have been used to frame any Agreements. | **Section 7.3.5 and specialist assessment (Attachment 7)** |
| **Bushfire Risk**<br>The Environmental Assessment must address the potential for wind turbines to start/influence the pattern of bushfires, and include bushfire management strategies and measures in consultation with the Rural Fire Service and the local council. | **Section 7.3.8** |
| **Traffic and Transport**<br>The Environmental Assessment must: identify transport routes to and from the project site, including details of any proposed upgrading or construction of road/access to the site; assess the construction traffic impact of the project in terms of capacity and safety of these routes and potential damage. | **Section 7.3.9 and specialist assessment (Attachment 12)** |
| **Land Values/Development Potential**<br>Assessment of the potential impact of the wind farm on surrounding land values, including a prediction of expected land value changes as a result of the development in the short and long term. Any consequences for development of surrounding land. | **Section 7.3.2 and specialist assessment (Attachment 11)** |
| **Community consultation**<br>Strategy for community consultation to keep affected landowners and communities involved and informed about the project, including proposed measures to address community concerns. | **Section 6, Attachment 5** |
| **Services and Infrastructure**<br>Assessment of potential impact on aircraft and telecommunications, roads, bridges, rail crossings and electricity infrastructure, in liaison with relevant authorities. In reference to aircraft, the assessment should consider the Civil Aviation Safety Authority Guidelines Draft Advisory Circular AC 139-18(0), December 2005, Obstacle Marking and Lighting of Wind Farms. | **Section 7.3.3, 7.3.9 (traffic), 7.3.10 (aviation)** |
| **Proposed substation and grid connection**<br>Discussion of connection agreements/approvals by Transgrid, including ownership and management of the connecting transmission line following construction. The EA must clearly demonstrate that grid connection is achievable. If proposed, full justification must be given for the use of aboveground lines to connect the turbine groups to the | **Section 3, Section 4** |

| Director General's Requirements | EA section |
|---|---|
| substation. | |
| **Cumulative impact**<br>Assessment of the cumulative effects of the proposal having regards to existing or other proposed wind energy facilities in the area. This should include consideration of the area's ability to accommodate additional wind energy facilities. | **Section 7.5** |
| **Commencement**<br>The EA should indicate timelines which clearly indicate when the proposal is likely to be implemented, if it is approved, and what commitment there is to such a timeframe. | **Section 3** |
| **Decommissioning**<br>Discussion of the envisaged lifespan of the project and the Proponent's commitment, arrangements and necessary approvals for removal of the wind turbines and associated infrastructure at the end of the project's life. | **Section 3,**<br>**Section 7.4** |
| **CONSULTATION REQUIREMENTS** | |
| You must undertake an appropriate and justified level of consultation with the following parties during the preparation of the EA:<br>• Commonwealth Department of Environment and Heritage regarding the application of the EPBC Act<br>• NSW Department of Environment and Conservation<br>• NSW Roads and Traffic Authority<br>• Yass Valley Council<br>• Rural Fire Service<br>• Transgrid<br>• Department of Primary Industries<br>• Department of Natural Resources<br>• Civil Aviation Safety Authority<br>• Aerial Agricultural Association of Australia<br>• Rural Lands Protection Board<br>• South-west Slopes Noxious Weeds Authority<br>• the local community. This should include how commitments made to community members during the consultation process will be confirmed.<br>The EA must clearly indicate the issues raised by stakeholders during consultations and how those issues have been addressed in the EA. This should include matters identified during the Planning Focus Meeting held on 11 November 2005 as recorded in the minutes. | **Section 6** |

### THREATENED SPECIES AND COMMUNITIES

Section 5A of the EP&A Act specifies seven factors (the 'Assessment of Significance') to be taken into account in deciding whether a development is likely to significantly affect threatened species, populations or ecological communities, or their habitats declared under the *Threatened Species Conservation Act 1995* (TSC Act) or *Fisheries Management Act 1994* (FM Act).

If the determination is made that there is likely to be a significant impact then a species impact statement (SIS) must be prepared and the concurrence of the Director-General of the National Parks and Wildlife Service obtained prior to the consent authority making a determination.

An Assessment of Significance for this project has been included in Attachment 6. The Assessment of Significance concludes that the proposal is not likely to have a significant impact on a threatened species, population or ecological community, or on Critical Habitat identified under the TSC Act.

### PLANNING FRAMEWORK FOR NATURAL ECOSYSTEMS OF THE ACT AND NSW SOUTHERN TABLELANDS

The Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands (Fallding 2002) provides regional principles and planning settings to be considered in planning and development control decision-making. The Framework identifies key planning issues and conservation values relevant for 18 landscape units within the Southern Tablelands region.

The Framework also provides recommended actions and impact assessment guidelines for threatened species and communities occurring in the region. The Framework has no statutory force, but is to be considered by decision-makers in development planning and approval processes.

The subject site is located in the Framework's Yass and Wee Jasper Landscape Units. Planning and management guidelines given in the Framework for these Units are presented below.

The conservation values and management issues identified in the Planning Framework for the Yass and Wee Jasper landscape units have been taken into account in the EA and the development of impact mitigation measures. The project would not conflict with the objectives, policies and actions contained in the Planning Framework.

## YASS LANDSCAPE UNIT

| **Description** | **Land uses** |
|---|---|
| Undulating country fringed to the east by the low Mundoonan Range and in the south-west by the Murrumbidgee valley, including the Burrinjuck Reservoir. Largely occupied by extensive Box-Gum Woodlands, areas of Grassland-Woodland Mosaic and areas of Grasslands, the unit is fringed to the east and south-west by Dry Forest on the low ranges. Riparian Forests of River Red Gum and River Oak occur along the Murrumbidgee River. | Cropping, grazing, a town and several small villages, rural subdivisions, two major transport links, lake-based recreation, one medium-sized and one very small nature reserve (Mundoonan NR, Hatton's Corner NR). |
| **Vegetation status** | **Endemic features** |
| Dry Forests on the fringing hills remain relatively intact in the east, though are largely cleared and fragmented in the south-west. The Box-Gum Woodlands have been severely cleared or modified throughout. The Grasslands are extremely highly cleared, modified and fragmented. The Riparian Forests are similarly fragmented. Burrinjuck Dam has replaced a large area of vegetation.<br>There are:<br>• Several samples of Box-Gum Woodlands and Grasslands of considerable diversity, including Nanima, Coolalie, Eedy's New and Wargeila TSRs, a reserve at Yass Gorge, and Bookham and Bowning Cemeteries. | This unit contains:<br>• The region's core nesting habitat for Superb Parrot<br>• The region's only population of Grey-crowned Babbler<br>• Records of vagrant Major Mitchell's Cockatoos<br>• Records of Striped Legless Lizard and Pink-tailed Worm-lizard<br>• The centre of distribution of Yass Daisy<br>• A minor karst landscape within Hatton's Corner NR. |
| **Known threatened and important species and endangered ecological communities** | **Planning and management issues** |
| **Plants:** Yass Daisy, Silky Swainson-pea, Tarengo Leek Orchid (an introduced population), Australian Anchor-plant<br>**Mammals:** Koala, Eastern Pygmy-possum, Spotted-tailed Quoll, Eastern Quoll (an old record), Eastern Bent-wing Bat, Little Pied Bat<br>**Birds:** Blue-billed Duck, Freckled Duck, Square-tailed Kite, Australasian Bustard (an old record), Major Mitchell's Cockatoo (vagrants), Superb Parrot, Powerful Owl, Grass Owl (a vagrant), Brown Treecreeper, Grey-crowned Babbler, Hooded Robin, Speckled Warbler, Regent Honeyeater, Diamond Firetail<br>**Reptiles and frogs:** Striped Legless Lizard, Pink-tailed Worm Lizard, Booroolong Frog<br>**Invertebrates:** Golden Sun Moth<br>**Vegetation communities:** Natural Temperate Grassland, White Box - Yellow Box - Blakely's Red Gum Woodland | In this unit there are:<br>• Small areas secure within nature reserves<br>• Major pressures from rural subdivisions around Yass and Murrumbateman<br>• Substantial areas developed as vineyards<br>• Major areas showing signs of former severe clearing<br>• Substantial areas of dryland salinity<br>• Minor areas of tree dieback<br>• Minor infestations of Chilean Needle-grass in low areas<br>Consists primarily of planning setting D (See Part 5 of report). |

### WEE JASPER LANDSCAPE UNIT

| Description | Land uses |
|---|---|
| A rugged unit whose major feature is the Murrumbidgee River below Burrinjuck Dam. The vegetation is largely Dry Forest with minor areas of Grassland and Box-Gum Woodland. | Grazing, two small villages, recreation (in caves and bushwalking), several areas of national park and nature reserve. |
| **Vegetation status** | **Endemic features** |
| Large areas of Dry Forest still dominate much of the hilly country and some areas of Box-Gum Woodlands also remain. Grasslands are highly modified or cleared.<br>There are:<br>• Several samples of Box-Gum Woodlands of considerable diversity, including the superb Cavan Woolshed TSR. | This unit contains:<br>• The region's most extensive karst landscapes. The cave system has yielded many records of the Eastern Bent-wing Bat and Large-footed Myotis<br>• The only populations anywhere of the Wee Jasper Grevillea and the only known record of *Caladenia* sp. 'Burrinjuck' (a spider orchid)<br>• The only known regional records of Woolly Ragwort |
| **Known threatened and important species and endangered ecological communities** | **Planning and management issues** |
| **Plants:** Wee Jasper Grevillea, Yass Daisy, Golden Moths Orchid, *Caladenia* sp. 'Burrinjuck' (a spider-orchid), Woolly Ragwort (an early record), Australian Anchor-plant<br>**Mammals:** Spotted-tailed Quoll, Eastern Bent-wing Bat, Large-footed Myotis<br>**Birds:** Powerful Owl, Brown Treecreeper, Hooded Robin, Diamond Firetail, Speckled Warbler<br>**Reptiles and frogs:** Rosenberg's Monitor, Pink-tailed Worm-lizard<br>**Vegetation communities:** Natural Temperate Grassland, White Box - Yellow Box - Blakely's Red Gum Woodland | In this unit there are:<br>• Large areas secure within several national parks and nature reserves<br>• A major area of dryland salinity<br>Consists primarily of planning setting C (See Part 5 of report). |

## 5.2.3. Murrumbidgee Catchment Action Plan

The Catchment Action Plan for the Murrumbidgee Catchment (2006) has been prepared by the Murrumbidgee Catchment Management Authority (MCMA) under the *Catchment Management Authorities Act 2003*. It is a statutory document intended to guide natural resource management through provision of incentives, education, planning and partnership development. The Plan commences on the date of its gazettal and has a term of 10 years from this date.

The Murrumbidgee Catchment covers about 84,000 square kilometres, is bounded by Cooma in the east, Balranald in the west, Temora to the north and Henty to the south, and contains a wide range of climates and ecosystems. The Conroys Gap proposal site is located in the catchment; Jugiong Creek to the north of the site and Yass River to the south are major tributaries of the Murrumbidgee River.

The Plan identifies the following major natural resource issues in the catchment; surface water quality, dryland salinity and water logging, irrigation salinity and water logging, soil erosion, soil acidity, streambank erosion, riparian zone degradation, urban salinity, wetland health, native vegetation decline, weeds and pests and feral animals and river regulation.

The catchment contains 25 Key Threatening Processes, 8 Threatened Ecological Communities, 3 wetlands listed under international agreements – Bonn, CAMBA, JAMBA and Ramsar, 17 nationally listed significant wetlands, 5 threatened populations, 130 threatened species of which 48 are endangered species (23 fauna and 25 flora), and 26 listed migratory bird species.

The Plan applies the timeframed Statewide Resource Condition Targets set by the Natural Resources Commission, covering community, biodiversity, water and land asset areas. The Plan uses a state-pressure-response model to develop and present outcomes, monitoring, actions and opportunities in relation to each of the resource condition and management targets. The MCMA will produce an annual report on progress in achieving targets set by the Plan. The Plan identifies priorities for conservation of vegetation types (including Box-Gum Woodland – high priority), and icon flora and fauna species (including the Yass Daisy, Burrinjuck Spider Orchid and Superb Parrot).

The Conroys Gap proposal would not conflict with the resource condition and management targets set in the Murrumbidgee Catchment Action Plan. The impacts of the proposal on each of the asset areas are addressed in relevant sections of this EA.

### 5.2.4. Surveying Act 2002

Under this Act, all survey marks must be protected unless authorisation is obtained from the Surveyor-General. A trig station is located near the proposed turbine locations in the north of the proposal site. This facility would not be impacted by the works and would be protected from accidental damage during the construction phase. A measure to this effect would be incorporated in the Project EMP.

### 5.2.5. Crown Lands Act 1989

The object of this Act is to ensure that Crown land is managed for the people of NSW through proper development and conservation. Approval under Crown lands legislation would be required from the Minister for Lands for any clearing undertaken on Crown land, leased or otherwise.

Depending on final cable routes, the proposal may involve the laying of electrical cabling through the Black Trig reserve located in the north of the proposal site. The Department of Lands would be consulted regarding approval and licencing requirements under this Act.

### 5.2.6. Roads Act 1993

This Act deals with, among other things, the rights of persons to pass along public roads, the rights of neighbouring landowners, the responsibilities and requirements of roads authorities and the regulation of various activities on public roads. The council of a local government area is the roads authority for all public roads within the area, other than any freeway, Crown road, or road for which some other public authority is declared to be the roads authority.

Under section 138, any work involving disturbance to the surface of a public road, the interference with a tree or structure on a public road, or the pumping of water onto a public road, requires the consent of the appropriate roads authority. A consent may not be given with respect to a classified road, such as a State Highway, except with the concurrence of the RTA.

In addition, a roads authority that proposes to provide conduits across a public road for the carriage of utility services must consult, as to the location and construction of the conduits, with all persons:

(a) who are providing utility services along or in the vicinity of the road, or

(b) who are, in the opinion of the roads authority, likely to provide utility services along or in the vicinity of the road (S.85).

Under S.101, a roads authority may direct any person by whom a public road is dug up to restore the road to its previous condition.

Paynes Road running south from the Hume Highway would be used as the principal access to the proposal site during the construction period. This road will require upgrading (including widening at specific locations and drainage works) on the existing alignment and perhaps sealing (Roger Ubrihien Bega Duo Designs, pers. comm.). Paynes Road is a public road managed by Council between the Hume Highway and the 'Linbrook' Homestead. Works on this road would require approval from Council as the authority under section 138 of the *Roads Act 1993*. The Act also requires consultation with relevant utilities providers.

### 5.2.7. Ecologically Sustainable Development

Ecologically sustainable development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable*

*Development*. In NSW, the concept has been incorporated in legislation such as the EP&A Act and Regulation, and the NPW Act.

For the purposes of the EP&A Act and other NSW legislation, the Intergovermental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline the following principles which can be used to achieve ESD.

(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

An assessment of the ecological sustainability of the proposal against these principles is presented in the Conclusion to this EA (section 9). The aims, structure and content of this EA have also incorporated these principles.

## 5.3. Commonwealth legislation

### 5.3.1. Environment Protection and Biodiversity Conservation Act 1999

This Act provides for a Commonwealth assessment and approvals system for:

a) actions that have a significant impact on ‘matters of national environmental significance’;
b) actions that (indirectly or directly) have a significant environmental impact on Commonwealth land; and
c) actions carried out by the Commonwealth Government.

A proposal requires the approval of the Environment Minister if an action is likely to have a significant impact on a matter of national environmental significance or listed as a matter of national significance which includes:

i) World Heritage Properties,
ii) Wetlands of International Importance (Ramsar wetlands),
iii) Commonwealth Listed Threatened Species and Ecological Communities,
iv) Commonwealth Listed Migratory Species,

v) Nuclear action,

vi) Commonwealth marine areas, or

vii) Commonwealth land.

The Act aims to ensure the conservation and recovery of flora and fauna species and communities at a state and national level. Schedules 1 and 2 list species and communities that are endangered, vulnerable or presumed extinct. Schedule 3 outlines key threatening processes.

Unless a proposal is covered by an exemption specified in the EPBC Act, a proponent must refer the proposal to the Commonwealth Minister for the Environment if they believe that the proposal will have, or is likely to have, a significant impact on a matter of national environmental significance.

A search for Matters of National Environmental Significance based on the study area and a 30 kilometre buffer was undertaken using the Commonwealth Government's web-based Protected Matters Search Tool. This tool covers World Heritage properties, National Heritage places, significant wetlands, migratory species, nationally listed threatened species and communities and other matters protected by the EPBC Act. The search identified 2 threatened ecological communities, 16 threatened species and 6 migratory bird species with potential to be present in the search area, and 5 National Estate properties. The search report is included in Attachment 13.

The proposal would not affect places listed on the Register of the National Estate, World Heritage properties, Commonwealth land or Ramsar wetlands. The likelihood and significance of impacts on threatened communities and species, and migratory bird species relevant to the proposal are assessed in the attached Biodiversity Assessment (Attachment 6) and associated Assessment of Significance (Commonwealth).

The Biodiversity Assessment indicates that the proposal survey area has at least moderate potential to support one threatened community (Grassy White Box Woodland), three threatened bird species (Superb Parrot, Swift Parrot, Regent Honeyeater), one invertebrate (Golden Sun Moth), two threatened plant species (*Ammobium craspedioides*, *Caladenia* sp Burrinjuck – syn. *Caladenia concolor*) and four migratory bird species (White-throated Needletail, Regent Honeyeater, Painted Snipe and Latham's Snipe).

The Biodiversity Assessment concludes that the proposal would not significantly affect any local populations of threatened or migratory species listed in the EPBC Act. The proposal would not affect other Matters of National Environmental Significance.

However, in light of the interest in the project expressed by the Department of Environment and Heritage (A. Rankin, DEH, letter to Taurus Energy, 23 Jan 2006), a precautionary referral was submitted with a copy of the Biodiversity Assessment. The Minister responded on 23 May 2006, indicating that the proposal is not a controlled action and assessment and approval under the EPBC Act would not be required. A copy of the decision and the Minister's covering letter are at Attachment 14.

### 5.3.2. Commonwealth Civil Aviation Safety Regulations 1998

Objects close to airfields that may infringe the obstacle limitation surfaces (OLS) of runways must be reported to the Civil Aviation Safety Authority (CASA). In addition, Civil Aviation Safety Regulations require that CASA be informed of proposals for structures with a height greater than 110 metres above ground level.

If CASA determines that a proposed structure would be hazardous due to its location, height or lack of marking or lighting, it will issue a notice to the proponent and approval authorities advising that if its advice is not followed, the proponent and authorities would be responsible for creating a hazard to aircraft safety and may be held liable for their actions (CASA 2005).

The precise location and height of each tower must be advised to CASA and the Royal Australian Air Force (RAAF), once built.

As the proposed turbine height would exceed 110 metres, CASA and AirServices Australia have been advised of the proposal and their comments sought. This is discussed further in section 7.3.10.

## 5.4. Wind energy industry policies and guidelines

The planning of the wind farm at Conroys Gap and the associated impact assessment draws on a range of guidelines specifically developed for the wind farm and electricity generation industry, including:

- Draft NSW Wind Energy EIA Guidelines (Planning NSW 2002);
- EPBC Act Supplementary Significant Impact Guideline 2.2.2 Wind Farm Industry Sector (DEH 2005b);
- Draft EIS Guideline Network Electricity Systems and Related Facilities (Planning NSW February 2002);
- Industrial Noise Policy (NSW EPA);
- Wind Farms – Environmental Noise Guidelines (SA EPA 2003);
- Electromagnetic Field Implications for Wind Farming in Australia (AGO/AusWEA);
- Wind Farms and Landscape Values (AusWEA/Australian Council of National Trust);
- Wind Farms and Heritage Policy (draft) (NSW Heritage Office);
- Draft Advisory Circular Obstacle Marking and Lighting of Wind Farms (CASA 2005);
- Best Practice Guidelines for Implementation of Wind Energy Projects in Australia (AGO/AusWEA);
- Bird Impact Assessment Protocols and Data Set Standards (AusWEA).

## 5.5. Statutory approvals and licences summary

The proposal requires the following government approvals:

- development approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (Minister for Planning);
- approval to undertake road improvement works on Paynes Road under section 138 of the *Roads Act 1993* (Yass Valley Council);
- licence under the *Crown Lands Act 1989* from Department of Lands if the cable route passes through the Black Trig Reserve;
- a determination from the Civil Aviation Safety Authority (CASA) under the Civil Aviation Safety Regulations relating to aviation safety issues;
- connection agreement with Transgrid.

# 6. CONSULTATION

## 6.1. Consultation Plan

Wind farm developments and approvals in Australia have elicited polarised responses from the community, highlighting the need to effectively involve stakeholders early in the development process. Taurus Energy has informed and consulted with the local community and other stakeholders during the planning and development of the Conroys Gap proposal. Methods of consultation have included release of media statements, the provision of information on the company website, newspaper advertisements and in-person meetings (including onsite meetings, teleconferences and Open House sessions*). A community consultation plan has been implemented concurrently with the specialist studies. Table 6.1 outlines the approach of the community consultation.

**Table 6-1 Scope and methods of consultation**

| Stakeholder | Method of consultation | Timing |
|---|---|---|
| **Involved landholders/occupiers**<br>- land holders/occupiers that may have wind turbines or electricity transmission easement occurring on their land. | Contact landholders and occupiers by phone or in person<br>Discuss details of the proposed work<br>Discuss environmental assessments and onsite meetings that will occur<br>Provide with means to communicate concerns/issues (Taurus and ngh phone number, address, website)<br>Send formal consultation letter containing the details of the proposed work, plan for environmental assessments and onsite meetings, copy of the consultation process plan<br>Invite to all Open House* sessions | August 2005<br>- February 2006<br><br>November 2005, March 2006 |
| **Nearby land owners and occupiers**<br>- landowners/occupiers within an 8km radius of the site. | Telephone contacts and mail formal consultation letter containing the details of the proposed work, plan for environmental assessments and onsite meetings, copy of the consultation process plan and means to communicate concerns / issues (Taurus, ngh, phone numbers, addresses, websites)<br>Invite to all Open House* sessions | August 2005<br><br>November 2005, March 2006 |
| **Aboriginal community**<br>- Local Aboriginal Land Councils contacted<br>- Liaison with DEC | Notification via local newspapers, advertising the details of the proposed work<br>Aboriginal stakeholders consulted directly during the archaeological assessment process<br>Inclusion of interested parties in the field assessment | October 2005<br><br>November 2005 |
| **General community** | Notification via local media (radio and newspapers, local newsletters), advertising the details of the proposed work, environmental assessments and onsite meetings that will occur, means to communicate concerns / issues (Taurus and ngh phone number, address, website), dates and purpose of Open House* sessions<br>Open House* session 1 to introduce the proposal and invite community feedback<br>Open House* session 2 to relate the findings of the specialist studies and the final proposal details | September 2005<br><br>November 2005<br><br>March 2006 |

| Stakeholder | Method of consultation | Timing |
|---|---|---|
| **Local Council**<br>Yass Valley Council | Introductory meeting to outline project and introduce proponent.<br>Invite to onsite Planning Focus meeting<br>Provide with a summary of comments from community Open House* sessions<br>Liaison to keep abreast of proposal changes and findings of assessments | August 2005<br>November 2005 |
| **Consent authority**<br>Department of Planning, Sydney | Initial Meeting to discuss the proposal, and obtain comments relevant to the proposal<br>Planning Focus meeting held onsite to discuss the proposal with government stakeholders<br>Lodgement of Project Application, outlining the proposal and key impact areas and requesting the Director General's Requirements for the Environmental Assessment<br>Lodgement of the Draft Environmental Assessment | September 2005<br>November 2005<br>December 2005<br>May 2006 |
| **Commonwealth and State Government agencies**<br>Department of Natural Resources, Department of Agriculture, Department of Environment and Conservation, Catchment Management Authorities, Rural Fire Service, Roads and Traffic Authority (RTA), Air Services, Country Energy, Transgrid and the Civil Aviation Safety Authority (CASA). | Invited to attend the onsite Planning Focus meeting to discuss issues relevant to each agency (except Air Services and Transgrid).<br>nghenvironmental liaise with representatives from relevant agencies as necessary during the specialist studies and preparation of the Environmental Assessment | November 2005<br>ongoing |

# 6.2. Community consultation

## 6.2.1. Open House approach

The Conroys Gap community consultation process was based on in-person contact between the community, Taurus Energy, and nghenvironmental (contracted by Taurus Energy to investigate the environmental impact of the proposal). The local community was invited to participate in two Open House Sessions. The first session introduced the proposal in its initial form, and invited community feedback. The second session presented the results of the specialist studies (separate reports detailing visual, archaeological, biodiversity and land value assessments) and how information from these reports, in addition to community feed back, has shaped the final details of the proposal.

An open house is an effective way to establish a local presence and provide opportunities for direct communication between the proponents and stakeholders. Consultations are based on personal discussions within small groups or on a one–to-one basis. It allows all interested parties to be informed and to contribute information at a personal level without the formality, time constraints, emotional pressures and confrontational styles that can impede the effectiveness of public meetings. The open house approach has recently been used very successfully by the Department of Environment and Conservation in consulting the community about plans of management.

## 6.2.2. Open House session 1

The first community consultation session was held at the Yass Soldiers Club, 86 Meehan Street, Yass on 16 November 2005. An advertisement was sent to the Yass Tribune on 9 and 16 November. In addition, invitation letters were mailed to 28 nearby residents, identified by Taurus Energy.

The aim of the session was to inform the community, obtain information about the proposal site and the community and learn about the general concerns of the community regarding the proposal.

The session was held over 5 hours on a week day, from 2-7pm. On hand to answer questions were Andrew Durran and Martin Poole (Taurus Energy – issues specific to the proposal), Nick Graham-Higgs and Brooke Marshall (nghenvironmental – issues specific to environmental impacts and the assessment process) and Philip Hutchinson (Scenic Landscape Architecture – issues specific to the visual impact assessment). Three lap top computers and one overhead projector presented rolling displays of the proposal. Several maps of the area and of the proposal were wall mounted so that people could locate their proximity to the proposal and be talked through the proposal. Wind farm fact sheets and an example of a wind farm environmental assessment document were also available to participants. Tea, coffee and seating were provided and participants were encouraged to stay and discuss their concerns.

Public input was recorded by session staff from conversations with participants and by participants on blank paper and structured feedback forms.

#### OPEN HOUSE 1 RESULTS

Forty-one members of the local community registered at the Open House. The majority were drawn from within several kilometres from the proposal site, particularly residents of Black Range Road, Burrinjuck Road and the nearby villages of Bookham and Bowning. Attendance was sparse early in the day; most people arrived around 5 pm, which limited opportunities for individual discussions but allowed for a group Powerpoint presentation by Taurus Energy.

Key issues raised at the Open House session included:

**Noise**
There were concerns that the noise of the proposal would ruin the tranquility of the area. It was suggested that low cloud cover could affect the way sound carries in the area.

**Land value**
Many people raised this issue. Potential for subdivision in the area increases the importance of this impact. Small blocks in the area have been bought for scenic value and are within commuting distance of Canberra. There was speculation among participants that the proposal would halve the land value.

**Visual impact**
The visual impact on smaller blocks close by was a concern.

**Biodiversity**
The impact on eagles and migratory birds was raised.

**Recreation/land use**
The possible impact on horses was raised. Horse riders and a pony club use the area.

### COMMUNITY FEEDBACK FORMS

Six community feed back forms issued at the Open House had been returned by 6 December 2005. While such surveys are not necessarily representative of overall community views, or meaningful in a statistical sense, they are useful in identifying the range of issues which concern the community. The collated results of the feed back forms are summarised in Attachment 5, and an overview of responses to feedback form questions is presented below.

**1. Where would you take some one to show them a good view of your local area (list as many places as you can think of).**

Views from a range of directions were nominated, including from private properties, major and minor roads, villages and Yass.

**2. What do you value the most about the local area?**

Respondents value visual, environmental, recreational and production aspects of the area, with a focus on views and recreation.

**3. What is your interest in the local area (please provide details)**

A large proportion of the respondents live nearby, enjoy recreation locally or are involved in commercial agriculture in the area.

**4. Which statements describe you (tick all those that apply)**

A large proportion of respondents anticipated that they would be able to see the wind farm from their house and/or property.

**5. If you have concerns about this wind farm, what aspect would have the biggest impact on you?**

Concerns were widely spread with some prominence given to visual and noise impacts.

**6. What do you <u>like</u> about wind farms, in general?**

Respondents to this question largely indicated a support for wind power on environmental grounds (greenhouse, climate change, renewable energy).

**7. What do you <u>dislike</u> about wind farms, in general?**

Respondent concerns were widely spread, with some prominence given to visual impact, the potential for land devaluation and noise.

**8. Do the following issues concern you?**

Asked to nominate issues of concern under broad headings, respondents identified a range of concerns, including environmental, visual, heritage and noise issues, recreation, health, land use, land value and social issues.

### 6.2.3. Open House session 2

The second Open House session was held at Yass Soldiers Memorial Hall, Comur Street Yass, on Thursday 6 April 2006. Methods similar to the first Open Session were used to notify the community about the event, including individually addressed letters to 58 property owners in the vicinity of the site and advertisements in the Yass Tribune on 22, 24, 29 and 31 March and 5 April 2006.

The second session sought to provide the community with an update on the results of the specialist assessments of values and impacts relating to the proposal, and changes to the project flowing from the assessments and consultations. The session also aimed to identify and record the responses of participants to the assessment results and proposed impact mitigation measures.

A series of information handouts were prepared and distributed at the Open House, including:

- a one-page summary of main points from the draft Environmental Assessment;
- the executive summary of the draft Environmental Assessment;
- a brief description of how the original proposal had changed in response to consultation and the specialist assessments; and
- a summary of the Part 3A approval process and related opportunities for community input.

In addition, a brief questionnaire was provided to participants focusing on their responses to the assessment information presented at the Open House. Copies of the Open House 2 hand-out material are provided in Attachment 5.

The duration of the session was four hours, from 3 pm to 7 pm. The layout of materials was similar to the first Open House, with copies of the biodiversity, noise, traffic, archaeology and visual assessment reports available for perusal on tables, and visual assessment images and large photomontages on walls. The session was unstructured and informal to encourage personal interaction between the proponents and assessment staff and community participants. Present were Andrew Durran and Martin Poole (Taurus Energy), Nick Graham-Higgs and Paul McPherson (nghenvironmental), Kate Waldren (Scenic Landscape Architecture) and Gustaf Reutersward (Heggies Australia).

#### RESULTS

Based on registration entries, 47 people attended the Open House, with most visits occurring in the second half of the session. Participants included:

- involved landowners;
- non-involved landowners located near the proposal;
- landowners interested in becoming involved in wind farming;
- residents of Yass interested in the proposal;
- secondary school students.

Approximately 16 people arrived late in the afternoon representing a group who identified themselves as the 'Black Range Guardians' and the 'Residences of Black Range'. This group was opposed to the proposed windfarm.

As in the first session, a range of opinions was expressed regarding the wind farm project. Some key concerns raised by participants objecting to the project included:

- loss of land value and land saleability near the wind farm;
- visual impacts on nearby property owners;
- noise impacts on nearby properties;
- late consultation and insufficient communications with neighbouring landowners;
- collision risks to stock along the unfenced Paynes Road;

- creation of division and conflict in the local community;
- fire hazards, particularly in the event of lightning strike;
- the perceived inefficiency of wind turbines;
- cement and siltation impacts to watercourses, including significant frog populations and drinking water supplies;
- bird impacts of operating turbines, including impacts on the Swift Parrot, Barking Owl, Little Eagle and autumn migrating birds.

Only one questionnaire was completed and submitted. In summary, the following points were made in the submission:

- the cumulative visual and noise impacts were considered to have been underestimated;
- the assessments were considered vague with regard to the variability of impacts such as noise on local residents;
- the location of a wind farm in this rural area with medium development and dwellings was considered inappropriate; and
- the community fund contribution was considered to be inadequate.

Participants were provided with information on how these concerns have been handled in the assessments, conclusions reached regarding the significance of likely impacts and the nature of any proposed mitigation measures. Information was also provided on the way forward regarding the consideration of consultation input, completion of the Environmental Assessment, the approval process and further opportunities for public comment.

### 6.2.4. Community update newsletters

A ‘Community Update’ newsletter was mailed to landholders east of Yass and the local press, and posted on the Taurus Energy website. The newsletter introduced the proposal, outlined the approval process and inviting participation in the first Open House. A copy of the Newsletter is provided in Attachment 5.

### 6.2.5. Local Press

The Yass Tribune (a Rural Press publication) is widely distributed within the local area, published twice per week. The Tribune has given a high profile to the proposed wind farm since the November Open House, with more than a dozen articles and a number of letters to the editor printed. Taurus has provided information and responses to questions to the Yass Tribune to help inform their position.

### 6.2.6. Taurus Energy website

The proponent maintains a company website with details of active projects, including the Conroys Gap wind farm proposal. The website provides contact details for the proponent and outlines the assessment and approval process, timelines, and opportunities for public input. The site provides links to government and industry information sources and assessment reports are available on the site for viewing and downloading as pdf files.

The URL for the site is <www. taurusenergy.com.au>.

### 6.2.7. Statutory consultation period

After the EA has been accepted by the Director-General, it would be placed on public exhibition for at least 30 days, to allow submissions from the community, local government and state agencies. Following the consultation period, the Director-General may require the proponent to respond to the comments, revise the proposal or revise the Statement of Commitments.

## 6.3. Government and public agency consultation

### 6.3.1. Yass Valley Council

Taurus Energy met with Yass Valley Council on 11 August 2005 to introduce the project and the proponent. Separate consultations with Council staff have been undertaken in relation to the specialist studies.

### 6.3.2. Department of Planning (initial meeting)

Taurus Energy met with the consent authority, the Department of Planning, formally on 8 September 2005 introducing the Conroys Gap proposal and seeking advice on the assessment process. The Department was also invited to participate in the onsite Planning Focus Meeting with other agencies.

### 6.3.3. Planning Focus Meeting

The Planning Focus Meeting (PFM) was held onsite at Conroys Gap on 11 November 2005. Comments from participants were sought in order that impacts relevant to each agency were addressed by the proposal. Participants at the meeting included:

- Neville Osborne and John Kerwan, Department of Planning
- Paul De Szell (and Councillors), Yass Valley Council
- Matthew Rizzuto, Department of Environment and Conservation
- Peter Dyce and Tim Street, Rural Fire Service
- Col Hackney, Country Energy
- Wendy Goodburn, Department of Primary Industries (Agriculture)
- Brooke Marshall and Paul McPherson, **ngh**environmental
- Andrew Durran, Martin Poole and Anthony Micallef, Taurus Energy.

Representatives from the Catchment Management Authority (CMA), Roads and Traffic Authority (RTA) and the Civil Aviation Safety Authority (CASA) were invited to attend but declined.

Comments from participants are summarised in Table 6.2.

**Table 6-2 Key comments by agencies at the Planning Focus Meeting**

| Agency | Key issues |
|---|---|
| ***Yass Valley Council*** | • Council shares the concerns expressed by other agencies. In particular, the assessment should address:<br>o site access during the construction stage, including impacts on roads and bridges<br>o visual impacts<br>o noise impacts<br>o environmental impacts<br>o weeds<br>o implications for the LEP<br>o the implications for a 20 lot subdivision proposal (2-160ha) to the east of the site, and other potential concessional lot applications in the surrounding district.<br>o community views on the proposal.<br>• There is less opposition to wind farms in the Conroys Gap community than other parts of the LGA, such as Spring Range, near Murrumbateman.<br>• The RLPB and South-west Slopes Noxious Weeds Authority (based in Boorowa) should also be contacted regarding the assessment. |

| Agency | Key issues |
|---|---|
| ***Department of Planning*** | • The assessment should consider:<br>o The impacts on the Yass Valley LEP, including the potential for future residential development;<br>o Visual impacts, especially from the Hume Highway.<br>o The assessment will need to provide justification for the project in terms of benefits to the community and affected landowners. This issue has come up in other assessments.<br>o The proposal indicates a range of options regarding turbine size and capacity. The assessment of negative impacts should be based on the larger size, and the description of positive benefits should be based on the smaller size. |
| ***Rural Fire Service*** | • The assessment should consider:<br>o The potential for emergencies during and following construction.<br>o Access to the site in the event of a fire<br>o Potential for containment lines<br>o Hot welding in fire danger periods – fire suppression required<br>o Potential for the substation to start a fire (if the power station caught on fire, it would be a NSW fire brigade issue, due to the hazardous materials, with RFS involved in a support role)<br>o Transformers are an ignition source, catch fire occasionally. |
| ***Country Energy*** | • Connection agreements and approvals<br>• Private ownership of powerlines would be an issue<br>• Usual arrangement is that the proponent creates assets and then vests them with CE to manage.<br>• A preliminary assessment has been undertaken to identify the preferred option to connect to the grid. The Conroys Gap site is one of the more fortunate in terms of connection options. |
| ***Department of Primary Industries*** | • The assessment should consider:<br>o the effects on farm operations;<br>o implications for weed management; and<br>o the potential for contaminating substances affecting dams and pastures. |
| ***Department of Environment and Conservation*** | • Primary issues concerning DEC relate to the EPA guidelines and the NSW Industrial Noise Policy, Aboriginal heritage and flora and fauna.<br>• While DEC has no statutory role if the development remains below 30MW with no scheduled activities, it would have input to the development approval process.<br>• Concrete batch plant may require license, determined by volume.<br>• Noise (need to assess in a manner consistent with other developments of this type).<br>• Heritage<br>• Biodiversity – DEC will liaise directly with DoP<br>• Recommends that the following technical guidelines be adopted:<br>o *Wind farms – environmental noise guidelines* (South Australia EPA, 2003)<br>o *Industrial noise policy* (NSW EPA, 2000)<br>o *Draft guidelines for Aboriginal cultural heritage impact assessment and community consultation* (DEC July 2005)<br>o *Draft guidelines for threatened species assessment* (DEC and DPI July 2005) |

### 6.3.4. Roads and Traffic Authority

In a letter to **ngh**environmental dated 19 December 2005, the Roads and Traffic Authority (RTA) indicated that it requires a Traffic Impact Study for the Cullerin and Evandale wind farm proposals, and has referred the Conroys Gap proposal to the South West Regional Office for assessment. Issues for inclusion in the Traffic Impact study were also identified, including access arrangements and routes, construction impacts and road safety impacts such as light flickering. The Traffic Impact Study has been undertaken by Duo Designs, and is included as Attachment 12. The results of the study are summarised in section 7.3. Roger Ubrihien (Duo Designs) has liaised directly with the RTA South West Regional Office (John Coman) regarding the specific requirements for the Conroys Gap assessment.

### 6.3.5. Department of Natural Resources and Murrumbidgee CMA

Darren Wallet of the Wagga Wagga Regional Office, DNR (pers. comm. 2 May 2006) advised that DNR concerns centre on soil and water protection, particularly given the steep ridgetop locations typical of wind farms. The works should incorporate adequate erosion controls, rehabilitation measures, water body protection, and aim to keep all impacts confined to the development footprint. Some infrequently used vehicle access routes could be kept grassed, rather than developed as an unsealed road surface to retain soil stability. Mr Wallet advised that he would be happy to comment on the Environmental Assessment if required.

Ray Willis (Murrumbidgee CMA) (pers. comm. 2 May 2006) advised that key issues for the CMA relate to vegetation protection under the Native Vegetation Act, particularly threatened species, overcleared vegetation types and overcleared landscapes. More detailed input would be provided when the Environmental Assessment is referred for comment.

### 6.3.6. Commonwealth Department of Environment and Heritage

The Environmental Assessment concludes that the proposal would not significantly affect any Matters of National Environmental Significance listed in the EPBC Act. However, in light of the interest in the project expressed by the Department of Environment and Heritage (A. Rankin, DEH, letter to Taurus Energy, 23 Jan 2006), a precautionary referral was submitted to the Department with a copy of the Biodiversity Assessment.

The Minister responded on 23 May 2006, indicating that the proposal is not a controlled action and assessment and approval under the EPBC Act would not be required. A copy of the decision and the Minister's covering letter are at Attachment 14.

### 6.3.7. Civil Aviation Safety Authority and Airservices Australia

CASA and Airservices Australia have been formally notified of the proposed Conroys Gap wind farm and the proponent is in ongoing discussion with both organisations to determine their final requirements.

A letter from Taurus Energy dated 20th December 2005 formally notified CASA of the proposal. Provided wind turbines are not located in close proximity to transmitters they will not cause any issue for aircraft navigation systems. CASA has provided a copy of their most recent guidelines regarding obstacle marking of wind farms, and the proponent will continue discussion with CASA once development consent has been granted to finalise lighting requirements based on the final wind farm layout.

At a meeting between Taurus Energy and Airservices Australia on 18th January, 2006, Airservices Australia stated that it is required to maintain a primary and secondary radar system for the Canberra International Airport (CIA), in order to comply with International Civil Aviation Organisation (ICAO) standards and proposed that further study be carried out.

On 13th April 2006, Taurus Energy commissioned Airservices Australia to conduct a study of the effects of the proposed Conroy's Gap wind farm development on the operation of the Mount Bobbara Air Traffic Control (ATC) radar facility located 6km north east of the township of Binalong, NSW. The Mt Bobbara radar is currently operating as the secondary radar to Mt Majura for the Canberra International Airport. Airservices Australia completed the study on 21st June 2006.

The results of this study are provided in section 7.3.7.

Further details regarding interaction with CASA and Airservices Australia are provided in section 7.3.10.

### 6.3.8. Aerial Agricultural Association of Australia

The Aerial Agricultural Association of Australia was contacted in writing to outline the proposed development and to determine issues of concern in relation to aerial agriculture. The Association has not expressed any concern at the time of writing. Taurus Energy will advise the Association of final turbine locations prior to construction.

### 6.3.9. Country Energy and Transgrid

A phone conference was held on 5 January 2006 between the proponent and Country Energy (Terry Crossley) to discuss transmission line and substation requirements, particularly land and asset ownership issues and approval processes. In addition, Country Energy was invited to and attended the Planning Focus Meeting held on site. This meeting and subsequent studies determined that Country Energy's assets will not be used for the proposed development.

The proponent's electrical engineering consultants E-Connect Australia Pty Ltd consulted with Transgrid in the preparation of the High Level Feasibility Study in relation to the connection of the wind farm to Transgrid's assets. A copy of this report has been provided to Transgrid for further discussion. The proponent will continue to consult with Transgrid in the preparation of a Grid Connection Agreement allowing the connection of the wind farm to Transgrid's electricity network.

### 6.3.10. Yass Rural Lands Protection Board

The Yass Rural Lands Protection Board was contacted by email to determine issues of concern in relation to livestock management, pest control or other matters relevant to the RLPB. Kim Turner (Manager, Yass RLPB) indicated that the Board resolved at a meeting that it had no specific issues for consideration in the assessment relevant to RLPB jurisdiction.

### 6.3.11. Southern Slopes County Council

This agency, based in Booroowa, was contacted to determine issues of concern in relation to noxious weeds at the Conroys Gap site. Damien Minehan, General Manager, responded by email stating that the noxious weeds Serrated Tussock and St Johns Wort may be present at the site, and noting that Serrated Tussock in particular can spread rapidly after soil and vegetation disturbance. Full inspection of the proposed development areas would be required.

While the Director-General's Requirements indicate consultation with the South-west Slopes Noxious Weeds Authority, the Southern Slopes County Council is now the 'local control authority' in relation to noxious weeds for the purposes of the Noxious Weeds Act.

# 7. ASSESSMENT OF KEY ISSUES

## 7.1. Scoping and prioritisation of issues

Recent reforms to the *Environmental Planning and Assessment Act 1979* and associated planning instruments provide for the consolidated assessment of major projects, including wind farms involving more than $30 million in capital investment. The reforms also provide for improvements to efficiency in the assessment and approval process, by allowing assessments to focus on key 'moderate to high priority' issues.

Consistent with the NSW Wind Energy Facilities Draft EIA Guidelines (Planning NSW 2002), issues have been prioritised based on impact severity, extent, duration and reversibility. The level of assessment contained in the EA reflects the complexity and priority accorded to each issue.

Moderate to high priority issues are those with the potential to produce significant environmental or human impacts. Lower priority issues are those which can be demonstrated to be manageable using established practices and mitigation measures. Using best practice and adaptive management approaches these issues are not likely to cause unacceptable environmental or human impacts. Where uncertainty or high levels of risk exist, issues are allocated to the moderate to high priority category.

Moderate to high priority issues have been identified by an extensive review of experiences and research at existing wind farms in Australia and overseas, and consultation with landholders, the general public, government agencies and experts. In particular, the issues scoping process drew on the results of public consultation through an Open House and questionnaire public consultation process held in Yass on 16 November 2005 (refer section 6.2), and a Planning Focus Meeting involving state and local government representatives held at the subject site on 11 November 2005 (refer section 6.3).

A Project Application indicating the issues to be addressed in the EA and their priority for assessment was accepted by the Department of Planning on 27 February 2006. The rationale for allocating priorities to each issue is summarised in Table 7.1 below.

The proposal indicates a range of options regarding turbine size and capacity in order to maintain flexibility in product selection and finescale design. Where this would affect the type or intensity of impacts, the assessment in the EA has been based on the option with greatest potential negative impact. Similarly, the description of positive benefits would be based on the option with least potential benefits. A range of possible turbine layouts are included in the proposal; where potential impacts vary between layouts, these differences are highlighted in the EA.

### Table 7-1 Rationale for issue prioritisation

| Issue | Rationale for prioritisation | Assessment strategy |
|---|---|---|
| HIGH PRIORITY ISSUES | | |
| **Biodiversity issues** | Values and impacts are highly specific to each site and require specialist identification and assessment. | Specialist Biodiversity Assessment (Attachment 6, and section 7.2) |
| **Operational noise** | Impacts localised but may be locally significant. Specialist modelling and assessment required. | Specialist noise assessment (Attachment 7, section 7.3.5) |
| **Visual impacts** | Values and impacts are highly specific to each site, requiring specialist assessment. | Specialist visual assessment (Attachment 8, section 7.3.4) |
| **Community impacts** | Potentially a divisive and controversial issue for the local community requiring thorough consultation and assessment. | Consultation Plan and review (sections 6 and 7.3.1 and Attachment 5). |
| **Land value and development potential** | An issue of community concern and potential local economic impact. Detailed review of experiences elsewhere required. | Crookwell wind farm study and review (Attachment 11 and section 7.3.2) |
| **Telecommunications interference** | Potentially serious communications and safety issues requiring detailed identification of issues and available mitigation measures. | Detailed assessment, section 7.3.6. |
| **Bushfire impacts** | Concerns expressed from government and community consultations. Bushfire is a significant seasonal hazard in the district. | Detailed assessment, section 7.3.7. |
| **Traffic and transport impacts** | Construction traffic has potential to degrade local roads and impose additional costs on Council. Requires review of impacts and mitigation. | Detailed assessment, section 7.3.8. |
| **Aviation impacts** | Potential safety issues related to siting and design of the wind farm. Detailed assessment is required in consultation with CASA and local authorities. | Detailed assessment, section 7.3.9. |
| **Safety and health** | Community concerns regarding the safety of local residents. Specific attention is required to assess the potential for health impacts. | Detailed assessment, section 7.3.9. |
| **Cultural heritage** | Specialist assessment and consultation with traditional owners required to determine values and potential impacts. | Specialist archaeological assessment Attachment 9, section 7.3. |
| **Removal of infrastructure** | Guarantees are required that the wind farm would be safely and effectively removed at the end of its operational life. | Specific assessment and measures, section 7.5. |
| **Cumulative impacts** | A significant issue with wind farms on the Southern Tablelands, given the growth in the industry throughout the region. | An assessment of cumulative impacts of wind farms located near the proposal, section 7.6. |
| LOWER PRIORITY ISSUES | | |
| **Air, water, soils** | No significant hazards apply. Impacts and risks are manageable with best practice and standard mitigation measures. | Section 8.1 |
| **Construction noise** | EPA noise emission standards for construction projects achievable using best practice and mitigation measures. | Section 8.2 |
| **Land use** | No significant constraints to existing land uses at the site are anticipated. | Section 8.3 |
| **Economic impact** | Local economic impacts are generally positive. | Section 8.4 |
| **Resource use and waste** | Simple review of practices and materials required. Best practice management sufficient to achieve resource efficiency and waste minimisation. | Section 8.5 |

## 7.2. Biological factors

### 7.2.1. Flora and ecological communities

A detailed description of flora values and ecological communities in the study area, including survey results and methodology, photographs, regional context, disturbance characteristics, and Assessments of Significance in relation to potential impacts on listed threatened species, is provided in the Biodiversity Assessment in Attachment 6.

Key conclusions from the assessment are summarised below. Flora features and survey zones are indicated on Figure 7.1.

**EXISTING ENVIRONMENT**

**Vegetation communities**

The majority of the study area is farmland that has been cleared and grazed for many decades. These areas generally lack sufficient integrity to enable confident attribution to the Southern Region vegetation types defined by Thomas *et al*. (2000). The location of the site in the transition zone between the tablelands and the western slopes also has implications for the composition and distribution of vegetation in the study area.

Nonetheless, there appears to be remnant native vegetation derived from at least three Southern Region vegetation types present in the study area. The natural dryland vegetation types and other assemblages in the study area include:

- **Red Stringybark – Broad-leaved Peppermint – Red Spotted Gum forest**
  - Red Stringybark (*Eucalyptus macrorhyncha*) is present on ridges and slopes as secondary grassland and scattered trees in the northern turbine, northern valley (mid-slopes) and powerline valley and sideslope zones (Photograph 1). Broad-leaved Peppermint (*E. dives*) is present as a small remnant patch comprising around 14 mature trees with a few Hickory Wattle trees (*Acacia implexa*) over a dense bracken fern groundcover, on a ridge slope in the northern turbine zone (Photograph 7). A small stand dominated by Red Spotted Gum (*E. mannifera*) with Broad-leaved Peppermint and Red Stringybark as sub-dominants, occurs beside the existing access track midway between Black Range Road and the southern turbine sites.
  - In all stands, understorey vegetation has been greatly modified by agriculture, with the general elimination of the medium-tall shrub stratum. This forest community is likely to have originally covered the ridgelines and sideslopes of the northern majority of the proposal area occurring on metasediments.
  - This community corresponds to Forest Ecosystem 109: Widespread Tablelands Dry Shrub/Tussock Grass Forest in the Southern Region CRA classification. Species characteristic of Forest Ecosystem 120: Western Slopes Shrub/Herb/Grass Dry Forest are present in some areas and the two types may have occupied the slopes and ridgelines as an intergrading complex.
  - Both FE 109 and FE 120 are under-represented in the conservation reserve system, according to JANIS criteria (JANIS 1997).
- **'Ferndale' dry shrub forest remnants**
  - Dry forest remnants variously dominated by Long-leaved Box (*Eucalyptus goniocalyx*), Red Box (*E. polyanthemos*), Red Stringybark (*E. macrorhyncha*) and White Gum (*E. rossii*) occur on the 'Ferndale' property, on granitic geology west of the southern turbine sites and in the southern part of the powerline corridor (Photograph 3). These remnants occur on ridgetops and upper slopes. The understorey is generally herbaceous and affected by grazing. A steep granite escarpment west of the southern turbine sites carries a rock scrub assemblage.

- This forest is likely to have originally occupied the ridges and slopes in the granitic southern part of the proposal area. The community can be assigned to Forest Ecosystem 114: Tablelands Dry Shrub/Tussock Grass Forest. FE 114 is under-represented in the conservation reserve system, according to JANIS criteria (JANIS 1997).

**Photograph 1. Secondary grassland on the northern turbine ridge (view north)**

**Photograph 2. Degraded remnant Box-Gum Woodland along Black Range Road**

**Photograph 3. Small Long-leaved Box remnant on 'Ferndale' property**

**Photograph 4. Remnant Box-Gum Woodland understorey in McCullums Creek valley**

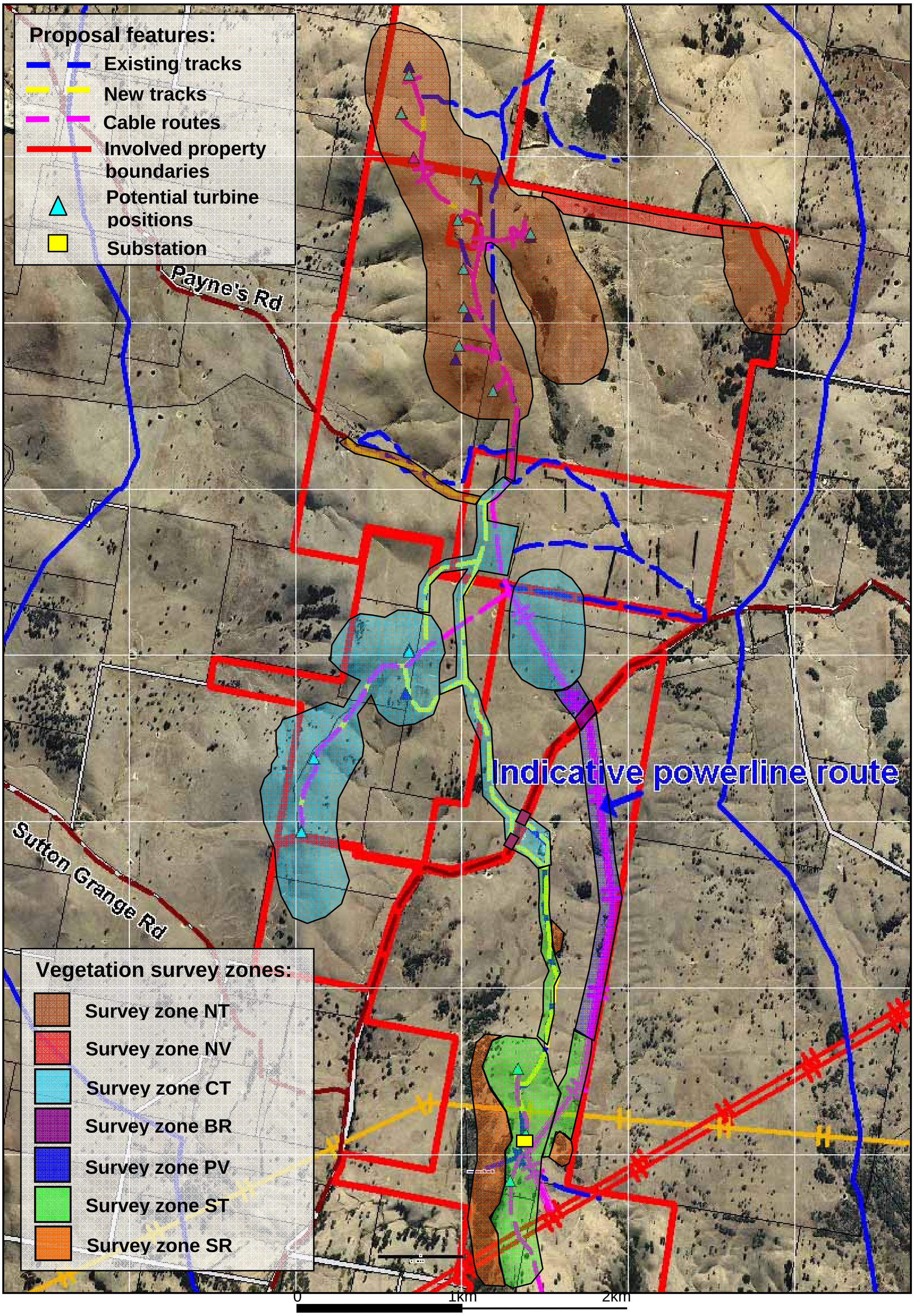



**Figure 7.1 Vegetation survey zones**

- **Valley woodland**
  - A woodland assemblage dominated by Blakely's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) is present in a discontinuous linear remnant beside Black Range Road in the vicinity of the proposed powerline and track crossing points (survey zone BR, Photograph 2). The understorey at the actual crossing points is largely dominated by introduced grass species, with some patchy representation of native groundcover species. The woodland community is also present as secondary grassland in the Northern Valley (NV) survey zone (Photograph 4).
  - These woodland communities are likely to have occupied the valley floor, low hills and lower slopes throughout the Yass district, including the valleys in the study area north of Black Range Road and much of the valley section of the powerline route through the 'Ferndale' property (zones NV, BR, PV).
  - Some riparian areas are likely to have carried Forest Ecosystem 92: Tablelands Acacia/Grass/Herb Dry Forest, dominated in the overstorey by *E. bridgesiana* and *E. melliodora*. Woodland remnants in the study area also carry indicators of Forest Ecosystem 160: Northern Slopes Dry Grass Woodland and Forest Ecosystem 161: Tablelands and Slopes Dry Herb/Grass Woodland. It is possible that either or both of these types would also have been present in valleys in the study area.
  - Forest Ecosystems 160 and 161 fall within the White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community (Box-Gum Woodland EEC). Type 92 overlaps the EEC, with grassy examples featuring Yellow Box covered by the EEC Determination. Yellow Box is likely to have been a significant component of the type 92 community in the study area. These vegetation types are also included within the Grassy White Box Woodlands community, listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
  - The secondary grassland community in the Northern Valley (McCullums Creek) survey zone, despite having lost the tree stratum, is sufficiently intact in the groundlayer to warrant recognition as part of the White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland) Endangered Ecological Community (EEC).
- **Modified aquatic habitats**
  - Wetland communities are present in streams and dams in the study area, particularly associated with instream pools in the 'Ferndale' section of the proposed powerline route (Photograph 6). Because of their inherent fertility, and impacts arising from erosion, sedimentation, grazing, clearing and disruption to flow regimes, these habitats have been extensively colonised by weeds.
  - Wetland and riparian assemblages in the study area are heterogeneous, and may be locally dominated by willows (**Salix* spp.), blackberry (**Rubus fruticosus* agg.), or one of several native graminoids or introduced grasses, sedges and aquatic forbs. These communities have local conservation value based on their role in maintaining water quality and flow conditions, stabilising soils and providing fauna habitat, rather than inherent botanical values.
- **Exotic pasture**
  - The moister, more fertile valley floors in the study area generally carry pasture dominated by exotic grasses and legumes, with some representation of native species (Photograph 5). Exotic pasture and other heavily modified areas occupy around 40% of the Southern Tablelands region (Fallding 2002). There are few paddock trees on the 'Linbrook' and 'Springvale' properties.

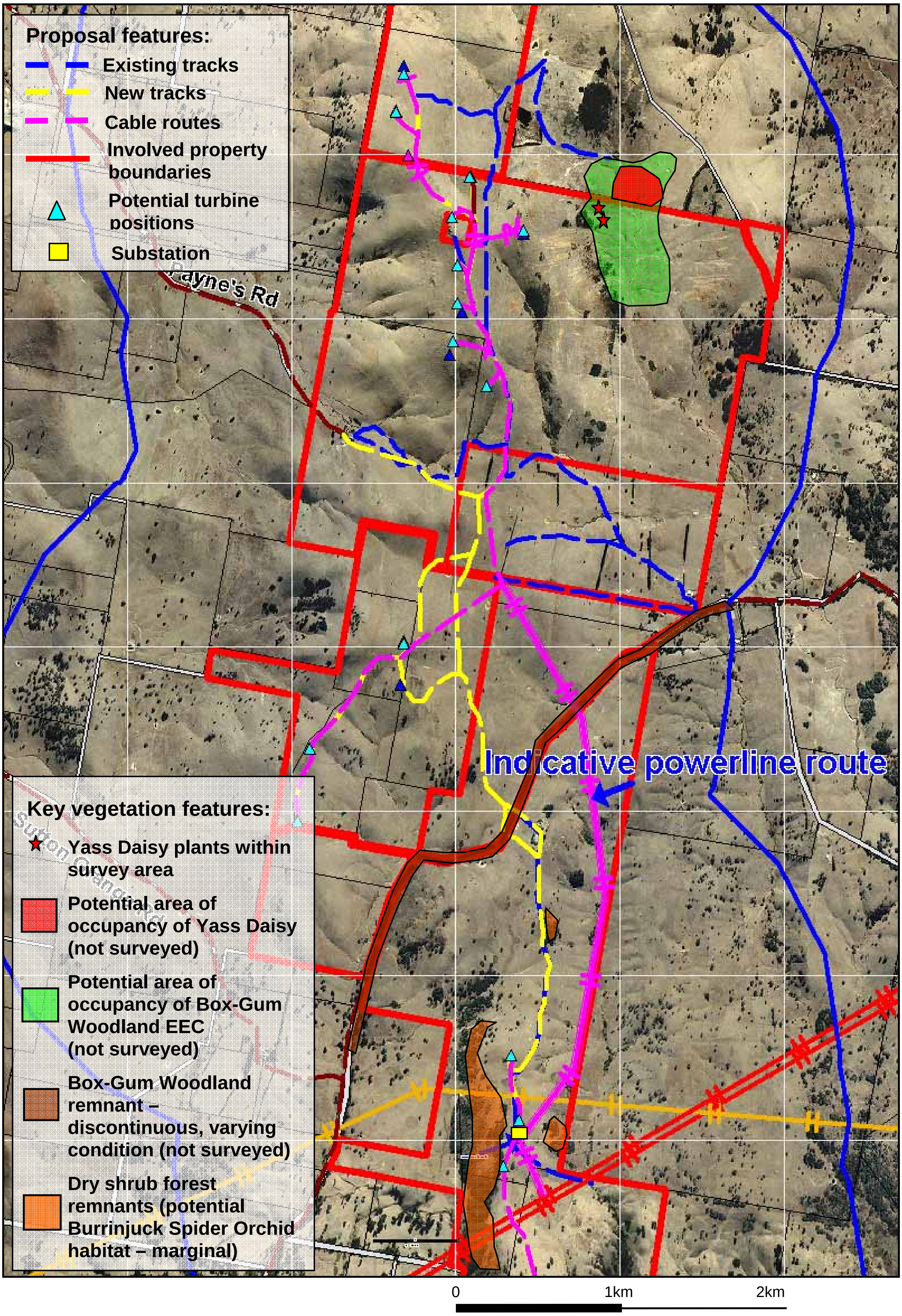



**Figure 7.2 Key vegetation features at the subject site**

**Photograph 5. Lower pastures dominated by exotics on the 'Springvale' property**

**Photograph 6. Weedy watercourse through the 'Ferndale' property**

### Species of conservation significance

Based on habitat available and existing records, four threatened species and a range of regionally significant species have at least moderate potential to be present in the study area. Threatened species with potential habitat in the survey area include:

- Yass Daisy (*Ammobium craspedioides*);
- Burrinjuck Spider Orchid (*Caladenia* sp Burrinjuck);
- Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var *tricolor*);
- Silky Purple Pea (*Swainsona sericea*).

In addition, two species have low-moderate potential to occur in the survey area:

- Tarengo Leek Orchid (*Prasophyllum petilum*);
- Small Purple Pea (*Swainsona recta*).

These species are listed as threatened under the NSW TSC Act. The Yass Daisy, Burrinjuck Spider Orchid and Hoary Sunray are listed as threatened under the Commonwealth EPBC Act.

Only one of these species was recorded in the survey area; the Yass Daisy, in the Northern Valley survey zone. The Burrinjuck Spider Orchid would not have been recordable during the survey, and the Tarengo Leek Orchid and Small Purple Pea may also not have been flowering at the time of survey. Given the disturbance history and fragmentation of habitats in the study area, the occurrence of these species is possible but unlikely.

The Yass Daisy (2 plants) was recorded in the Northern Valley (McCullums Creek) survey zone, in remnant Box-Gum Woodland understorey (AGD 658901 6145625 and AGD 658889 6145630). Immediately north of this area, on neighbouring property, a sizeable population (hundreds) of the Yass Daisy was observed. The species was also observed in roadside remnants beside Black Range Road, east of the subject site.

#### DISTURBANCE AND WEEDS

Forests and woodlands in the study area have been progressively ring-barked and felled over the past century to provide pasture. Clearing and agriculture has produced a range of direct and indirect impacts to flora habitats, including altered microclimate, loss of pollinator and dispersal fauna, sheet erosion of soils, watercourse bed incision and damming, localised sedimentation, elevated soil nutrients and rising saline groundwater.

Agricultural activities have also resulted in the colonisation of a range of introduced plant species, with greatest displacement of natives occurring in moister, more fertile valley floor areas and areas subjected to pasture improvement and cultivation. In many areas, grazing is likely to have reduced or eliminated selectively grazed or grazing sensitive species, such as Kangaroo Grass (*Themeda triandra*), terrestrial orchids, wattles and sub-shrubs.

Six Class 4 weeds declared under the *Noxious Weeds Act 1993* were recorded at the subject site. Locations of these weeds at the subject site are provided in the Biodiversity Assessment (Table 4.2). Of these, Serrated Tussock (*Nassella trichotoma*), which is present around the northern turbine sites, is most problematic because of its local abundance, long-lived soil seed reservoir and capacity to spread on the wind.

#### IMPACT ASSESSMENT

The principal impacts to flora values would occur during the construction phase. Impacts during the operational and decommissioning phases are discussed in the Biodiversity Assessment. Relevant measures to mitigate impacts during the construction phase are also applicable to the operational and decommissioning phases.

### Direct impacts

The proposal would result in the removal of vegetation under the development footprint, including the turbine towers and surrounding hardstand areas, control building, substation, new and widened access tracks and powerline poles. This vegetation would be removed for at least the life of the wind farm (up to 30 years).

Underground cable corridors would generally follow access tracks constructed between the wind turbines and other facilities. Existing tracks run from the 'Springvale' property onto the trig ridge and from Black Range Road south to the southern turbine cluster site. Approximately 4.3 hectares of native secondary grassland derived from dry shrub forest types would be permanently removed. A smaller area of exotic pasture would be permanently lost under the proposed powerline and new access track connecting the northern, central and southern turbine clusters. Approximately 2 hectares of secondary grassland would be temporarily removed during construction, but restored during the rehabilitation phase.

The routing of the powerline through cleared parts of the 'Ferndale' property and the siting of the southern turbines to the east of the remnant forest patches would avoid the need to clear native forest. Similarly, the selection of Paynes Road to access the site would avoid the need to trim branches from trees beside Black Range Road.

The proposal would not directly affect the northern valley survey area (McCullums Creek) or the ridge to the east of the valley. This area was removed from the proposal in light of the results of biodiversity, visual and noise assessments. Measures would be adopted to protect this area from the peripheral and indirect impacts of the development.

### Indirect and peripheral impacts

Vegetation surrounding the development footprint would be affected by vehicle access and parking, materials laydown and spoil deposition and retrieval. Peripheral impacts may include soil compaction, soil erosion and sedimentation. The works have the potential to introduce and spread weed species. A concrete batch plant which may be required for the works would have further impacts, but does not form part of the current proposal. If developed, the batch plant and associated flush pit would alter local subsoil conditions over the medium term. This is likely to be sited in an existing quarry, which has been heavily impacted by gravel excavation. This development would be assessed independently as required.

Pollution risks are associated with concreting works, fuels and lubricants and construction chemicals used at the site. With appropriate safeguards and practices (refer section 8.1), these risks to native vegetation are expected to be low. Similarly, the increased bushfire risks to vegetation caused by construction activities are expected to be manageable and acceptable. Dust would be generated from the excavation and building activities at the construction sites, and by traffic using unsealed access routes, over the 6-9 month construction period. The limited duration of dust deposition is not expected to significantly affect soils and vegetation at the site.

The potential indirect impacts of the proposal on the threatened Yass Daisy (*Ammobium craspedioides*) and the Box-Gum Woodland Endangered Ecological Community located in the Northern Valley survey zone are identified and assessed in the Assessment of Significance presented in Appendix D. Measures would be adopted to protect this area from the peripheral and indirect impacts of the development.

### IMPACT AVOIDANCE AND MITIGATION

The following measures to avoid and minimise impacts to flora and ecological communities are included in the proponent's Statement of Commitments (Attachment 3).

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Further surveys** | If areas of dry shrub remnant forest on the 'Ferndale' property require clearing, the areas will first be surveyed for the Burrinjuck Spider Orchid (*Caladenia* sp Burrinjuck) during the late August-October flowering period. |
| **Microscale site selection** | The southern turbines and access track will be sited to avoid the need to clear or trim remnant eucalypts to the west of the southern turbine sites. |
| | The powerline will be routed to avoid the need for clearing or trimming of the Long-leaved Box (*Eucalyptus goniocalyx*) forest remnant on the 'Ferndale' property. |
| | The Black Range Road crossing points for the proposed new tracks near the Ferndale residence will be sited in available gaps between mature Yellow Box and Blakely's Red Gum trees in the road reserve. The northern track crossing appears to be sited in such a gap; the southern crossing may need to be shifted slightly to the north (to AGD 658311 6141864) to avoid mature trees. |
| **Design and construction measures - general** | Site stabilisation, rehabilitation and revegetation will be undertaken without delay, following the rehabilitation guidelines in the EA. |
| | Works will avoid impacts to mature eucalypts wherever possible. Wherever practicable, excavations and vehicle/machinery movements will occur outside the canopy dripline of large eucalypts. |
| | As a general rule, disturbed areas will be used for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and the deposition and retrieval of spoil whenever practicable. |
| | Works will be avoided during, and immediately following heavy rainfall events to protect soils and vegetation at the site. |
| | Any compaction of soil resulting from vehicle access and laying of materials, particularly during saturated soil conditions, will be avoided and remediated as necessary. |
| | Excavated topsoil, subsoil and weathered rock will be stored separately and replaced in a manner that approximates the original profile as closely as possible. |
| | Where practicable, whole sods will be removed with an excavator where these areas are well-vegetated with dense root systems. Sods will be stored in moist, shaded conditions and replaced following the works. Sod storage time will be minimised and sods will be replaced in a manner that maximises the chances of re-establishment. |
| | Appropriate fire fighting equipment will be held on site when the fire danger is very high to extreme, and a minimum of one person on site will be trained in its use. |
| | Machinery and vehicles used in construction works will be washed before and after site access to reduce the introduction and spread of weeds and pathogens. |
| | Laydown sites for excavated spoil, equipment and construction materials will be weed-free or treated for weeds wherever practicable. |
| | Weed monitoring will be carried out at all sites after the completion of construction works and ongoing weed control will occur where noxious or invasive species are recorded. In particular, monitoring will be undertaken during the following late spring/early summer, and remedial action taken as required. |
| | Only certified weed free hay bales will be used for sediment control, if available. |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| | Wherever practicable, the overstorey canopy in forest communities will not be disturbed to assist weed suppression. |
| | Imported materials such as sand and gravel will be sourced from sites which do not show evidence of noxious weeds or *Phytophthora* infection. |
| **Design and construction measures – project-specific** | Contractors and staff will be made aware of the significance and sensitivity of the Northern Valley/upper McCullums Creek valley area (Box-Gum Woodland EEC and threatened Yass Daisy habitat). The area will be protected from peripheral and indirect impacts and will not be used for site access or materials/equipment laydown. |
| | In areas dominated by exotic groundcover species, exposed soils in the excavation corridor will be lightly mulched with chipped vegetation or sterile hay, and sown with a cover crop such as oats or millet, depending on season and seed availability, or an appropriate pasture seed mix (in consultation with landowners). |
| | In areas dominated by native grasses, exposed soils will be lightly mulched with chipped native vegetation or sterile hay, and sown with Weeping Grass (*Microlaena stipoides*) and/or Wallaby Grass (*Austrodanthonia* spp), or a cover crop such as oats or millet, depending on season and seed availability. In such areas, seed-bearing native pasture hay could be used for mulching, depending on availability. |
| | Fertiliser will not be used to promote revegetation in native grass-dominated areas of the site to reduce weed pressures. |
| | The development sites will be inspected for weeds prior to the commencement of works, in consultation with the Southern Slopes County Council. Noxious weeds in the vicinity of the works site (refer Table 4.2) will be treated prior to the commencement of works, subject to seasonal factors. |
| | Where cement is included in cable trench backfill, at least 20 centimetres of cement-free topsoil will be replaced as the top layer in the backfill. |

### 7.2.2. Fauna

A detailed assessment of fauna values in the study area, including survey results and methodology, photographs, regional context, Assessments of Significance in relation to threatened species and a Bird Risk Assessment, is provided in the Biodiversity Assessment in Attachment 6. Key conclusions from the assessment are summarised below.

#### EXISTING ENVIRONMENT

#### Fauna habitats

Six broad habitat types were identified in the study area, related to topography and vegetation:

- **modified wetland areas and watercourses**
  - small dams and watercourses, generally cleared of tree cover and heavily degraded by weeds, streambed erosion and sedimentation.
- **exotic pasture on valley flats and lower slopes**
  - occupying the more fertile, moister areas on flats generally between the northern and central turbine clusters, dominated by exotic pasture grasses and legumes.
  - planted shelterbelts (non-local native and introduced species) are present along some fencelines.
- **cleared ridgetops and side slopes**
  - undulating ridgetops with steep to very steep sideslopes, outcropping fine-grained and steeply dipping metasediments in the north, and granitic boulders in the south.
  - large rock crevices, boulder piles, smaller rocks and scattered fallen logs and stags provide shelter and basking habitat to reptiles.

  - vegetation cover is mixed native-exotic grasses and forbs, with a higher proportion of exotics and less outcropping rock on the southern turbine ridges. Some parts of the northern ridges carry dense bracken fern cover.
  - isolated mature eucalypts (mostly Red Stringybark, *E. macroryncha*) are present but infrequent.
- **dry shrub forest remnants**
  - small areas of remnant dry forest are present on ridges and sideslopes on the central east ridge (*Eucalyptus dives*, in poor condition) and the southern turbine/powerline corridor zone on the 'Ferndale' property (*Eucalyptus goniocalyx, E. rossii, E. polyanthemos, E. mannifera, E. macrorhyncha*).
- **grassy woodland remnants (cleared)**
  - the Northern Valley (McCullums Creek) survey area carries degraded grassy woodland understorey, dominated by native grasses.
- **grassy woodland remnants (with tree cover)**
  - the section of Black Range Road crossed by the proposed powerline carries degraded grassy woodland remnant with some tree loss and general replacement of native understorey with a tall cover of exotic pasture and weed species.
  - this habitat is distributed along Black Range Road, and provides tree hollows for bats, birds and arboreal mammals. No hollows were observed in trees in the vicinity of the powerline route or proposed track crossing points.

**Photograph 7. Degraded Broad-leaved Peppermint dry forest remnant in Northern Turbine zone**

**Photograph 8. Scattered Red Stringybark trees in Central Turbine zone**

**Species present**

46 fauna species were recorded during the field survey of the subject site; including 7 terrestrial mammal species, 3 microbat species, 25 bird species, 8 reptile species and 6 frog species (refer Attachment 6). Trap results suggest a low small mammal abundance and diversity at the site, attributed to poor available habitat resources (shelter, food sources), disturbance history and the recent period of extended drought. Bird fauna recorded in the cleared paddock and ridge areas of the subject site was restricted to a few species, most commonly Magpies, Richards Pipits and Wedge-tailed Eagles. Waterbirds such as Wood Ducks and White Ibis were recorded at dams and watercourses.

### Sensitive habitat features

Rare and limiting habitat features in the locality include Box-Gum Woodland and eucalypt tree hollows. No intact Box-Gum Woodland is located within the subject site, although woodland understorey is located in the McCullums Creek valley to the east of the northern ridges.

Forest communities have been heavily depleted locally, and remnants have high local habitat value for arboreal mammals, microchiropteran bats, birds and reptiles.

Large hollow-bearing trees have been locally depleted by clearing for agriculture and are likely to be a limiting habitat resource for dependent species. There are very few hollows in paddock trees at the subject site and most trees in forest remnants are mature regrowth yet to reach hollow-forming age. A mature Red Spotted Gum in the north of the southern turbine envelope (658295 6140489) has a medium-sized trunk hollow which could provide bird and arboreal mammal nesting habitat. A number of live and dead paddock trees have cracks and crevices which may provide shelter for micro bats.

No rare or limiting food sources for threatened bird species is expected to be located at the subject site. The prolifically flowering Red Box and other eucalypts which provide a potential food source for the Regent Honeyeater and other bird species are present and widespread in the southern part of the subject site.

The rabbit population on the turbine ridges, coupled with the ridge slope updraft, may provide an important, and limiting, hunting resource for the Wedge-tailed Eagle and Little Eagle. This issue is further discussed in section 5.3 (Box 5.2) of the Biodiversity Assessment.

While there are no examples of undisturbed or high quality wetland habitats in the study area, the local dams and watercourses may provide essential habitat for resident frog and skink populations and resting and foraging habitat for waterbirds moving between more significant habitat areas.

### Threatened species

No fauna species that are listed as endangered or vulnerable on Schedule 1 or 2 of the *Threatened Species Conservation Act 1995* were recorded at the subject site during the survey. One species, the Superb Parrot, was recorded beside Black Range Road 3 kilometres to the east of the study area.

Parts of the survey area have at least moderate potential to provide habitat for nine threatened fauna species:

**Mammals**
Little Pied Bat
Eastern Bent-wing Bat

**Invertebrates**
Golden Sun Moth

**Birds**
Barking Owl
Superb Parrot
Swift Parrot
Gang-gang Cockatoo
Diamond Firetail
Regent Honeyeater.

### Matters of National Environmental Significance

Matters of National Environmental Significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* within a 30 kilometre buffer of the study site were identified using the EPBC Act web-based search tool (http://www.deh.gov.au/erin/ert/epbc/index.html) in November 2005. The search report is included at Attachment 13.

The EPBC Act search report indicates that the following threatened or migratory fauna species or habitats listed under the EPBC Act are or may be present within the search area:

- the catchments of two Ramsar wetland sites (Fivebough and Tuckerbil Swamps);
- four threatened bird species (Swift Parrot, Superb Parrot, Australian Painted, Snipe Regent Honeyeater);
- two threatened fish species (Murray Cod, Macquarie Perch);
- one threatened insect (Golden Sun Moth);
- three threatened mammals (Tiger Quoll, Eastern Long-eared Bat, Smoky Mouse);
- two reptile species (Striped Legless Lizard, Pink-tailed Worm-lizard);
- four terrestrial migratory species (White-bellied Sea-Eagle, White-throated Needletail, Satin Flycatcher, Regent Honeyeater);
- two migratory wetland species (Latham's Snipe, Painted Snipe);
- ten listed marine species.

In addition, the search identified five natural areas on the Register of the National Estate; Derringullen Creek Area, Hattons Corner Area, Lake Burrinjuck *Grevillea iaspicula* Sites 1 and 2, and the Upper Lake Burrinjuck Area.

Four listed threatened fauna species are assessed as having at least a moderate potential of being present in habitat in the survey area; the Golden Sun Moth, Superb Parrot, Swift Parrot and Regent Honeyeater. Two listed terrestrial migratory species also have at least a moderate potential to use habitat in the proposal area; the Regent Honeyeater and the White-throated Needletail.

### IMPACT ASSESSMENT: CONSTRUCTION PHASE

#### Habitat loss and modification

The proposal would result in the permanent (30 years) loss of approximately 4.3 hectares of secondary grassland habitat derived from dry sclerophyll forest, with scattered rock outcrops, in the construction of the wind turbines, substation, control building and new tracks. The ridgetop habitat is used by reptiles, birds, macropods and rabbits. The habitat is not high quality and is abundant throughout the district. This minor areal loss is not expected to significantly affect any local fauna population. Around 2 hectares of secondary grassland would be disturbed and reinstated following construction. These impacts are expected to be temporary and would not significantly affect local fauna.

The proposal would not directly affect the woodland habitat in the northern valley (McCullums Creek) survey area or the ridge to the east of this valley. This area was removed from the proposal in light of the results of biodiversity, visual and noise assessments. Measures would be adopted to protect this area from the peripheral and indirect impacts of the development.

The routing of the powerline through cleared parts of the ‘Ferndale' property and the siting of the southern turbines to the east of the remnant forest patches would avoid the need to clear native forest. Similarly, the powerline and new track crossing points on Black Range Road would be located in cleared gaps, avoiding the need to clear or trim woodland trees. The selection of Paynes Road to access the site would also avoid the need to trim branches from trees beside Black Range Road.

#### Dust, noise, vibration and visual disturbances

The dust, noise, vibration and activity associated with the 6-9 month construction phase at the construction sites and along the access routes may affect the foraging behaviour of local fauna species, particularly birds and macropods. Given the local abundance of similar habitat, this temporary effect on habitat utilisation is not likely to significantly affect local populations of these generally highly mobile species.

### Pollution risks

The concreting works, construction activities and the storage and use of fuels, lubricants and construction chemicals carries a pollution risk for aquatic habitats. These risks are considered acceptable and manageable using appropriate safeguards and practices (refer section 8.1).

#### IMPACT ASSESSMENT: OPERATIONAL PHASE

The key operational impacts of the proposal relate to the operation of the wind turbines. The potential bladeswept area of the turbines would range from 34 to 126 metres above the ground. The impacts of the wind farm would be most acutely felt by those species utilising aerial habitat within the bladeswept zone. At the Conroys Gap site, this fauna belongs to two groups; birds and microchiropteran bats. Terrestrial fauna may also be affected by turbine noise and blade flicker, although, given the low fauna diversity and abundance at the site, these impacts are not likely to be significant.

### Birds

The assessment of impacts and risks to birds at the proposal site has involved distinctions drawn between:

- the likelihood of adverse impacts and the consequences of those impacts;
- the impacts on individuals at the site and the impacts on the wider populations;
- the direct impacts on birds (from bladestrike) and the indirect impacts on habitat or habitat availability.

These inter-related factors are addressed separately in the Biodiversity Assessment (Attachment 6) and combine to produce the overall level of risk operating for each species at the site. Key conclusions from the assessment are presented below.

#### Bladestrike impacts

The proposed wind turbines have the potential to cause mortalities in local bird populations due to collision with turbine blades or being swept down by the wake behind a turbine blade. For the purposes of this assessment, 'bladestrike' refers to both forms of impact.

Some structural and design characteristics of the proposal serve to reduce collision risks, including widely spaced, high turbines, tubular towers without perch opportunities and the underground installation of most reticulation cabling.

An assessment of the cumulative wind farm collision risk for threatened and migratory birds was recently undertaken by Biosis Research (2006) for the Commonwealth Department of Environment and Heritage. Directly observed collision avoidance rates have been documented as 100% for a range of species at Codrington, Victoria, including the Wedge-tailed Eagle, Brown Goshawk, Nankeen Kestrel, Swamp Harrier, Brown Falcon, Richards Pipit, Magpie-lark, Magpie, Raven, Straw-necked Ibis, White Ibis, Egret species and White-faced Heron (Meredith *et al.* 2002).

Cumulative bladestrike risk modelling for the Swift Parrot resulted in an average combined annual number of deaths at 39 wind farms of between 0.08 and 0.13 birds per annum. This equates to slightly more or less than a single parrot being killed every ten years. For the Tasmanian Wedge-tailed Eagle, the assessment concluded that impacts would be very small and would be masked by normal fluctuations in the population due to natural variables. A preliminary assessment of risk to 34 EPBC Act listed species with potential to occur in the vicinity of five operating or planned Gippsland wind farms concluded that collision impacts are likely to be low or negligible for all species assessed. It was considered that a very small proportion of the Australian population of these species would ever move through a wind farm site and that, if they do enter a wind farm, they would be likely to actively avoid collisions or fly outside the bladeswept zone (Biosis Research 2006).

All species recorded at the Conroys Gap site and most likely to be affected by the proposal are widespread and not considered threatened. At the time of survey, there were no unusual or significant congregations of birds at the site. Based on experiences elsewhere in Australia, local raptor species and night-flying waterbirds are the species at most risk of bladestrike.

In the Biodiversity Assessment, bladestrike risks for 21 species were assessed from three principal risk groups – raptors, owls and frogmouths, threatened species and waterbirds and migratory species. Risks were assessed for individual birds at the site and for the wider local or regional populations (refer Table 7.2).

While some risk exists to individual birds at the site, blade collisions are expected to be rare. The Conroys Gap proposal is not considered likely to significantly affect bird species at the population level. These assessments are provisional, and based on available information. In particular, knowledge is incomplete regarding the migration behaviour and routes of local bird species, and the behavioural responses of local species to the wind turbines.

**Raptors**

Six raptor species were considered to be at moderate or moderate-high risk at the individual level; Wedge-tailed Eagle, Little Eagle, Australian Kestrel, Brown Falcon, Australian Hobby and the Spotted Harrier.

Two species were assessed to be at moderate or moderate-high risk at the population impact level; Wedge-tailed Eagle and the Little Eagle. For these species, the indirect impacts of the proposed wind farm on local hunting habitat have the potential to affect the reproductive success of local breeding pairs which may adversely affect the health of populations at the local and possibly region scales.

These raptor species typically construct stick nests in eucalypts, and soar over open country at turbine blade height. These species are frequently recorded close to human development, and are likely to be able to habituate to the proposed wind farm over time. A Californian study shows a similar number of raptor nests before and after wind plant construction (Howell and Noone 1992 in Strickland 2004). Raptor populations have also been found to co-exist with turbines at Australian wind farms, including at Codrington (Biosis Research Pty Ltd 2002, Wonthaggi EES Panel 2003), Toora (Brett Lane and Associates 2005), Crookwell (URS 2004) and Woolnorth (Hydro Tasmania 2003).

Compared to larger raptors with extensive breeding territories, such as the Wedge-tailed Eagle, the Brown Falcon, Australian Hobby and Spotted Harrier have higher reproductive rates and are more abundantly distributed. The potential for population level impacts is therefore likely to be lower for these species. Risks to the Wedge-tailed Eagle at the site are discussed in the case study in the Biodiversity Assessment (Box 5.2). Given the low frequency of recorded collision at existing Australian wind farms, it is unlikely that the bladestrike impacts of the proposed Conroys Gap wind farm would create a continuing population sink for the regional Wedge-tailed Eagle population. However, the alienation of ridgetop hunting resources may have more pervasive consequences for this species (refer below).

**Waterbirds**

In the Biodiversity Assessment, no waterbirds, or migratory or threatened species were assessed as being at moderate or high risk of bladestrike at the Conroys Gap site. Small ephemeral wetland habitats are present in watercourses, paddock dams and wet pastures in the study area and surrounding farmland. Although precise waterbird migration routes are not known, the subject site is not located between significant habitat areas and bird movements across the site may be diffuse and irregular, rather than concentrated and seasonal.

Small numbers of waterbirds were recorded at the site, in dams and wet drainage lines. Short-range foraging journeys by these species may follow chains of small wetland habitats scattered over the lowland areas of the district. Major migration routes for these species are not known. Longer range migrations may involve crossing high ridges at blade height, but the frequency of this occurring at the Conroys Gap site is likely to be low.

**Terrestrial migratory and woodland birds**

No migratory or threatened woodland bird species were assessed as being at moderate or high risk of bladestrike at the Conroys Gap site. The principal flight paths for woodland species are likely to follow valleys and lowland areas carrying remnant woodland and water sources. Birds moving at tree canopy height through the Black Range Road corridor and between other lowland remnants are unlikely to be affected by the wind turbines located on adjacent ridges.

**Bird habitat and habitat utilisation impacts**

The operational phase of wind farm developments has the potential to affect bird habitats and habitat utilisation patterns by:

- degrading off-site habitats (for example, from polluted runoff or weed introductions);
- alienating and fragmenting breeding or foraging habitat;
- altering migration behaviour.

Off-site degradation resulting from the construction and operational phases of the project are readily avoided and controlled using standard best-practice mitigation methods. Risks to local bird populations from off-site habitat degradation are assessed as low.

In the Biodiversity Assessment, habitat loss and avoidance risks for 21 species were assessed from three principal risk groups – raptors, owls and frogmouths, threatened species and waterbirds and migratory species. Risks were assessed for individual birds at the site and for the wider local or regional populations (refer Table 7.2).

For most species, the subject site is unlikely to provide limiting, uncommon or significant habitat. In view of the substantial buffer distances involved, the wind turbines are not expected to alter habitat utilisation rates on neighbouring farmland, remnant woodland and wetlands.

In the case of the Wedge-tailed Eagle (refer Biodiversity Assessment, Box 5.2) and possibly the Little Eagle, the high ridge habitat may provide an important updraft hunting resource and food supply (rabbits). The loss of this habitat may not affect existing birds but, if the area forms part of a breeding territory, it may affect breeding success over the longer term.

The degree or effect of habitat alienation on the local eagle population is difficult to predict. As part of the proposed adaptive management program, further pre-works investigations are required to determine if nests are located near the subject site, and operation-phase monitoring will be required to record bladestrike mortality, habitat avoidance and impact on breeding success (refer mitigation measures below).

While the seasonal and diurnal migration routes for bird species at the site are not known, the subject site is not expected to present a significant migration corridor for waterbirds and woodland species. The site does not appear to lie between significant and localised habitat areas where large numbers of birds congregate. Migration patterns of waterbirds and other species over the site are likely to be diffuse, reducing the risk of catastrophic collision events.

## Table 7-2 Overall impact risk for vulnerable bird groups (bladestrike and habitat impacts)

| Species | Risk to individuals at site | Risk to local population |
|---|---|---|
| **RAPTORS** | | |
| Wedge-tailed Eagle (*Aquila audax)* | Moderate | Moderate-high |
| Little Eagle (*Hieraaetus morphnoides*) | Moderate | Moderate |
| White-bellied Sea-eagle (*Haliaeetus leucogaster)* | Low | Low |
| Australian Kestrel (*Falco cenchroides)* | Low-moderate | Low |
| Brown Falcon (*Falco berigora*) | Moderate | Low |
| Peregrine Falcon (*Falco peregrinus*) | Low-moderate | Low |
| Australian Hobby, Little Falcon (*Falco longipennis*) | Moderate | Low |
| Spotted Harrier (*Circus assimilis)* | Moderate | Low |
| Barking Owl (*Ninox connivens*), Barn Owl (*Tyto alba)* and other owl species | Low-moderate | Low-moderate |
| Tawny Frogmouth (*Podargus strigoides)* | Low | Low |
| **THREATENED SPECIES (PASSERINES AND PARROTS)** | | |
| Diamond Firetail (*Emblema guttata)* | Low | Low |
| Regent Honeyeater (*Xanthomyxa phrygia*) | Low-moderate | Low-moderate |
| Superb Parrot (*Polytelis swainsonii)* | Low-moderate | Low-moderate |
| Swift Parrot (*Lathamus discolor)* | Low-moderate | Low-moderate |
| Gang-gang Cockatoo (*Callocephalon fimbriatum)* | Low-moderate | Low-moderate |
| **WATERBIRDS AND MIGRATORY SPECIES** | | |
| Painted Snipe (*Rostratula benghalensis*) | Low | Low |
| Latham's Snipe, Japanese Snipe (*Gallinago hardwickii*) | Low | Low |
| White Ibis (*Threskiornis molucca*) | Low-moderate | Low |
| Australian Wood Duck (*Checonetta jubata)* | Low-moderate | Low |
| White-faced Heron (*Ardea novaehollandiae)* | Low-moderate | Low |
| White-throated Needle-tail, Spine-tailed Swift (*Hirundapus caudacutus*) | Low-moderate | Low |
| Satin Flycatcher (*Myiagra cyanoleuca*) | Low | Low |

### Microchiropteran Bats

#### Bladestrike impacts

The proposed wind turbines have the potential to cause mortalities in local bat populations due to bladestrike. The risk of collision is influenced by the behavioural and possibly morphological characteristics of particular bat species, as well as site environmental factors. Species characteristics which may affect collision risk include reproductive potential, migration behaviour, echolocation ability, flying manoeuvrability, foraging height, long-distance flying height and reaction to the new infrastructure.

There appears to be little published information which explains bat collisions at existing turbine sites. The relative vulnerability of the various bat species in Australia to bladestrike is also not well known. United States studies show that higher flying 'tree bats' are disproportionately affected (AusWEA 2004) and migratory species comprise the majority of mortalities to date (Erickson *et al* 2002, Arnett 2005). Species which rely more heavily on vision for navigation, with a low echolocation call emission rate, may also be at higher risk. Bat species with each of these characteristics may occur at the Conroys Gap site.

Environmental factors which may affect the potential for collision include wind speeds and weather, proximity to foraging and roosting resources, linear vegetation features which may influence migration behaviour and proximity to other landscape features which may affect bat movements. German studies have shown higher collision rates from turbines located near hedgerows (Australian Bat Society 2005). Many species use linear vegetation or topographic features while commuting (Limpens and Kapteyn 1991, in Erickson *et al.* 2002) and migrating (Humphrey and Cope 1976, Timm 1989, in Erickson *et al*. 2002). The Conroys Gap site is located in heavily cleared farmland. The nearest linear vegetation feature is remnant woodland beside Black Range Road, located some distance from the turbine ridges.

Little research exists about collision or avoidance risks to bats in Australia. Monitoring research at the three operational wind farms in Victoria has recorded no rare, threatened or endangered birds or bats killed by wind turbines to date. Searches conducted by Biosis Research for dead birds around seven turbines at Victoria's Codrington Wind farm (Victoria) showed one bat death (a White-striped Mastiff Bat) during the 2001-2003 monitoring period (AusWEA 2004). Incidental carcass finds showed a further White-striped Mastiff Bat death. Six bat mortalities were recorded at the Toora wind farm between 2002 and 2003; this impact was not considered to be of conservation significance (AusWEA 2004).

Monitoring of wind farms to date has shown that bats investigate the blades and blade area of turbines and that while collisions do occur, they are able to avoid the blades on most occasions (ABS 2005).

The Anabat surveys at the Conroys Gap proposal site detected three species, including the low-flying Goulds Wattled Bat (which would be at low risk of turbine collision), and the high-flying White-striped Mastiff Bat (which may be at considerably higher risk). Based on known behaviour and mortalities at other wind farm sites, some level of White-striped Mastiff Bat mortality caused by turbine collision is possible at the site.

Bats moving between the larger remnant forest patches in the local area would not be required to pass over the proposed turbine ridges at the Conroys Gap site.

The risk of bladestrike to microbat species and the likely impact of various mortality rates to local populations at the Conroys Gap site cannot be precisely determined. However, the relatively low level of recorded mortalities at existing wind farms in south-east Australia, the absence of recorded significant species mortalities, the widespread nature of similar foraging habitat and the absence of woodland and forest habitat at the subject site combine to suggest that the proposal would not be likely to significantly affect local populations of microbats. The uncertainty would need to be managed using monitoring and an adaptive management approach.

#### Bat habitat and habitat utilisation impacts

Most of the site offers marginal roosting habitat because of the scarcity of tree or cave habitat. Isolated paddock trees are present but uncommon. Small forest remnants are present, particularly near the southern turbine sites, comprising mostly mature regrowth with few hollows. Larger remnants are present outside the involved properties, but within foraging range of bat species. Rock outcrops on the trig ridge turbine site have cracks, but are unlikely to provide quality roosting habitat because of their limited size and the level of exposure.

The proposed wind farm would involve minimal tree clearing or branch trimming and is not expected to result in the loss of roosting habitat at the site.

Abundant insect activity was observed across the site during survey work, providing foraging resources for microbats, possibly related to warm updrafts. Microbats are known to forage over cleared paddocks with isolated paddock trees and this may have benefits in terms of regulating herbivorous insects on these trees (Lumsden and Bennett 2004). The presence of operating turbines may affect foraging behaviour through habitat avoidance or collision with rotor blades or powerlines. However, foraging habitat at the site is locally and regionally abundant. Some degree of localised habitat avoidance is in fact desirable to reduce collision risks.

Given the extent of habitat loss in the district, habitat utilisation could be expected to be broadly dispersed through the locality, with some focus on the larger forest/woodland remnants, which are generally located some distance from the subject site. The proposed turbines are unlikely to alienate potential foraging and nesting habitat areas.

The proposal would not involve the removal of substantial maternity, over-wintering or roosting habitat. Given the heavily cleared nature of the site and the absence of linear vegetation features, any bat migration traffic over the site is probably more likely to be diffuse rather than concentrated.

There does not appear to be evidence that the subject site provides limiting or dependent habitat for microbats. The impacts on habitat or habitat utilisation are not expected to significantly affect local populations of microbats. However, monitoring and an adaptive management approach would be required to account for the lack of information about these species.

### IMPACT AVOIDANCE AND MITIGATION

The following measures to avoid and minimise impacts to fauna and fauna habitats are included in the proponent's Statement of Commitments (Attachment 3).

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Further surveys** | Prior to the commencement of works, timbered areas within 2 kilometres of the turbines will be surveyed for the presence of Wedge-tailed Eagle nests, access permitting. Active nests will be monitored and breeding success recorded over the preceding breeding season (July-January). Both breeding success and habitat use behaviour at the subject site will be recorded to provide a baseline for operational monitoring and adaptive management. |
| **Microscale site selection** | Contractors and staff will be made aware of the significance and sensitivity of the Northern Valley/upper McCullums Creek valley area (potential threatened fauna habitat). The area will be protected from peripheral and indirect impacts and will not be used for site access or materials/equipment laydown. |
| | The southern turbines and access track will be sited to avoid the need to clear or trim remnant eucalypts to the west of the southern turbine sites. |
| | The powerline will be routed to avoid the need for clearing or trimming of the Long-leaved Box (*Eucalyptus goniocalyx*) forest remnant on the 'Ferndale' property. |
| | The Black Range Road crossing points for the proposed new tracks near the Ferndale residence will be sited in available gaps between mature Yellow Box and Blakely's Red Gum trees in the road reserve. The northern track crossing appears to be sited in such a gap; the southern crossing may need to be shifted slightly to the north (to AGD 658311 6141864) to avoid mature trees. |
| | The turbine towers will be as widely spaced as possible to reduce bird collision risks, though this must be balanced with an increased visual impact. A minimum spacing of twice the rotor diameter will be used between turbines (centre to centre). |
| | At all sites, the clearing or trimming of mature and hollow-bearing trees and stags will be avoided. |
| | The turbines will be sited as far back from the edge of the ridgelines as possible to minimise disturbance to the use of updrafts by raptors. |
| **Design and construction measures** | Where practicable, reticulation cabling between turbines will be installed underground to reduce bird collision risks and disturbance to habitat use patterns. |
| | To protect aquatic habitats, the concrete batching plant if required will be well bunded, silt fences will be used around all excavation works, the duration of works will be minimised, and drainage line and creek crossings will be stabilised (consistent with Fisheries NSW guidelines). |
| | Where practicable, power poles and overhead powerlines will be bird-safe using flags or marker balls, large wire size and wire and conductor spacing. |
| | If lights are required to be fitted to the towers (eg for aircraft safety), they will be red flashing lights to reduce attractiveness to insects and possibly night-flying birds (subject to CASA requirements). For similar reasons, turbine paint will be non-reflective if practicable. |
| | Where possible, guy lines will not be fitted to towers or associated structures. Any guy lines which need to be used will be indicated with marker balls or flags. |
| | The turbine towers and associated structures will not provide perching opportunities. |
| | Rock and log habitat removed during the construction phase will be reinstated following the works. |
| | |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| | Any trench sections left open for greater than a day will be inspected daily, early in the morning and any trapped fauna removed. |
| **Operational measures: site management** | Sheep may be preferable to cattle as grazing stock on the turbine ridges (farm operational requirements permitting) to reduce the incidence of insects, which could provide prey for smaller raptors, owls, insectivorous passerines and bats. |
| | Vegetation at the turbine sites will be kept low to allow a high level of carcasse detectability. The use of dogs to find carcasses could improve search efficiency. |
| **Operational measures: monitoring** | The OEMP will contain details of a three-tiered monitoring program for bird and bat mortalities and habitat utilisation impacts:<br>**1. First six months of operation**<br>- a more intensive period of monitoring because birds and bats are in the process of habituating to the new development, and sensitive species may experience higher levels of mortality during this period.<br>- during this period all turbine sites will be surveyed to determine variation in impact over the study area. Surveys will include monthly dead bird and bat searches (with at least two scavenging trials), bird utilisation surveys, observation of bird avoidance/diversion behaviour and targeted surveys for species of concern.<br>- if practicable, a reference site located between 500 metres and 1,500 metres from the turbines will also be surveyed.<br>**2. First three years of operation**<br>- an extended period of monitoring to assess mortality rates and trends over successive seasons and longer term changes to local species abundance, habitat use patterns and possibly breeding success.<br>- the survey may be limited to representative or higher risk turbine sites, based on the results of the first six months of monitoring.<br>- surveys will include monthly dead bird and bat searches, bird utilisation surveys, observation of bird avoidance/diversion behaviour and targeted surveys for species of concern.<br>- dead bird and bat searches may be extended beyond three years if thresholds are exceeded and adaptive management responses are required to be implemented.<br>- if any active Wedge-tailed Eagle nest sites are located within 2 kilometres of the turbines, these nests will be monitored during breeding seasons (July-January) for at least 5 years following the commencement of operations to determine any impacts on breeding success caused by bladestrike mortality or habitat alienation. Ideally, breeding success at a comparable reference nest site not affected by the wind farm will also be monitored concurrently.<br>**3. Ongoing monitoring**<br>- mortality inspection and reporting will be continued for the life of the wind farm. The inspection regime will be linked to turbine inspection and maintenance cycles. Mortalities of any significant species (including threatened species and Wedge-tailed Eagles) will be reported to DEC.<br>- monitoring methods and data standards for dead bird searches, indirect disturbance impact assessment and habitat avoidance studies will be based on protocols in the Interim Standards for Assessing the Risks to Birds from Wind Farms in Australia (Brett Lane and Associates 2005). |
| | Given the concentration of operational and proposed wind farms in the Southern Tablelands region, monitoring of bird and bat impacts will ideally be coordinated and consistent with monitoring programs conducted at other wind farms, and the results of monitoring collected and published by AusWEA or government. |
| **Operational measures: adaptive management** | Mortality and habitat avoidance thresholds will be developed and used to trigger specific management responses to mitigate impacts. |
| | |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| | Thresholds for mortality rates and habitat impacts for threatened or sensitive bird and bat species will be determined for each of the three monitoring periods during the development of the monitoring program, having regard to species reproductive potential, conservation status and experiences at other Australian wind farms. |
| | Management responses to monitoring threshold exceedances will be dependant on the cause and the impact, but could include further research, detailed risk modelling and population assessments, adjustments or enhancements to turbine and associated infrastructure, the installation of flight diversion or deterrent structures, blade painting (refer Hodos *et al.* 2001), removing local food sources or insect attracting light sources, compensatory off-site habitat protection or enhancement, nest site protection, sponsoring the care of injured birds and the periodic shutdown of one or more turbines (on a daily or seasonal basis). |

## 7.3. Social and economic factors

### 7.3.1. Community impacts

**EXISTING ENVIRONMENT**

Yass Valley Local Government Area has a population of 12,938, distributed in generally low-moderate density rural areas, and the town of Yass and villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper (Yass Valley Council 2005). The LGA covers 3,970 square kilometres with an average population density of 3.26 people per square kilometre.

One indication of 'community' is social group participation rates, especially volunteer organisations such as the RFS brigade, Meals on Wheels, the Country Women's Association and Landcare groups. These groups are well represented in the district. For example, there are fifteen Landcare Groups in the Yass area (YANLG 2005). Local sports and recreation clubs are well represented.

The presence of residents with long association with the area can also strengthen local communities. The local community comprises families that have been in the area for several generations and newer residents attracted by work opportunities or by the rural lifestyle. The proximity to Canberra and the location on a major rail and road artery connecting Sydney and Melbourne suggests the potential for a growing and dynamic sub-population of retirees, 'tree-changers' and city commuters. While the influx of new settlers can bring skills and diversity to a community, it can also be a source of division by increasing the pace of change and affecting established structures or attitudes. By virtue of the increased transient population alone, the 'tree-change' demographic shift can result in a loss of sense of community (Gurran *et al.* 2005).

The community consultation open house session held in Yass on 16 November 2005 drew forty-one members of the local community. The majority came from within several kilometres from the proposal site, particularly residents of Black Range Road, Burrinjuck Road and the nearby villages of Bookham and Bowning. Community feedback forms used to record comments indicated that a large proportion of participants are involved in commercial agriculture, use the area for recreation, expect that they would see the wind farm from their home or property and/or are concerned about a range of issues including visual impact, noise, environmental impacts and the potential for land devaluation.

### IMPACT ASSESSMENT

Warren *et al.* (2005) observed that the move from centralised power generation to decentralised use of renewable sources raises novel and challenging issues for planning, land use and social engagement. Community issues strongly overlap with noise, visual, economic, traffic and safety impacts. Specific impacts and mitigation measures relating to these values are discussed in the relevant sections addressing these issues.

#### Community disempowerment

Rural residents may feel a connection with the local environment that extends beyond their properties boundaries. This common interest and responsibility is associated with 'community' in rural areas, and underpins attitudes of shared self-reliance and community support in areas where government services are relatively few.

The construction of the wind farm has potential to impact the community by introducing an external force beyond the control of residents, producing a sense of disempowerment. This may be expressed in reduced commitment to local social resources, cooperative or volunteer activities or government services and agencies.

Public attitudes are critically influenced by the nature of the planning and development process; the more open and participatory, the greater the level of public support (Birnie *et al.* 1999; Khan 2003, cited in Warren *et al.* 2005). Although the community consultation process was instigated early in the development of the Conroys Gap wind farm proposal and the community was invited to participate, past experience with wind farm developments and the assessment and approvals process in the neighbouring Canberra and Goulburn regions may have created a history that influences the community's perception of this proposal.

The Consultation Plan for the project has an aim of engaging local community members and encouraging participation in the project planning and assessment phase. The provision of information and opportunities for comment and input is intended to reduce feelings of disempowerment and exclusion. Several comments during the consultation process indicated cynicism about the assessment and consultation process. Attempts have been made to ensure that the consultation process is as open, accessible and responsive as possible.

A further means of empowering and engaging the community (outside the scope of this proposal) would be to involve the community in a government strategic planning process for wind farms in the region. An outcome of this process may be to provide planning certainty for both developers and the community.

#### Community conflict and division

The wind farm has the potential to cause community division. The Open House revealed a wide range of attitudes toward wind farms, which could polarise and create conflict between community members. The unequal distribution of perceived costs and benefits between local residents could also be a source of conflict.

Community concerns expressed in the Open House focus on visual, noise, biodiversity and recreational impacts. Specific assessments have been undertaken for these issues. The proposal was also substantially amended to take account of community concerns, particularly the visual impact on properties to the east of the site. A proposed turbine cluster in the north-east of the site was removed from the proposal, in favour of sites to the south of Black Range Road which are considerably less visible from most local residences.

The subsequent assessment revised proposal concluded that impacts would be acceptable and manageable using a range of avoidance and mitigation measures. The assessments and proposed mitigation measures were presented at the second Open House held in Yass on 6 April 2006.

The existence of polarised views in the community is not necessarily an accurate reflection of the views of the wider community Planisphere (2005). A recent on-line survey conducted by the Yass Tribune indicated that 68.6% of respondents were in favour of the Conroys Gap Wind Farm, out of a total of 86 votes (Yass Tribune website 8 April 2006). This poll is not scientifically valid but may indicate a broad support base for the development in the wider community.

Studies of community views about wind farms in Scotland and Ireland noted a polarisation of views before construction, but that negative attitudes moderated considerably after construction and actual experience of the wind farm (Warren *et al.* 2005). More positive feelings about wind farms were actually recorded closer to the wind farm sites than further away. Negative attitudes are not necessarily a reliable indicator of attitudes over the longer term.

**Equitable distribution of costs and benefits**

It is acknowledged that some costs in terms of visual and other impacts are borne by Conroys Gap community members that have no direct financial interest in the wind farm development. In order to address this imbalance, the proponent has undertaken to establish a Community Fund to ensure that some of the economic returns from the wind farm are used for activities and resources which would benefit the wider community. The proponent would contribute $25,000 per annum during the operation period to a Community Fund to finance community projects such as local Landcare and environmental projects, (such as Box-Gum Woodland reserves, erosion remediation, riparian revegetation, pest and weed control, salinity mitigation), sporting and other facilities, development of recreation opportunities (such as walking tracks, horse-riding trails, picnic areas, parks), road and telecommunications improvements, Rural Fire Service support, heritage management and academic scholarships.

The structure of the fund is to be determined, and could involve management by or joint management with the local Council and/or local community representatives. The expenditure would where possible be focused to benefit affected residents in the immediate vicinity of the wind farm.

The proponent would also liaise with local industry representatives to maximise the use of local contractors and manufacturing facilities in the construction of the wind farm (refer section 8.4).

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Community involvement and distribution of benefits** | The proponent will establish a Community Fund and contribute $25,000 per annum during the operation period for community projects such as local Landcare and environmental projects (such as Box-Gum Woodland reserves, erosion remediation, riparian revegetation, pest and weed control, salinity mitigation), sporting and other facilities, development of recreation opportunities (such as walking tracks, horse-riding trails, picnic areas, parks), road and telecommunications improvements, Rural Fire Service support, heritage management and academic scholarships. |
| | A conflict mediation process will be established and implemented through the project EMP. |
| | The proponent will assist with the development of the wind farm as a local tourism and educational resource if there is local interest and support in the concept. |
| | The proponent will maximise the use of local contractors and manufacturing facilities in the construction of the wind farm (refer section 8.4). |

### 7.3.2. Land/property value and development potential

#### EXISTING ENVIRONMENT

Land values are influenced by prevailing and permitted land uses, economic conditions, access and proximity to markets and workplaces, demand for lifestyle and a range of other subjective and dynamic factors.

While the land surrounding the proposal site is zoned 1(a) Rural Agriculture, Council has received a proposal for a 20 lot subdivision (with lots ranging from 2-160 ha) to the east of the site (Paul de Szell Yass Valley Council pers. comm.). There is also potential for further concessional lot applications in the surrounding district. In addition to traditional farmers, 'hobby farm' or 'lifestyle' residents are present in the local area particularly along Black Range Road, east of the proposal site. Increasing numbers are settling in the Yass district and commuting to work in Canberra.

### IMPACT ASSESSMENT

### Land and property values

The wind farm has potential to affect land values in the immediate area of the wind farm as well as the general locality. While public perception of wind farms is highly variable and subjective (SRSC 2005), there is the potential for a section of the market to be negatively affected by perceived visual or acoustic impacts, or by changes to compatible land uses.

The wind turbines would be visible to motorists passing the Conroys Gap site on the Hume Highway and this may colour their view of the Yass district. At distances greater than 2 kilometres from the turbines, no operational noise impact is anticipated. At distances greater than 15 kilometres, the structures are not anticipated to attract the eye.

Many of the hobby farm or lifestyle residents around the study area, particularly along Black Range Road east of the proposal site, would have purchased property for aesthetic qualities. The consistency of the visual environment with the ‘bush’ or ‘farm’ ideal is important for this group (Scenic Landscape Architecture 2005). Landholders involved in traditional farming have a more pragmatic approach to the landscape (Scenic Landscape Architecture 2005) and are more likely to view land and property primarily in terms of production. The former group would be most sensitive to the visual or acoustic impact of wind farms, while the latter are more likely to interpret wind farms as simply another element in a production landscape.

Community consultation during the Open House session in Yass on 16 November 2005 showed that impact on land values is an issue of public concern.

#### Crookwell Case Study

Prediction and quantification of land value impacts is problematic. There are few studies examining the effects of wind farms on land values in Australia. To date no valuation research has been completed in Australia on the effect wind farm developments have on subject or surrounding land values. A review of overseas research provides a single statistical analysis in the United States and a perceptual study has been undertaken in the United Kingdom (Henderson and Horning Property Consultants 2006).

For this reason, Taurus Energy commissioned Henderson and Horning Property Consultants to undertake an assessment of land value changes in the Crookwell area since the construction of the Crookwell 1 wind farm. The report is provided in Attachment 11, and key findings are summarised in Box 7.1. The Crookwell I wind farm comprises 8 turbines and was constructed in 1998 by government owned Eraring Energy (then Pacific Power). It is the nearest wind farm to the Conroys Gap site, located around 70 kilometres to the north-east. The study found the market evidence suggests that having a view of the wind turbines did not have an effect on land value.

The Crookwell area is analogous to the Conroys Gap site in terms of existing land use and land use trends, and the results of this study are relevant to the current proposal. The authors suggest that the revenue provided by the wind farm may offset the economic attraction of sub-division and help slow the transition to small-lot rural residential development.

#### Other Australian studies

The Bald Hills Wind Farm Panel Inquiry in Victoria examined the issues of property devaluation for neighbouring properties in a qualitative manner (reported in Henderson and Horning Property Consultants 2006). 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.”*

#### Overseas studies

In studies at a range of comparative sites in the United States, Sterzinger *et al.* (2003) found that there was no statistical evidence to indicate that properties within the viewshed of wind farms experienced reduced values or poorer market performance. For the majority of cases, property values in the viewshed increased faster than properties in comparable regions. (The report does not attempt to explain the reasons for this.) This study concluded that there is no support for the claim that wind development will harm property values, qualified with a statement that more data will need to be analysed as it becomes available.

The Royal Institute of Chartered Surveyors (RICS) carried out a study of its members to gauge professional property opinion about the impact wind farm development had on both residential and agricultural land values. The report found that 72% of the sample believed wind farm development had no impact or a positive impact on agricultural land values, but 60% believed wind farms decreased the value of residential properties where the wind farm was in view (Henderson and Horning Property Consultants 2006). The perceived negative impact continues but becomes less severe after two years post completion.

Several studies conducted in the United Kingdom have also failed to find evidence that wind farm developments have caused house values to decrease. These studies include resident surveys around the wind farms in Scotland (Robert Bell Associates 1998 in AGO/AusWEA undated) and South Wales (Robert Bell Associates 1997 in AGO/AusWEA undated). A British Wind Energy Association study of house prices at Nympsfield, Gloucestershire found that house prices continued to increase following the announcement of plans to construct a wind farm in 1992, and following the commencement of wind farm operations in 1997 (BWEA: http://www.bwea.com/ref/stroud.html).

### Development potential

There are examples of successful residential estates being developed near existing wind farms. An informal study of the Salmon Beach estate near the Esperance wind farm in Western Australia showed a strong trend of increasing house prices (AusWEA website 2004 http://www.auswea.com.au/auswea/).

It appears likely that, although the presence of the wind farm may dampen a sensitive section of the property buying market, this effect is overwhelmed by other forces influencing the demand for land and housing opportunities (such as commuting distance). Consequently, the land and housing prices and sales performances reported in various studies are not appreciably affected by the presence of local wind farms.

Yass is located on the major road and rail transport corridor between Melbourne and Sydney, and 40 minutes from Canberra, a large centre with a population of 300,000. The Yass Valley Shire is maintaining a high 5.5% population growth rate, with Sydney and Canberra residents relocating to the region for the rural lifestyle, access to high standard educational institutions, a strong commercial base and proximity to Canberra (Capital Region Development Board website 2005 http://www.capitalregion.org.au/yass.htm). The proximity to Lake Burrinjuck, a popular tourism and recreation destination would add to the attractiveness of real estate in the Conroys Gap area.

Given the rising demand for affordable rural residential land in the Yass district, the wind farm is not expected to adversely affect the development potential of properties to the east of the subject site.

## Box 7.1 Crookwell Land Value Case Study

### Introduction

Henderson and Horning Property Consultants were contracted by Taurus Energy to examine impacts on local land values resulting from the Crookwell I wind farm. Key findings have been summarised in this section, and the full report is at Attachment 11.

The Crookwell I wind farm comprises 8 turbines and was constructed in 1998 by Eraring Energy (then Pacific Power). It is the nearest wind farm to the Conroys Gap site, located around 70 kilometres to the north-east. The Crookwell and Conroys Gap areas share similar land uses (agriculture) and land use trends (including increasing subdivision and rural residential development).

### Case study purpose and methods

The case study sought to determine the effect of the wind farm on the values of land subject to the development and the surrounding properties affected by visual, noise, shadow or other direct impacts (‘affected properties’). A control group of sales in the same location with little or no physical and visual link to the Wind Farm were also examined (‘unaffected properties’).

Shadow and noise impacts were generally not relevant to the sales examined. A six kilometre threshold was applied for visual effects. Visual effects are highly dependent on local topography.

### Findings and conclusion

Sale transactions in the Crookwell area over a 15 year period were searched (1990 to 2006). A general trend of larger properties being sold and broken up into smaller lots commenced in the late 1990’s, and very few sales occurred in the period prior to the development of the wind farm. The Lake Birubi property to the north of the wind farm was recently sub-divided into four lots. Buyers were aware of the wind farm and the Crookwell II proposal, but this did not affect the marketing. Most purchasers documented in the study were locals or non-resident locals with adjoining properties. Only one ‘sea change’ purchase was noted.

> ***The sales evidence shows that there was no detectable difference between sales of affected properties and unaffected properties. That is, having a view of the turbines did not affect land values.***

Local agents also indicated that although topical, the existing wind farm had little or no effect on land values in Crookwell. Agents commented that the greatest impact on land values had been the upgrade of the Canberra-Sydney road and the increased demand from commuters.

### Discussion

The agricultural productive capacity of the land is not affected by the wind farm. This is reflected in the absence of any reduction in values. The property hosting the development in fact enjoys additional revenue and has some added benefits from improved roads, erosion control and passive wind protection for stock from the substation and turbine tower structures.

Over the last fifteen years land use in the Crookwell area has shifted toward rural residential holdings where amenity is valued more highly than productive capacity. The wind farm property and surrounding properties are capable of further subdivision. Given the demand for rural residential lots, this trend is likely to continue locally.

However, the revenue stream from the wind farm plus the underlying agricultural production from the land may well outbid the subdivision potential for the site.

Further research will be required to determine what value the market will place on the wind farm revenue streams however, it is suggested that the capitalisation rates will be similar to other infrastructure improvements like mobile communication towers and signage investments. Therefore the wind farm development has the potential to slow down the process of productive agricultural land changing to rural residential uses in the short to medium term. This is because the additional income generated from the wind farm revenue would make the continuation of agricultural uses an economically viable alternative to sub-division.

The wind farm could be seen as 'quarantining' the ridgelines of the subject site from residential and other development pressures which may detract from scenic values. The revenue provided by the wind farm may slow the transition to rural residential use (Henderson and Horning Property Consultants 2006).

The proposal is highly reversible, with the subject site restored to effectively pre-works condition following decommissioning. The positive effects of the local and regional economy flowing from the wind farm (refer section 4) could also be expected to buoy the local real estate market.

**IMPACT AVOIDANCE AND MITIGATION**

The majority of any negative effect on land value impacts is likely to flow from visual and noise impacts. Mitigating these impacts should also reduce impacts on land values. Visual and noise impacts can be mitigated using a range of measures including tree-planting, screening, and noise suppression. These issues are discussed in sections 7.3.4 and 7.3.5.

### 7.3.3. Services and infrastructure

**EXISTING ENVIRONMENT**

Community infrastructure, facilities and services in the Yass district include water supplies, transport systems (road, rail and air), electricity, telecommunications, bushfire control, education, welfare, policing and recreation facilities.

Community infrastructure in the study area includes the road system, powerlines, telecommunications facilities and a trig survey station. The study area is located south of the Hume Highway, a major arterial route connecting Sydney and Melbourne. The community of Yass Valley is largely dependent on the motor vehicle and availability of roads. Black Range Road runs through the study area; this is an unsealed local road managed by Yass Valley Council which connects Yass with the Burrinjuck road, and services properties west of Yass.

57% of the roads in Yass Valley are sealed, and around 40% of sealed roads, and 20% of unsealed roads are considered to be in good condition (Yass Valley Council 2005). The estimated average annual kilometres travelled per vehicle in Yass Valley LGA is 23471 kilometres, more than twice the annual average of 14,400 kilometres (ABS 1999 in Yass Valley Council 2005).

The central trig ridge on the 'Linbrook' property has telecommunications towers and transmitters for a range of purposes and a trig survey station located in a small trig reserve.

**IMPACT ASSESSMENT**

The impact of the proposal on telecommunications services is addressed in section 7.3.7.

Impacts on roads from traffic will be at the maximum during construction. The major heavy vehicle usage that would occur during the construction period involves the delivery of infrastructure components, construction equipment, and delivery of concrete, gravel and other materials. Predicted haulage requirements are outlined in Table 7.3.

**Table 7-3 Delivery of wind turbine materials and equipment**

| | Parts per Turbine | Parts for 16 Turbines | Weight of component (indicative) | Length of component (indicative) |
|---|---|---|---|---|
| Tower sections (tower up to 80m) | 4-5 | 64 -80 | 150–180 Tonnes in total | Up to 30 metres |
| Turbine blades* | 3* | 48* | 6–10 Tonnes | Up to 46 metres |
| Nacelle | 2 | 32 | 50–75 Tonnes | Approx 10 metres |
| Step-up transformer | 1 | 16 | 3-6 Tonnes | Approx 6 metres |

* Wind turbine blades may be able to be carried two per delivery vehicle, reducing vehicle movements.

A single large power transformer will also be required, with a possible weight of up to 100 tonnes.

Additional vehicle movements would be required for delivery of building materials, cranes, rock crushing equipment, batching plant, earthmoving equipment, delivery of materials for concrete batching or delivery of concrete, and transport of the workforce to and from site over the construction period.

Haulage vehicles and trailers are purpose-designed to reduce axle weights to acceptable levels and thereby minimise possibility of damage to access road surfaces. It is likely that concrete mixer trucks operating on site would have the highest axle weight, notwithstanding their considerably smaller overall weights.

Establishment of a batching plant on site eliminates long truck movements of concrete mixer trucks, significantly reducing the number and potential impact of traffic movements off site. Each concrete footing could require up to 50 concrete mixer trucks over an 8 hour pour, an onsite batching plant would significantly reduce the number of truck movements.

As most of the work will be carried out by specialised crews consisting of less than 10 workers it is assumed that the maximum volume of vehicles entering the proposed development will be 10 vehicles per hour from any direction during the peak hour. During the concrete pouring phase an additional 12 concrete trucks movements per hour can be included.

Turbine blades up to 46 metres long would be transported on purpose designed steerable trailers making 45 trips to the site (3 blades x 15 turbines). Tower sections would measure up to 30 metres long and weigh up to 36 tonnes (estimated as approximately 80 trips to transport all turbines). The remaining wind tower components are up to 10 metres long weighing up to 75 tonnes. These loads would be transported as platform loads with trailers up to 4.2 metres wide to spread the load (estimated as 40 trips). It is expected that most of the heavy and oversized deliveries will take place over eight weeks, at a rate of 4 vehicles per day.

Construction traffic would access the subject site via the Hume Highway and Paynes Road. Paynes Road and the existing access tracks on the involved properties would be upgraded. Existing roads and new tracks would be maintained throughout the construction period to ensure appropriate standards of stability, drainage and driving surfaces. Following the construction period, roads and tracks would be maintained in a condition generally suitable for farming and maintenance requirements.

Each turbine would require maintenance every three months. It is proposed that the wind farm will operate unattended, with maintenance by a small crew operating an average of 2-3 days per week. Access for maintenance would be undertaken using a light vehicle. During the operational phase, the condition of wind farm access tracks would be monitored by the proponent and maintenance undertaken as required. Maintenance staff are likely to visit the site most weeks of the year.

The precise location of any buried services would be determined prior to excavations, in consultation with relevant agencies and property owners. The works are not expected to result in any interruptions to communications, power or water supplies. The development would not adversely affect electrical services in the locality. The provision of the new substation may allow future electricity network improvements for properties in the area.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Impacts on roads, tracks and access** | Roads and tracks used for the proposal will be upgraded as required and maintained to a standard of stability, drainage and driving surface appropriate to farming and wind farm maintenance use following the construction period. |
| | Access to private property will be maintained during the construction period. |
| **Impacts to buried services** | The precise location of any buried services, if present, will be determined prior to excavations using Dial Before You Dig services searches and consultation with relevant agencies and landowners. |
| **Impacts to survey marks** | The Black Trig station located near the proposed turbine locations in the north of the proposal site will be protected from accidental damage during the construction phase. |

### 7.3.4. Landscape character and visual values

Scenic Landscape Architecture has undertaken a visual impact assessment for the Conroys Gap wind farm proposal. This report provides an analysis of the existing visual amenity and landscape character of Black Range and the surrounding area, an analysis of user sensitivity and viewpoints, an assessment of the visual impact of the proposed development and recommendations to minimise visual impacts. The assessment is based on locations with views to the wind farm within a 15 kilometres radius of the site.

The method used to determine the visual impacts has been adapted from the *Windfarms and Landscape Values*, a report commissioned by Australian Wind Energy Association and the National Trust (Planisphere 2005), and from the Bureau of Land Management in the United States, known as the BLM method.

The visual impact assessment report is included as Attachment 8, and key findings are summarised below.

The cumulative visual impacts of the wind farm proposal are assessed in section 7.5.

#### EXISTING ENVIRONMENT

Most of the region consists of a modified farming landscape characterised by pastures with light scattered timber, located on rolling hills, typical of much of the farming land on the western slopes of the Great Divide. Lake Burrinjuck is a key landscape component in the area. There are also a series of large ridges running through the landscape. Black Range rises to 841 metres ASL, which is over 300 metres above surrounding valleys.

The landscape is largely a cultural landscape due to modifications resulting from 180 years or so of agriculture. The local landscape has positive elements of a picturesque rural setting - rolling hills, scattered eucalypts and grazing stock. There are also localised visual scars such as dieback affected trees, soil erosion and salinised soils. The landscape at Conroys Gap has an iconic rural character but this landscape is widespread in the region.

Five landscape character types were identified in the region determined largely by the dominance of agriculture as the primary land use. The landscape types are:

- country towns;
- transport corridors;
- waterways;
- agricultural land; and
- ranges and hills.

The main users of the area are graziers/primary producers, rural residential land owners, towns' people, arterial road users and recreational users. Each group varies in their sensitivity to the proposed wind farm based on a number of factors including their attachment and relationship to the landscape of the area.

Unscreened or unfiltered views from a house, regardless of the user type, tend to be valued highly and are appreciated more than other views. Views from working areas of properties are generally valued less as they tend to be of lower duration, and will generally be experienced while conducting other activities.

**IMPACT ASSESSMENT**

### Public perceptions and attitudes

For wind farms, potential visibility and related landscape effects are usually the key issues (Meridian Energy 2005). It is apparent that the beliefs of the individual are the major determinant of whether a wind farm will be viewed favourably or not. Warren *et al.* (2005) has noted the importance of personal beliefs and values in determining attitudes to wind farms, regardless of facts. Most people believe there is broader public benefit from the production of 'green' and sustainable energy. An understanding of the broader benefits of wind farms can result in people being more accepting of the structures and this type of development.

Wind farm proposals typically meet with opposition from some local residents. Recent studies show that opposition to wind farms (especially to their visual impact) does not appear to be the majority view. Lothian (undated) notes that in the United Kingdom, most people regard them favourably, and that surveys indicate broad support for wind farms.

Warren *et al*. (2005) points to an Irish survey of 1200 people which found that only 1 per cent of the general public is opposed to wind farms, that 84 per cent regard them as a good thing, and that most of those with direct experience of wind farms do not consider that they have had any adverse impact on the scenic beauty of the area. The study found that, prior to construction, locals typically expect the landscape impacts to be negative, whereas, once in operation, many regard the turbines as an attractive addition (Warren *et al.* 2005). Therefore, the visual impact of wind farms is not necessarily negative and wind turbines can sometimes add a positive visual quality to the landscape.

### Landscape character impact

The wind farm would not create an unacceptable contrast to the existing landscape. The landscape is substantially modified by farming practices and contains many built elements, including prominent electrical and telecommunications infrastructure and the Hume Highway. Consequently the landscape of the area will be able to absorb the change in the landscape character resulting from the introduction of a wind farm.

### Zone of visual influence

Wind turbines can be seen up to 20 kilometres away in clear weather but are difficult to perceive (Planisphere 2005). At 14 kilometres away, a single turbine is insignificant although a collection of turbines becomes more significant depending on the number of towers and the horizontal area they occupy.

A Zone of Visual Influence (ZVI) study was undertaken by Garrad Hassan Pty Ltd of the proposed Conroys Gap wind farm (see Figure 7.3). The ZVI study identifies, within a 15 kilometres radius around the site, where the turbines can be viewed from and how many turbines can be viewed from any given location.

The ZVI is based on ground level contours and does not take into account vegetation which can screen views of the wind farm from specific viewpoints. Nor does it give additional weighting to key viewpoints such as from individual houses. However, the ZVI is useful in verifying and confirming information obtained during site visits.

The analysis shows clearly the high visibility of the turbines east of Mount Bowning, south across Black Range Road to the area south of Yass River, but close to Black Range, the turbines will generally not be visible as views are blocked by the eastern ridge line. Further back from the Range, more turbines will be visible. 4 to 6 turbines will be visible from the area around Graces Flat

Road. From the hills around Bowning, more turbines are visible. North of the site, views of the site are intermittent due to the hilliness of the terrain.

On the western side of Black Range, the wind farm will be highly visible from a strip of land between Black Range and the Ranges to the west. The ZVI shows the wind farm is especially visible from within 5 kilometres to the south west of Black Range. The road from the Hume Highway to Lake Burrinjuck bisects this area. The ranges to the west of Black Range screen most of the views to the west of the site, except for either side of the Hume Highway, where the wind farm will be clearly visible. To the south of the site, the wind farm is visible from several locations on or around Lake Burrinjuck from with 3 or 4 kilometres of the wind farm.

The visibility of the turbines will vary throughout the day and season due to the level of the intensity of light. The turbines will be more visible in the early morning and evening when light shines directly upon the structure. Additionally, the backdrop to the structures can also affect the visual contrast. Where the structures are located against the sky, the structures, due to the off-white colour, blend into the horizon especially when there is haze or cloud. When the structures are viewed against land, the colour contrast increases the visual prominence of the structure (Planisphere 2004).

Because of the orientation of the blades facing into the prevailing winds, and the orientation of the line of turbines, the wind farm will be most prominent from a western or eastern viewpoint.

**Photomontage analysis**

A series of photomontages were prepared to illustrate the visual appearance of the proposal from 10 sites around the wind farm. Viewpoints used for the photomontages are shown on Figure 7.4 The full series of photomontages are included in the Visual Assessment Report (Attachment 8).

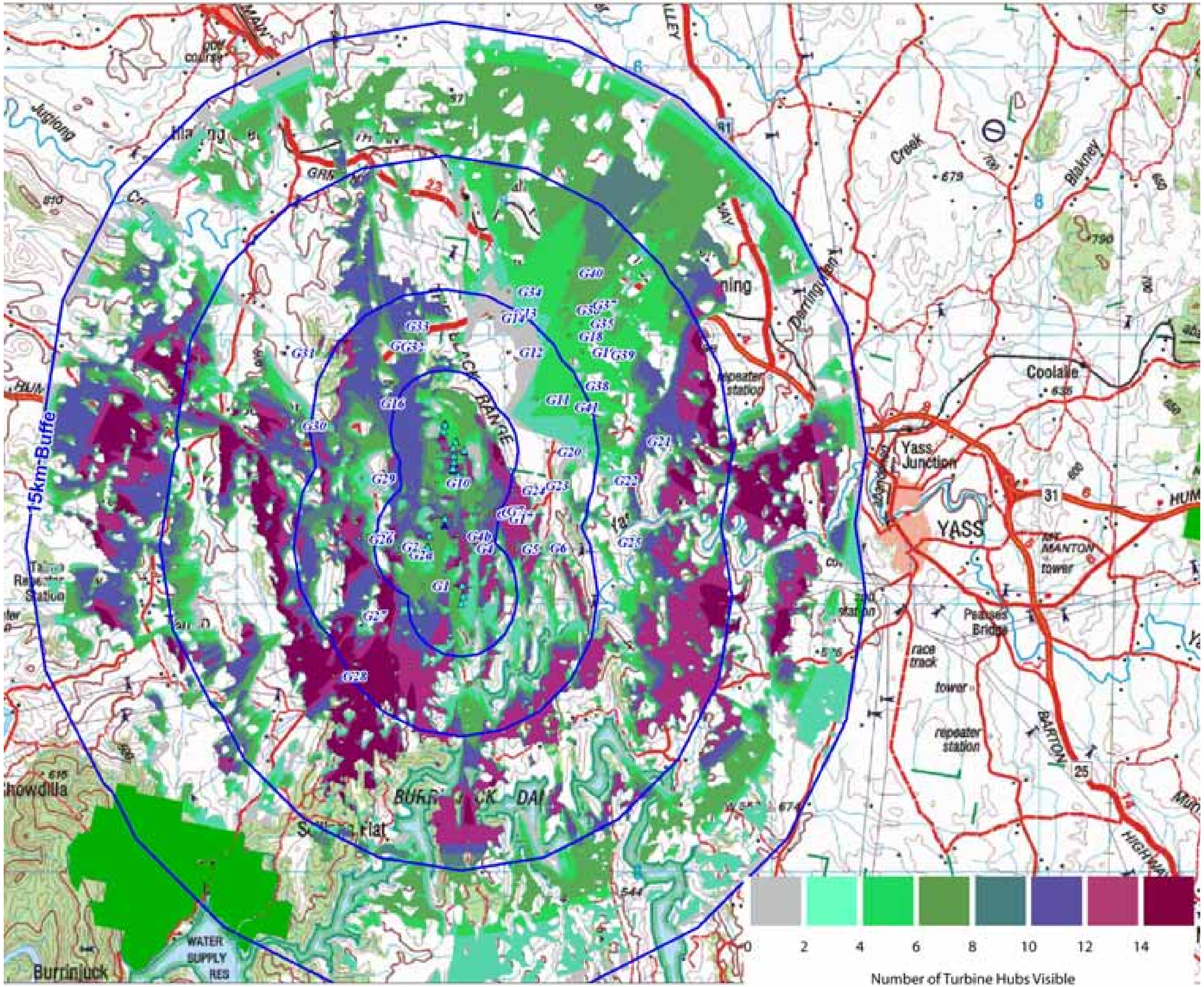



**Figure 7.3 Zone of Visual Influence analysis (Garrad Hassan 2006)**

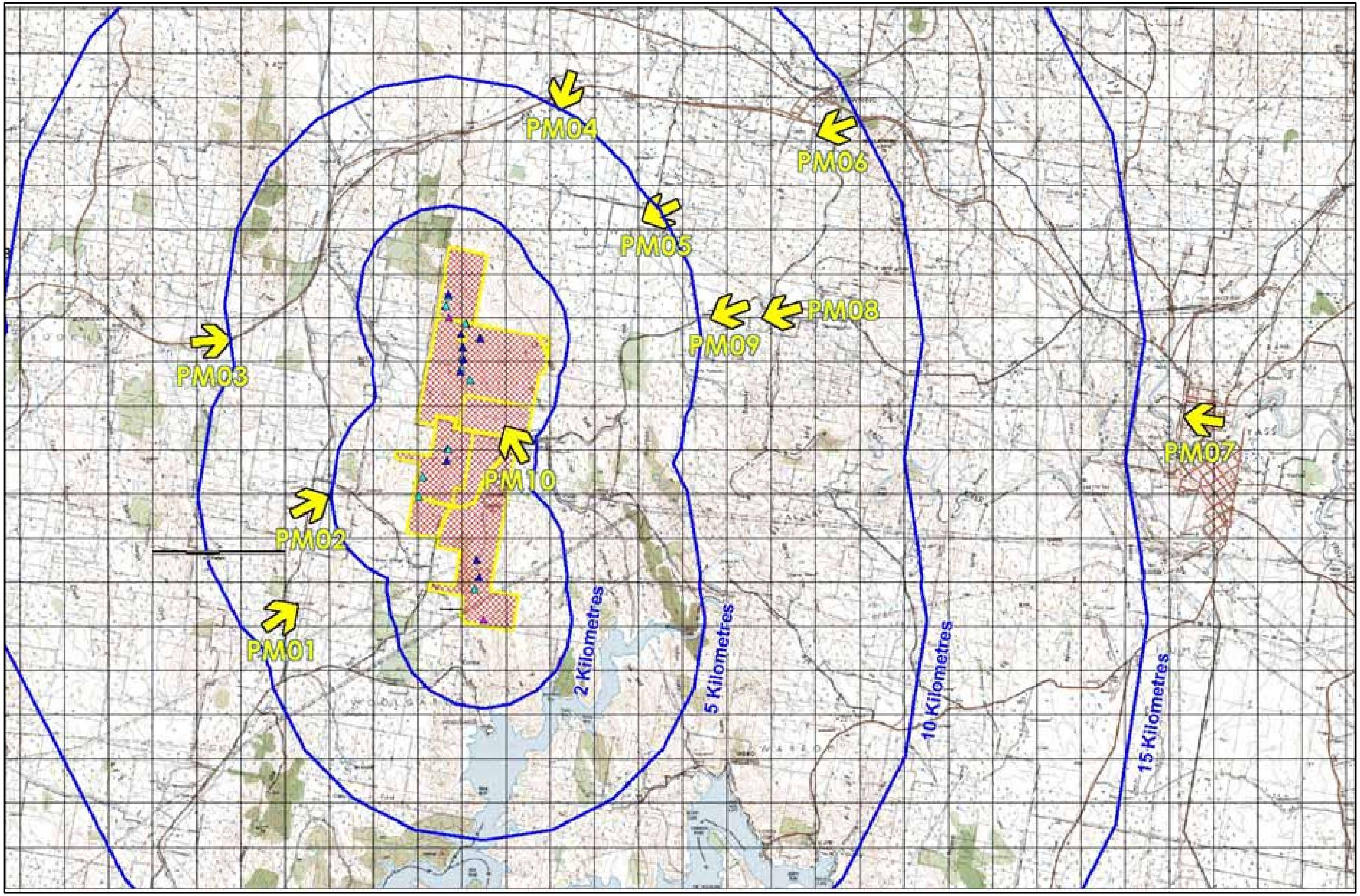



**Figure 7.4 Viewpoints used for preparation of photomontages**

## Visual impact assessment

### Turbines

The negative visual impacts of a wind farm can include scale, form and colour of turbines in contrast to the surrounding landscape (Planisphere 2005).

There are also potentially positive visual impacts associated with wind farms. De Gryse (2000) notes that:

> *"The overall assessment of visual impact must consider the positive contribution that the scenic interest of wind farms generally has on the landscape … While scenic interest does not necessarily mitigate these impacts, it does, nonetheless, ameliorate them, by adding positively to the landscape setting thus contributing to the acceptability of the impact."*

The level of visual impact for each viewpoint area and landscape type is summarised in Table 7.4.

There are a number of large working properties and rural residential homes around the site who will be able to view the wind farm, particularly the properties around Black Range Road to the south of the site and houses on working properties to the west of the Range. There will be a considerable visual impact from some locations particularly from around Black Range. There will be views of the wind farm from the towns of Bowning and limited views from Yass, Bookham and Goondah. From other locations around the site, the wind farm will not represent a significant visual impact.

From the majority of view points, the visual impact is moderate to low.

The highest visual impact area is the land along Black Range Road, Graces Flat Road and closer areas of the road to the Burrinjuck Dam. The impacts from the east of the site have now been substantially be ameliorated by the removal of turbines in the current proposal from the eastern ridge.

### Table 7-4 Summary of visual impacts

| Viewpoint/area | Level of visual impact | Contributing factors |
|---|---|---|
| **LANDSCAPE TYPE A - COUNTRY TOWNS** | | |
| **Area 1:**<br>**Yass** | Low | • Views from Yass from 15 kilometres from the site and the towers are difficult to perceive.<br>• The wind farm will be a small element on the landscape.<br>• The built form of Yass reduces the visual contrast of the wind farm. |
| **Area 2:**<br>**Bowning** | Moderate visual impact | • Bowning is located approximately 8 kilometres from the site.<br>• Some of the views from Bowning are open and the wind farm will be quite visible.<br>• Views to the site are across the built form of the Hume Highway which reduces the visual contrast of the wind farm to the landscape. |
| **Area 3:**<br>**Bookham** | Low to moderate visual impact | • Views of the wind farm are limited by the mature trees through the town.<br>• The landscape character of the town is dominated by the built form of the Hume Highway.<br>• The limited views reduces the visual impact of the wind farm. |
| **Area 4:**<br>**Goondah** | Low | • There will be limited views of the wind farm from Goondah. |
| **LANDSCAPE TYPE B – TRANSPORT CORRIDORS** | | |
| **Area 5:**<br>**Hume Highway** | Low | • The built form of the highway dominates the landscape character.<br>• The surrounding landscape is a typical of much of the landscape along the Hume Highway.<br>• The built form of the wind farm will not be a significant contrast to the landscape due to the strong built form of the |

| Viewpoint/area | Level of visual impact | Contributing factors |
|---|---|---|
| | | highway. |
| **Area 6: Southern Railway** | Low | • Views are very limited from the railway.<br>• The railway runs no closer than 8 kilometres from the wind farm.<br>• Passengers are not likely to have any connection with the landscape. |
| **LANDSCAPE TYPE C – WATERWAYS** | | |
| **Area 7: Lake Burrinjuck** | Moderate-high | • The lake is a unique landscape element in the region.<br>• Predominantly used for recreational purposes and users will be relatively sensitive to the surrounding landscape.<br>• The Lake was constructed for the purpose of electricity production and has a functional link to the wind farm.<br>• The wind farm will sit high above the Lake and will not be in the normal field of view of users of the Lake. |
| **LANDSCAPE TYPE D – AGRICULTURAL LAND** | | |
| **Area 8: Black Range East** | Moderate-high | • Views to the site are open from houses and roads.<br>• The landscape has a pleasant rural character along Black Range and Common Roads. The highway diminishes the landscape character in the north of the area.<br>• The wind farm will have an impact on the landscape character but as a modified rural landscape, the contrast should be acceptable.<br>• Rural residential land holders in the area are sensitive to changes in the landscape character as they have moved to the area for its scenic appeal. |
| **Area 9: Black Range South** | Moderate-high | • The area has a feeling of remoteness with few built elements tree lined roads<br>• Beyond road verges, the landscape is predominantly a modified farming landscape with only scattered remnant vegetation<br>• The wind farm will create a contrast to the existing landscape, but the landscape should be able to absorb the change<br>• There are a number of rural residential owners who will have views of the wind farm and will be quite sensitive to changes in the landscape. |
| **Area 10: Black Range West** | Moderate-high | • This area consists of large working properties and the cleared landscape reflects the primary production nature of the landscape.<br>• There are a number of houses with views to the wind farm from within 4 kilometres. |
| **Area 11: Black Range North** | Low-moderate | • The landscape is highly modified by primary production<br>• Views to the wind farm include the strong built form of the highway<br>• The contrast of the wind farm to the landscape is not significant<br>• Few houses have clear views to the wind farm |
| **Area 12: South of Lake Burrinjuck** | Low | • The landscape is open rural land.<br>• There are clear views to the wind farm across the open landscape, but few residences in the area.<br>• Views to the wind farm will be from 13 to 15 kilometres. |
| **Area 13: South of Yass** | Moderate | • The landscape is open rural land.<br>• There are clear views to the wind farm across the open landscape, but few residences in the area.<br>• Views to the wind farm will be from as close as 5 kilometres. |
| **Area 14: East of Yass** | Moderate | • This area has a number of rural residential land holders who are assessed to be sensitive to changes in the landscape. |

| Viewpoint/area | Level of visual impact | Contributing factors |
|---|---|---|
| | | • The distance to the wind farm significantly reduces its visual impact.<br>• The landscape is a modified rural landscape.<br>• The built elements of the highway and Yass service centre are nearby.<br>• The wind farm will create a contrast with the existing landscape but this will be an acceptable change from this location. |
| **Area 15: North of Bowning** | Low | • There are limited views of the wind farm from this location.<br>• The closest views to the wind farm will be approximately 8 kilometres.<br>• The landscape is heavily modified by its agricultural land use and other built elements on and around the site. The wind farm will be an acceptable change to the landscape character. |
| **Area 16: Mylora** | Moderate | • Views from this area are limited to houses along the highway.<br>• The highway is an existing dominant built element in the landscape and reduces the visual impact of the wind farm.<br>• There are some houses with views from greater than 9 kilometres. |
| **Area 17: Childowla** | Low | • Views from this area are limited to houses along the highway.<br>• The highway creates a strong built element in the landscape and reduces the visual impact of the wind farm.<br>• There are some houses with views from greater than 12 kilometres. |
| **LANDSCAPE TYPE E – RANGES AND HILLS** | | |
| **Area 18: Black Range** | Low-moderate | • The landscape is heavily modified by its agricultural land use and other built elements on and around the site. The wind farm will be an acceptable change to the landscape character of Black Range.<br>• Views to the wind farm will be by landholders working on their properties. The wind farm will be viewed occasionally while undertaking other activities. |
| **Area 19: Mount Bowning** | Low | • The landscape character will not be unduly impacted by the wind farm<br>• There are no houses that will view the wind farm from this location |
| **Area 20: Other Ranges and Hills** | Low | • The landscape character will not be unduly impacted by the wind farm<br>• There are no houses that will view the wind farm from this location |

It is noted that localised landscape treatment can assist greatly in reducing the visual impact of the wind farms from specific view points, particularly around houses. Placing vegetation carefully can allow key views from a home while screening less desirable views. For example, some homes along Black Range Road could retain the key view shed to the south but screen views to the west. In most cases visual screens could become effective within 3 to 5 years.

### Powerline

The proposed location of the transmission lines are south of the ridgeline towards the 'Ferndale' property. After crossing Black Range Road, the powerlines are proposed along the eastern slope of Sugarbag Hill and intersect with the 330kV line running east west across Sugarbag Hill.

The proposed route appears to be appropriate as there are very few vantage points of the powerlines. The property adjoining 'Ferndale' to the east may have additional exposure to the electrical transmission lines, but this is offset by the existence of powerlines already running through the property. The additional power lines aligned down the hill will be viewed from Black Range Road. Little or no additional clearing of vegetation will be required.

**Substation and control building**

The proposed location for the substation is between the 132kV and 330kV powerlines crossing Sugarbag Hill. There is one adjoining property that may be able to view the substation and adjacent control building. If necessary, vegetation could be used to screen the substation and control building, and the facilities coloured to reduce its visual impact.

**Shadow flicker**

The shadow flicker analysis for Conroys Gap was undertaken based on the 15 turbine layout using an 80 metre hub and 90 metre blade diameter. The study found that there are two existing houses and one proposed house that could be impacted by shadow flicker. ‘Linbrook’ is at the end of the Paynes Road, and could be impacted by shadow flicker in the mornings. ‘Grenville’, along Sutton Grange Road could also be impacted by shadow flicker in the morning. A proposed house along Black Range Road could be impacted by shadow flicker in the evenings.

The proponent intends to prevent shadow flicker from disrupting residences by pre-programming the wind turbine control system to automatically shut down individual wind turbines during conditions that could cause shadow flicker. Only a small number of turbines is required to be switched off for a small number of hours in a year, the cost of this (in lost energy production) has been assessed to be negligible.

The health impacts of shadow flicker are discussed in section 7.3.6. The impacts of flicker on traffic are assessed in section 7.3.9.

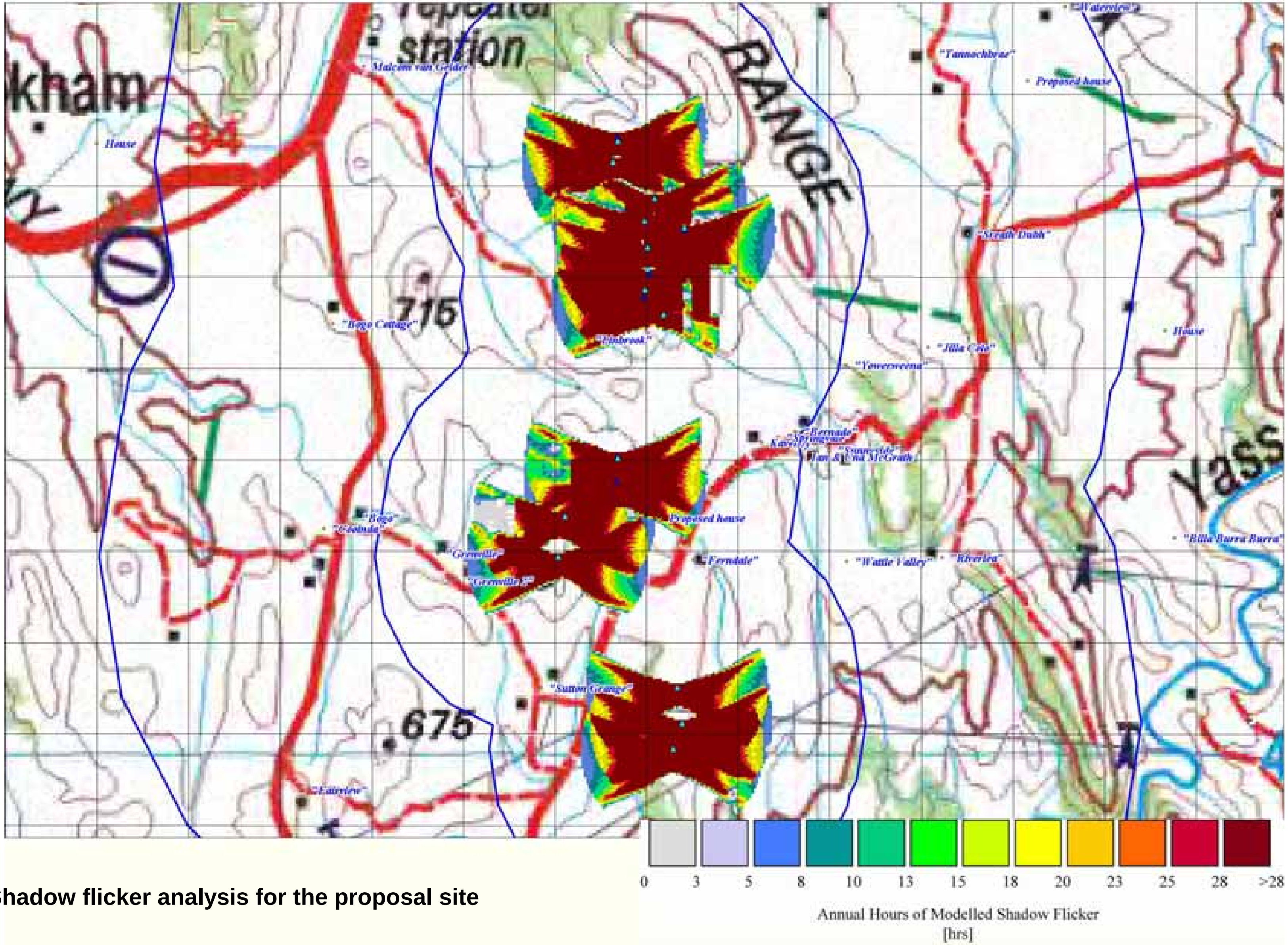



**Figure 7.5 Shadow flicker analysis for the proposal site**

### Blade glint

The movement of the blades can catch the light and produce glint as seen from surrounding areas. The paint proposed to be used on the blades and tower of the turbines is expected to minimise glinting. In addition, the screening campaign will minimise effects to local residences.

An adaptive approach will be used with respect to blade glint. Where blade glint becomes a significant issue at a particular residence, the proponent will provide the landowner with appropriate screening to ensure that the residence is not affected.

#### IMPACT AVOIDANCE AND MITIGATION

The impact avoidance and mitigation measures listed below are drawn from the visual impact assessment prepared by Scenic Landscape Architecture (2006) (Attachment 8).

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Turbine impact, vegetation and screening** | No wind turbines or other infrastructure will be located on the eastern most ridgeline on the site. |
| | The proponent will avoid locating turbines in areas of native vegetation, and minimise the removal of native vegetation for turbine bases and access roads. |
| | The proponent will provide landscaping material to landholders where the visual impact of the wind farm is high to screen views of the wind farm from houses or outdoor entertaining areas around the site. |
| **Tower colour** | Towers will be coloured light off white/grey/light blue to help reduce visual impact. |
| **Access road** | Access the site will be via Paynes Road. Black Range Road will be avoided as residences are very sensitive to changes to the existing scenic quality of the area. |
| **Substation and control building** | The substation and control building will be located to minimise the visual impact from roads and surrounding properties. |
| | Plantings will be used around the facilities to screen them from the surrounding landscape. Planting should utilise local native species. |
| | The facilities will be coloured grey to blend into the surrounding landscape and surrounding vegetation. |
| **Shadow flicker** | The proponent intends to prevent shadow flicker from disrupting residences by pre-programming the wind turbine control system to automatically shut down individual wind turbines during conditions that could cause shadow flicker to residences. |
| **Blade glint** | Taurus will monitor reports of blade glint for a period of 12 months after installation, and will consult with owners of any affected residences with a view to undertake the installation of mitigation measures such as screening. Where blade glint becomes a significant issue at a particular residence, the proponent will provide the landowner with appropriate screening to ensure that the residence is not affected. Screening using tree planting will be offered to residents affected by blade glint within 2 kilometres of the turbines. |

## 7.3.5. Operational noise

Heggies Australia was contracted by Taurus Energy to undertake a Noise Impact Assessment of the proposed Conroys Gap Wind Farm (the full report is in Attachment 7). The Noise Impact Assessment details the noise criteria, background noise measurements and the predicted noise level at all potentially impacted receivers from the operation of the proposed wind farm. This section summarises key findings from the assessment.

### EXISTING ENVIRONMENT

Noise monitoring was conducted at surrounding residences over a two week period in December 2005 and January 2006. A further monitoring campaign was conducted in May 2006. The combined collected data was used to establish baseline noise conditions and establish indicative criteria for surrounding residential receivers. Monitoring and modelling methodologies and detailed results are included in the Noise Impact Assessment report (Attachment 7).

The location of residences around the Conroys Gap site is illustrated on Figure 7.9. Road traffic on the Hume Highway is relatively constant and residential dwellings close to the highway would have background noise levels dominated by road traffic. Most other properties surrounding the site, including those along Black Range Road have an ambient background noise environment that is determined by predominantly natural sources which are largely wind influenced.

### IMPACT ASSESSMENT

#### Noise impacts

Noise levels, particularly where they occur continuously and affect sleep patterns, can be harmful to humans and is cited by the World Health Organisation (WHO) as one of the most serious effects of environmental noise. The noise levels generated by an operational wind farm are particular to the turbine design, local topography, distance to receiver and weather conditions. Turbine noise is more noticeable at lower wind speeds as high winds tend to increase background noise levels which mask turbine noise.

Noise impacts have been the subject of a specialist study undertaken by Heggies Australia Pty Ltd (Attachment 7) which models anticipated wind farm noise levels, based on measured turbine parameters. The study is supported by existing background noise level data obtained from noise loggers placed at several locations around the proposed site. The assessment locations include all dwellings located within 5 km of a proposed wind turbine.

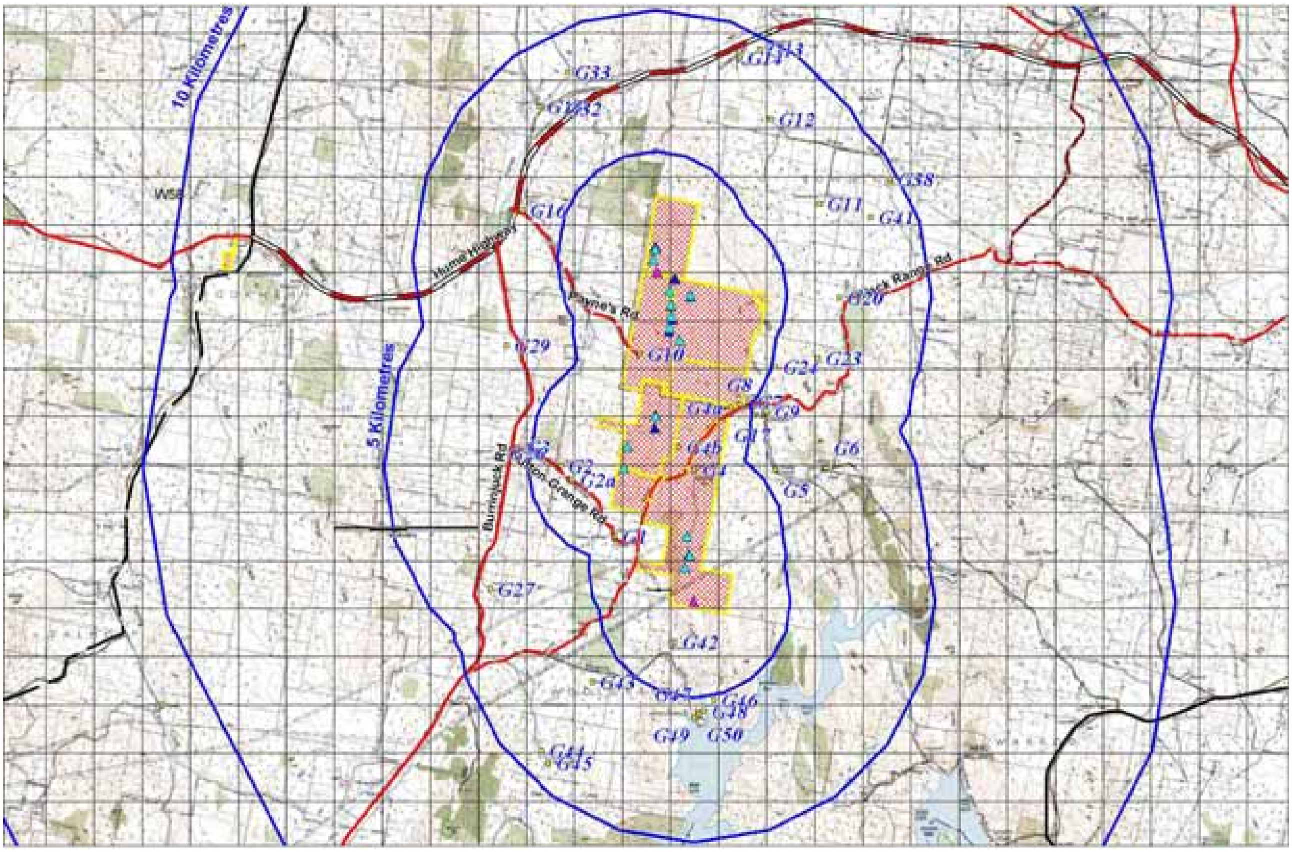



**Figure 7.6 Location of residences around the proposal site (Heggies Australia 2006)**

## Assessment criteria and methods

The SA EPA Noise Guidelines for Wind Farms recommends that predicted equivalent noise levels should not exceed 35 dB(A) or background noise levels by more than 5 dB(A) (whichever is the greater). These noise limits are intended to apply to receivers who are not involved with the project.

The impacts on residential receivers involved in the project are viewed with respect to any agreements that are in place between the proponent and the landowner, as per the SA Guidelines (refer Noise agreements, below). It is anticipated that these noise agreements will require the proponent to meet the World Health Organisation Guidelines for Community Noise. These guidelines recommend that sound levels inside bedrooms during sleep should not exceed 30 dB(A) for continuous background noise, and that individual noises events exceeding 45 dB(A) should be avoided (WHO 2004). For the purposes of the project, the application of this guideline effectively applies an external limit of 45 dB(A) or 5 dB(A) above background (whichever is the higher) for involved residential receivers.

The proponent is committed to meeting:

(a) the SA Noise Guidelines of 35dB(A) or background plus 5dB(A) (whichever is higher) for all non-involved residential receivers; and

(b) the World Health Organisation Guidelines for Community Noise requiring 45dB(A) or background plus 5dB(A) for all involved residential receivers.

A detailed computer noise model was used to predict wind turbine generator noise levels for three layouts. The layouts have been consolidated in the single layout presented in this proposal (Figure 3.7).

Noise monitoring data was used to determine baseline conditions and establish indicative criteria for surrounding residential receivers. A detailed computer noise model was used to predict wind turbine generator (WTG) noise levels for the layouts.

In general the assessment procedure contains the following steps:

1. Predict and plot the $L_{Aeq}$ 35 dBA noise level contour from the wind farm under reference conditions. Receivers outside the contour are considered to be within acceptable wind farm noise levels.

2. Establish the pre-existing background noise level at each of the relevant assessment receivers within the $L_{Aeq}$ 35 dBA noise level contour through background noise monitoring.

3. Predict wind farm noise levels at all relevant assessment receivers for the wind range from cut-in to approximately 10 m/s.

4. Assess the acceptability of wind farm noise at each relevant assessment receiver to the established limits.

Where the assessment of a receiver has shown unacceptable resulting wind farm noise levels, a process of noise mitigation and alternative wind farm layouts is considered. Steps 3 and 4 were repeated until an acceptable arrangement was developed.

A three dimensional computer noise model was used to predict $L_{Aeq}$ noise levels from all wind turbine locations at all surrounding residential dwellings. The estimated accuracy of the prediction model is approximately ±3 dBA.

**Assessment results**

An assessment of the acceptability of wind farm noise levels at all assessment receivers located within a distance of 5 km of the proposed wind farm was made in accordance with SA EPA Guideline criteria and the pre-existing background noise level regression analysis.

**Layout A: 15 Repower MM82 turbines (2 MW)**

Layout A was predicted to comply with all relevant noise criteria, SA EPA Guidelines and WHO limits at all receiver locations.

**Layout B: 15 Vestas V90 turbines (1.8 MW)**

Layout B was predicted to comply with all relevant noise criteria, SA EPA Guidelines and WHO limits at all receiver locations.

**Layout C: 14 Suzlon S88 turbines (2.1 MW)**

Layout C was predicted to comply with WHO limits, and generally meet the SA EPA criteria at most locations. Location G42 (Riverview) is predicted to exceed the SA EPA guideline criteria by up to approximately 2.6 dB(A) in the wind speed range 3-6 m/s. Location G01 (Sutton Grange) is predicted to exceed the SA EPA guideline criteria by up to approximately 1.4 dB(A) in the wind speed range 3-6 m/s. These exceedances would be marginal and site-specific baseline monitoring would be required to confirm the ambient baseline noise conditions at these locations.

A final design study will be carried out prior to construction to confirm that the final selected turbine and final selected layout meet the noise criteria for each house established above. The results of this study will be provided to the Department of Planning and distributed within the local community.

**Tonality**

An assessment of tonality was carried out in accordance with IEC 61400-11. The SA guidelines state that a 5 dB(A) penalty should also be applied if an authorised officer determines that tonality or annoying characteristics of the turbine emissions are an issue. Heggies Australia conducted tonal audibility tests for the Conroys Gap project. For the wind speed range 6-10 m/s, tonality was deemed inaudible and hence no penalty has been applied.

### Infrasound

The SA guidelines do not provide criteria for the assessment of infrasound, but notes that recent turbine designs do not appear to produce significant levels of infrasound, as earlier models did. While low frequency noise was a feature of some early wind turbines designs that had blades down-wind of the tower, modern turbine designs have reduced the level of low frequency noise to below human perception (AusWEA fact sheet number 6). This has been determined through measurements taken at turbines in the United Kingdom, Denmark, Germany and the USA over the past decade. The British Wind Energy Association has stated that there is no significant infrasound emitted from current designs of wind turbines (BWEA Briefing Sheet Low Frequency Noise and Wind Turbines www.bwea.com/pdf/energy/lfn_summary.pdf).

In its noise assessment of the Conroys Gap project, Heggies Australia noted that in general modern wind turbine generators do not produce significant infrasound emissions, and hence was not included in the assessment.

### Substation noise emissions

The predicted noise levels from the proposed substation are expected to be less than 22dB(A) at the most exposed receiver location, Location G01 Sutton Grange, which is below the existing ambient background. These emissions will not affect the compliance assessment of the wind farm.

### Noise agreements with involved landowners

The proposed site incorporates the farming properties 'Linbrook', 'Springvale', 'Sunnyside' and 'Ferndale', which include residential dwellings. The owners of these residences will have a direct involvement with the project through lease agreements for use of their land. The proponent has discussed the possible noise implications of the various turbine layouts with the involved residents, and provided copies of the noise assessment. It is possible that under certain turbine configurations, noise levels at 'Ferndale', 'Sunnyside' and 'Linbrook' may exceed the SA EPA guidelines.

If SA EPA guidelines would be exceeded, the proponent intends to enter into noise agreements with affected landowners once the final turbine layout has been selected, prior to construction. The agreements would allow Taurus Energy to exceed SA EPA Guidelines but ensure that the project does not cause 'unreasonable interference' to the involved landowners.

The agreements would specify that:

- Taurus Energy would ensure that WHO guidelines are met (45 dB(A) or background plus 5 dB(A), whichever is higher);
- Taurus Energy would adopt an adaptive management approach which could include the use of building treatments and turbine operation/management strategies if operational noise causes significant impact to the amenity of involved residents.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Excessive operational noise | The proponent will adjust turbine selection and turbine layouts to ensure noise predictions meet the SA Noise Guidelines of 35 dB(A) or background plus 5 dB(A) (whichever is higher) for all non-involved residential receivers. |
| | The proponent will adjust turbine selection and turbine layouts to ensure noise predictions meet the World Health Organisation Guidelines for Community Noise requiring 45 dB(A) or background plus 5 dB(A) (whichever is higher) for all involved residential receivers. |
| | Prior to construction, the proponent will prepare and submit to the Department of Planning a noise report providing final noise predictions based on the final turbine model and turbine layout selected and demonstrating compliance with these relevant guidelines for all houses. |
| | If, following these assessments, minor exceedances are predicted to occur for facades that include noise sensitive uses, such as bedrooms, consideration will be given to providing mechanical ventilation (to remove the requirement for open windows) or structural acoustic treatments (such as improved glazing) to the satisfaction of the relevant residents. |

### 7.3.6. Safety and health

#### EXISTING ENVIRONMENT

The proposal site is located in farmland used for cattle and sheep grazing. The safety risks operating at the site include those that are common to similar agricultural enterprises. Risks and hazards at the site are associated with stock handling, farm chemical use, farm machinery operation, vehicle use on steep and rough terrain, bushfire and powerlines. The risks are generally considered acceptable with standard levels of awareness, caution, protection and prevention. Additional risks apply at the trig ridge, where telecommunications towers are sited. Public access is restricted throughout the proposal site, and risks to public health and safety are currently minimal.

#### IMPACT ASSESSMENT

**Construction phase risks**

Landholders, project managers, construction staff and site visitors would be exposed to a range of health and safety risks during the 6-9 month construction period. Specific risks would relate to electrical hazards, machinery and vehicle operations on steep slopes, blasting (if required), chemical use and construction noise. Occupational Health and Safety procedures would be implemented to reduce these risks, as outlined below.

The increase in traffic, particularly large vehicles during the construction period would increase risks on local roads. A traffic impact study has been prepared (Attachment 12) and specific measures would be implemented to avoid and mitigate traffic risks (refer section 7.3).

**Operational phase risks**

The operation of the wind farm has the potential to generate health risks, such as exposure to electromagnetic fields and shadow flicker. Bushfire, traffic and aviation safety risks are addressed in sections 7.3.8, 7.3.9 and 7.3.10 respectively. Impacts to recreational activities such as horse-riding are addressed in section 8.3.

**Electromagnetic fields**

Electromagnetic fields are generated by operating electrical equipment, such as powerlines, substations, and the wind turbines themselves. Powerlines and electrical devices generate 50 Hz electric and magnetic fields in their vicinity. They can have acute and chronic impacts. While electric fields can be reduced by shielding and with distance, magnetic fields can only be reduced with distance.

The development would generate electromagnetic fields around electrical infrastructure. Due to the voltage and proximity to people, powerlines would generate greater EMFs than the wind turbines. High voltage lines can produce magnetic field exposure to those standing beneath them of up to 80 milligauss (mG) however, this is far less than the 1000mG limit recommended for 24 hour exposure (National Health and Medical Research Council Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields).

NHMRC Interim guidelines evaluated the evidence to date on chronic exposure and stated that to date, chronic low-level exposure to 50 Hz fields has not been established to increase the risk of cancer (NHMRC 1989).

The wind turbine ridgelines would not be accessed by the general public and only periodically by maintenance staff, hence opportunity for exposure to EMFs will be low. Onsite, underground cabling would be used where practicable; this reduces the level of electric fields present. The turbines and substation would be located as far as practicable from residences. The areas around the substation and powerline are not likely to be used for prolonged periods or on a regular basis by property owners or the general public. EMF health impacts are therefore expected to be low.

**Physical injury risks**

There is a risk of rotors or rotor fragments to fall from a turbine during operation, resulting from materials failure or damage. Built up ice may also be thrown from the rotor blades during operation. All but two residences would be located more than 1 kilometre from the turbines. Public access to the site would be restricted. The risks to human safety from thrown materials are considered to be very low. The turbines would shut down automatically in the event of excessive wind speed or overheating components.

**Shadow flicker, flicker vertigo and photosensitive epilepsia**

Shadow flicker is produced by the shadow cast by moving turbine blades when the sun is at a low angle (morning and evening). The flickering can cause a nuisance, particularly if the shadow is cast onto a house window. The effect of ‘chopping the light’ attenuates with distance and is not considered, by modellers of shadow flicker (Danish Wind Energy Association) to be noticed beyond 500-1000m from a turbine. Two houses would potentially be located within 1000 metres of turbines, one only intermittently occupied.

The proponent will ensure that the wind turbine control systems switch off turbines which are likely to cause shadow flicker at residences.

If shadow flicker is found to be a nuisance to motorists, conditions can be pre-programmed into the control system and individual wind turbines automatically shut down whenever these conditions are present. The potential impacts on traffic safety has been addressed as part of the traffic investigations (refer section 7.3.9 and Attachment 12).

Flicker vertigo is an imbalance in brain cell activity caused by exposure to low frequency flickering or flashing of a light or sunlight seen through a rotating propeller (Rash 2004). It can result in nausea, dizziness, headache, panic, confusion and – in rare cases – loss of consciousness.

Flicker vertigo is usually associated with a light flashing sequence, or flicker frequency, of between approximately 4 hertz (cycles per second) and 20 hertz (Rash 2004, NASA 2001).

Shadow flicker frequencies of between 8-30 hertz can trigger epileptic seizures for photosensitive epileptics. Less than 5% of cases involve photosensitive epilepsia, and only a portion of these photosensitive cases have experienced a seizure triggered by flickering light (Epilepsy Association of Australia).

Flicker frequency of rotating propellers, including wind farm rotors, is derived by multiplying the hub rotation frequency by the number of blades. Based on the rotation speed of the 3 bladed wind turbines proposed for the Conroys Gap project, the maximum shadow flicker frequency would be 1 cycle per second (1 hertz), well outside the frequency range associated with flicker vertigo or photosensitive epilepsy. The proposal is therefore unlikely to represent a health risk to local residents or road users in relation to flicker vertigo or photosensitive epilepsy.

### Operational noise

Noise levels, particularly where they occur continuously and affect sleep patterns, can be harmful to humans and is cited by the World Health Organisation (WHO) as one of the most serious effects of environmental noise. WHO guidelines recommend that sound levels inside bedrooms during sleep should not exceed 30 dB(A) for continuous background noise, and that individual noises events exceeding 45 dB(A) should be avoided (WHO 2004). This translates to a level of 45 dB(A) or background plus 5 dB(A) outside of residences.

The noise levels generated by an operational wind farm are particular to the turbine design, local topography and weather conditions. This has been the subject of a specialist study which modelled anticipated noise levels, based on existing background noise (obtained from noise loggers placed at several locations around the proposed site). Final turbine selection and location will ensure noise levels remain within acceptable levels at residences. In accordance with the South Australian EPA Wind Farm Environmental Noise Guidelines, 2003, the limits at local residences (excluding involved residences) are 35 dB(A) or background noise plus 5 dB(A), whichever is the higher limit. This is well below WHO Guidelines.

This issue of infrasound is discussed in section 7.3.5 above. The SA guidelines and other authorities note that recent turbine designs do not appear to produce significant levels of infrasound, as earlier models did.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Construction phase<br>Risk of injury during construction works.<br>Risk of injury during transport of equipment to the site.<br>Risk of injury to the public.<br>Risk of injury to stock. | Workplace health and safety protocols will be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities. |
| | The safety of the workforce will be managed by strict safety procedures, good design of site tracks, and regular maintenance. If an incident occurs, communications to ambulance or medical services will be via phone or radio. |
| | Traffic management will be investigated within the Environmental Assessment to ensure that roads and bridges are adequate to handle the loads required and to identify strategies to reduce the risk to other motorists during the construction and decommissioning phase. |
| | Site fencing will be installed where work staff consider that there is a risk to the safety of the general public (ie. when the trench is left open for extensive periods). |
| Operational phase: physical risks | Start-up and shutdown (including safety shutdowns) are fully automated, with manual interruption available via onsite control systems and remote computer. |
| | The substation area will be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Operational phase: noise | Noise modelling and investigation of the operational wind farm have been undertaken as part of the Environmental Assessment to ensure that the noise levels are within State prescribed guidelines and do not pose a health risk during the operation and construction phases. |
| Operational phase: electromagnetic fields (EMF) | The National Health and Medical Research Council (NHMRC) Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields will be adhered to (24 hour exposure: 1000mG, occupational exposure: 5000mG). |
| Operational phase: shadow flicker | If shadow flicker is found to be a nuisance to residents or motorists, conditions will be pre-programmed into the control system and individual wind turbines automatically shut down whenever these conditions are present. |
| Post-operational: risks to landowners and the public due to turbine disuse and decommissioning | Wind turbines, substation, control building, and the associated above ground electricity infrastructure are to be removed and the site restored once the wind farm is decommissioned. |
| | Individual wind turbines not used to generate electricity for a continuous period of 12 months will be removed unless extenuating circumstances apply. |
| | Written evidence will be provided to the Director General, that the lease agreement(s) with the site landowners have adequate provisions to meet the decommissioning requirements, that the site be restored to a similar condition as existed before the development. |

### 7.3.7. Telecommunications impacts

**EXISTING ENVIRONMENT**

The Conroys Gap Wind Farm is to be located in a rural area approximately 15km west of Yass in NSW. While this is a rural area with relatively sparse housing, a number of communications links and broadcast networks are present in the surrounding region.

**Figure 7.7 Black Trig Communications tower**

### Existing television and radio broadcast services

The ACMA RadCom database lists the following broadcasters for television and radio, under postcode 2582, Yass.

**Television broadcasting:**

- Southern New South Wales TV1: ABC, CBN, CTC, SBS and WIN.

**Radio broadcasting:**

- Canberra RA1: 1ART, 1CBR, 1CMS, 1WAY, 1XXR, 2ABCFM, 2CA, 2CC, 2CN, 2JJJ, 2PB, 2RN, 2ROC, 2SBSFM
- Canberra RA2: 1RPH
- Goulburn RA1: 2ABCFM, 2ABCRN, 2ABCRR, 2GN, 2JJJ, 2RN, 2SNO.
- Yass RA1: 2YAS.

Canberra (Black Mountain) is the nearest TV transmission source for the locality of the proposed Conroys Gap wind farm. Details of the Canberra television channels are provided in Table 7-5 below.

**Table 7-5 Canberra television channels**

| Broadcaster | Channel | Band | Frequency (MHz) |
|---|---|---|---|
| Capital (CTC) | 7 | VHF | 182.25 |
| ABC | 9 | VHF | 196.25 |
| SBS | 28 | UHF | 527.25 |
| WIN | 31 | UHF | 548.25 |
| Prime (CBN) | 34 | UHF | 569.25 |

### Existing radio communication licences

The Australian Communication and Media Authority (ACMA) issues radio communications licenses in accordance with Part 3.5 of the Commonwealth *Radiocommunications Act 1992*. The ACMA issues licenses to use specific segments of the radio broadcasting frequency spectrum for different purposes and maintains a register (the ACMA RadCom Database) of all the licenses issued.

The register allows the ACMA to create a ‘density’ classification of areas across Australia as high, medium or low depending on the number of licenses in operation in a particular area. According to the ACMA RadCom Database, the area in the vicinity of the proposed wind farm is classified as a “Low Density Area”.

According to the ACMA RadCom Database, license holders operate a range of radio communications services, primarily fixed link microwave communication and mobile communication systems within a 25km radius of the proposed wind farm. Multiple license holders use some sites, while sole users employ others.

**Table 7-6 Radio communication license holders within 25 kms**

| ACMA Licence Holder | ACMA Site ID No. |
|---|---|
| Airservices Australia | 34921 |
| Ambulance Service of New South Wales | 402447, 34921 |
| Australian Capital Television Pty Ltd | 9514 |
| Australian Rail Track Corporation Ltd | 40012 |
| BA & LP Hellyer | 48936 |
| Commissioner of Police NSW Police | 55601,9526, 34921 |
| Concrite Pty Ltd | 36172 |
| Country Energy | 55601, 36149, 9000026, 9542, 34921 |
| Department of Environment and Conservation | 9519 |
| Diane Maree Nacson | 100903 |
| Harden Shire Council | 9542 |
| NSW Fire Brigades | 100903 |
| NSW Fisheries | 40307 |
| NSW Rural Fire Service | 9519, 34897, 34888, 201543, 34887, 9542 |
| NSW State Emergency Service | 201458, 9528 |
| NSW Volunteer Rescue Association | 39030,34921 |
| Optus Mobile Pty Ltd | 201821, 55601, 9525, 202115, |
| Prime Television Southern Pty Ltd. | 9514 |
| Roads and Traffic Authority of NSW | 9519 |
| RW Glover | 48304 |
| Singtel Optus Pty Ltd | 201821, 55601 |
| Soul Pattinson Telecommunication Pty Ltd | 204072,100785 |
| State Water | 100673 |
| Suzette Elizabeth Munro | 150443 |
| Telstra Corporation Ltd | 130627, 9518, 205842, 39130, 132565, 131404, 38369, 131407, 101537, 101536, 100785, 38513 |
| The info Radio Network Pty Ltd | 55601 |
| TransGrid | 204073, 204072, 34921, |
| Vodafone Network Pty Ltd | 201821 |
| Wendy Blackmore | 199282 |
| WIN Television NSW Pty Ltd | 9514 |
| Yass Community Radio Association | 39129 |
| Yass Valley Council | 9519 |

**Mobile phone services and facilities**

High frequency communications links used for mobile transmission networks are covered under Radio Communication Services, this section covers CDMA and GSM services. Included below are maps showing existing local mobile phone coverage from the three providers (source: company websites).

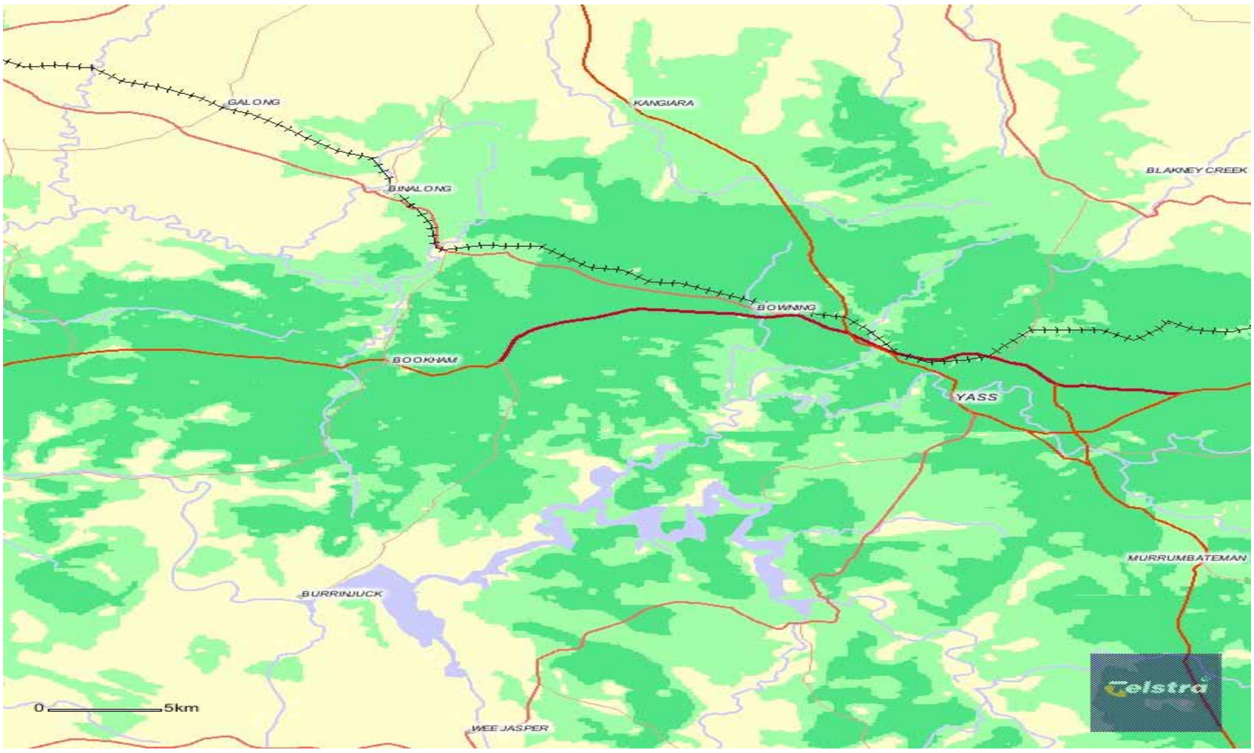



**Figure 7.8 Telstra 3G and GSM Coverage**

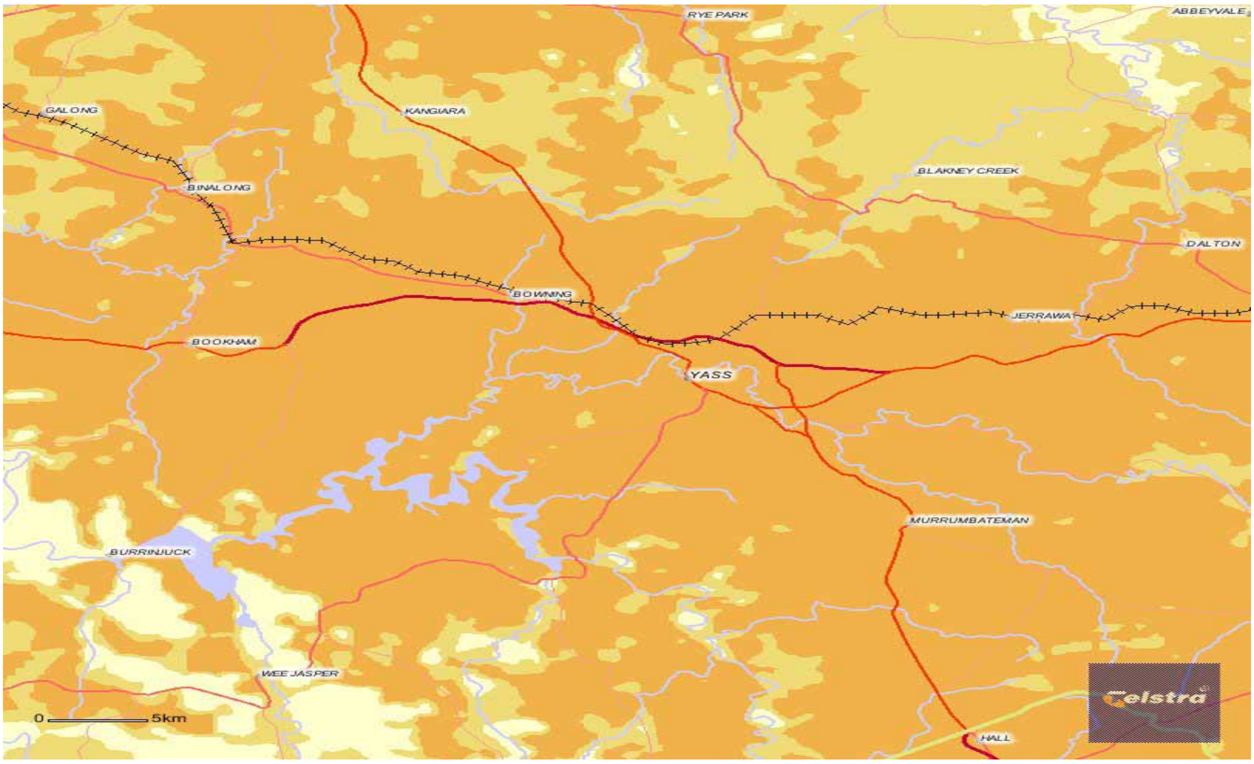



**Figure 7.9 Telstra CDMA Coverage**

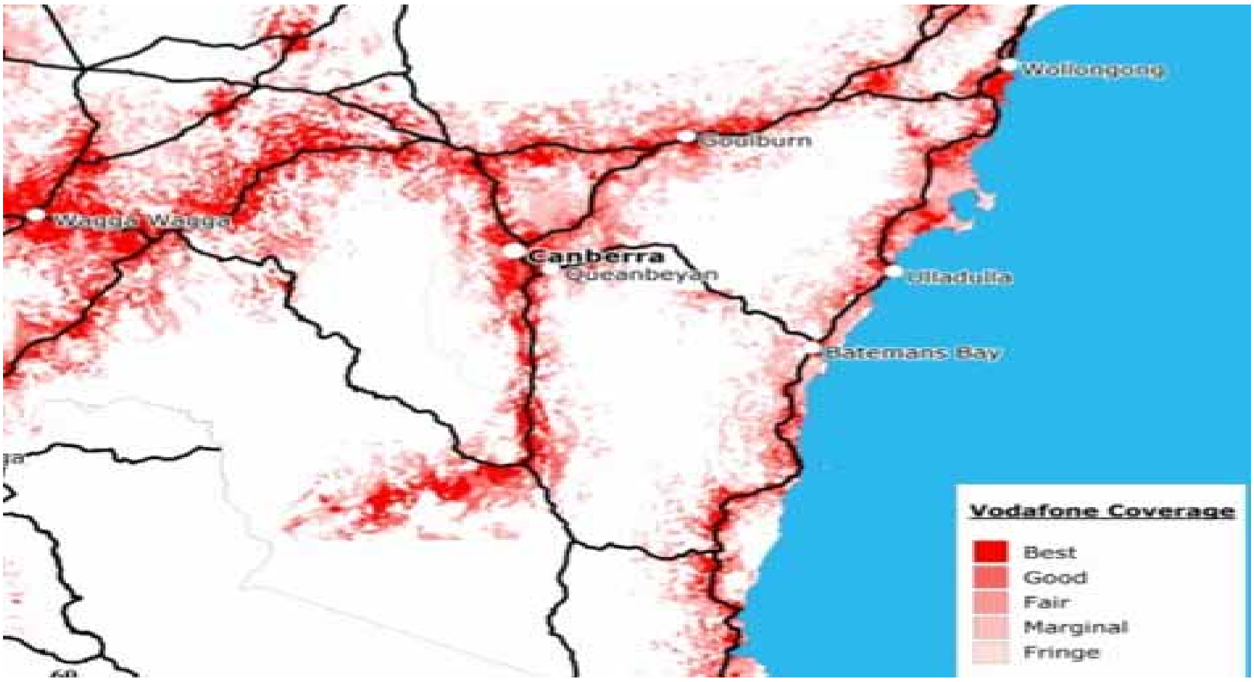



**Figure 7.10 Vodaphone GSM Coverage**

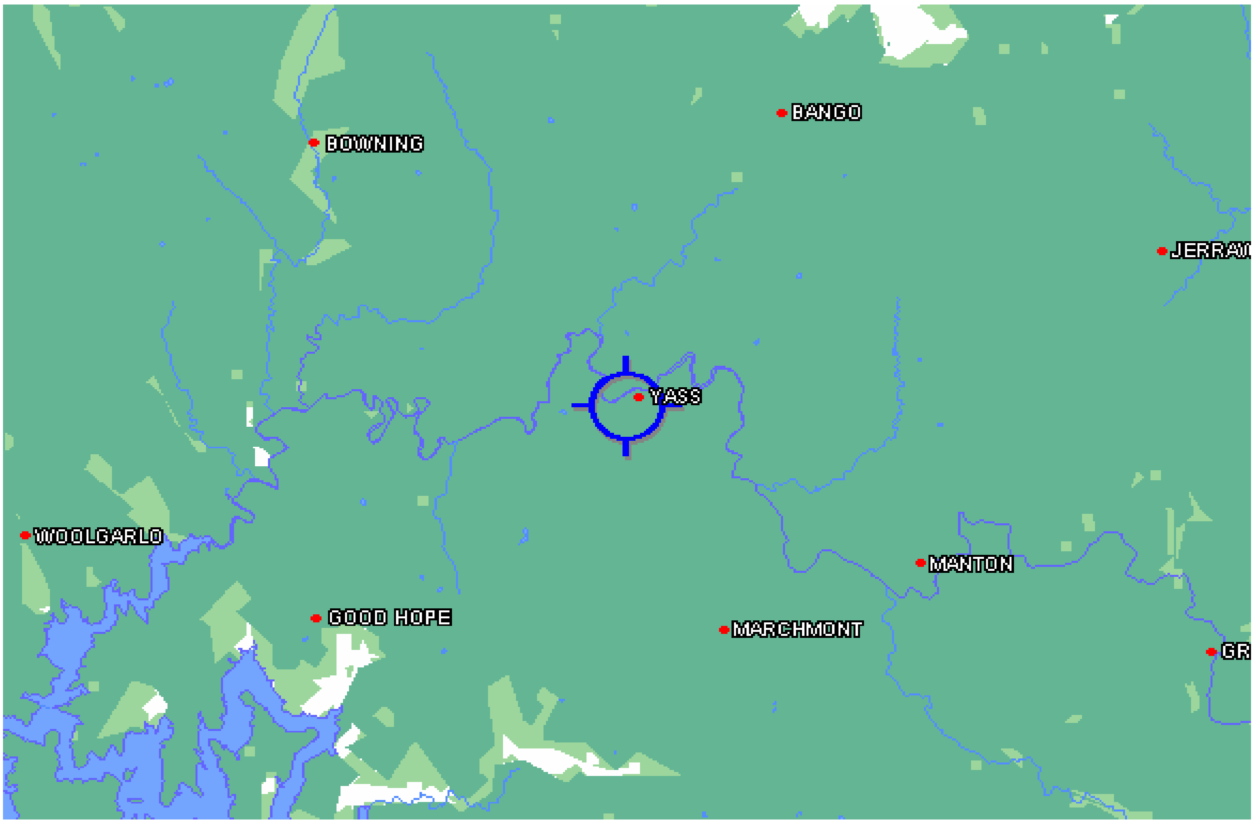



**Figure 7.11 Optus GSM Coverage**

The ACMA RadCom Database identified three mobile phone companies as using base stations within the vicinity of the proposed wind farm. Table 7-7 below lists the companies and ACMA site ID numbers.

**Table 7-7 Mobile phone companies operating at site**

| Mobile Phone Companies | ACMA Site ID No. |
|---|---|
| Optus Mobile Pty Ltd / Singtel Optus Pty Ltd | 201821, 55601, 9525, 202115 |
| Telstra Corporation Ltd | 130627, 9518, 205842, 39130, 132565, 131404, 38369, 131407, 101537, 101536, 100785, 38513 |
| Vodafone Network Pty Ltd | 201821 |

### Aircraft navigation services and facilities

The closest airports to the proposed wind farm site are Canberra and Goulburn. There is one radar installation in the vicinity of Canberra airport, namely Mt Majura. A secondary radar installation is located at Mt Bobbara.

## IMPACT ASSESSMENT

### Electromagnetic interference (EMI)

Electromagnetic Interference (EMI) has the potential to cause degradation or total loss of signal strength and may cause poor TV reception and/or “ghosting” effects. EMI may also result in a reduction in the coverage of mobile phone, radio and aircraft navigation communications in certain instances.

There are three principal mechanisms by which wind turbines may cause EMI:

- Reflection or scattering;
- Diffraction;
- Near field effects (Bacon 1999).

#### Reflection or scattering

When a signal sent between a transmitter and receiver becomes obstructed by an object located within the path of a signal, reflection and/or scattering may occur. If the rotating blade of a wind turbine receives a primary transmitted signal, a scattered time delayed (or out of phase) signal may be produced and transmitted to the receiver. The out of phase signal will be distorted in relation to the primary signal, causing EMI (URS 2004a).

#### Diffraction

In some instances when an object is located in the path of a signal wave front, the object can both reflect and absorb the signal. This phenomenon is commonly referred to as diffraction (URS 2004a).

#### Near field effects

Wind turbines may cause interference to radio signals due to the electromagnetic fields emitted by the generator and the switching components within the turbine nacelle. This is referred to as a near field effect (URS 2004a).

Due to advances in technology and compliance with the Electromagnetic Emission Standard, EN61000-6-4 (AS/NZ 4251.2:1999) Emission standard for industrial environments, the wind turbines proposed will not cause active EMI due to near field effects.

### Factors determining the level of impact

The level of EMI produced by a wind turbine due to the above effects is dependant on a number of factors, including placement of the wind turbine in relation to the signal path/s; the signal frequency; the characteristics / composition of the wind turbines rotor blades; the receiver characteristics; and the propagation characteristics of the radio wave in the local atmospheric conditions (URS 2004a).

### Approach to the assessment

As with any large structure, there may be circumstances where wind turbines cause disruption to the electromagnetic signals used in a variety of commonly used radar, navigation and telecommunications services. The possible impact of the proposed wind farm on the following communications services has been investigated:

- Television and radio broadcast services;
- Mobile phone services;
- Radio communication services and
- Aircraft navigation services.

The following approach was used to carry out the impact assessment:

- Identify license holders within a 25km radius of the proposed wind farm site, and point-to-point links in the vicinity of the site, using information provided on the ACMA RadCom database;
- Provide written notification of the proposal to each license holder identified via the ACMA RadCom database within a 25km radius of the site;
- Record and review all responses received to identify any issues raised by license holders;
- Discuss issues raised with relevant license holder with the aim to resolve or identify mitigation options;
- Carry out internal assessment of Fresnel Zones associated with fixed point-to-point communications links in the vicinity of the site;
- Determine appropriate exclusion zones for proposed turbine layout based on Fresnel Zone calculations and advice from license holders;
- Confirm all turbines (including blades) are located outside of this exclusion zone;
- Determine appropriate additional mitigation measures which may be required.

### Television interference

All television and radio license holders identified via the ACMA RadCom database within a 25km radius of the wind farm were notified of the proposal by Taurus Energy regarding potential impacts and asked to provide comments. At the time of writing, no concerns had been raised from these license holders contacted regarding possible impacts to television or radio broadcasting services. Taurus Energy will work with organisations to resolve any issues, should they be identified.

Television Interference (TVI) is dependent on a range of factors including environmental factors (topography, direct signal strength, transmitter type, and receiver type) and wind farm design factors (turbine elevation, rotor size and orientation, speed of rotation, blade material and pitch) (Spera 1994).

TVI caused by the operation of wind turbines is characterised by video distortion, while the audio component of the signal is not affected (Spera 1994).

Due to the variability of local conditions and the characteristics of antennae used in particular installations, there is a degree of uncertainty regarding predicted levels of interference.

The level of TVI can be influenced by a number of factors including:

- Where the receiver is located, relative to the TV transmitter and the wind farm;
- The frequency of the transmitted TV signal;
- Whether there are any other tall structures in the vicinity of the receiver;
- The direction of the rotor blades and blade material;
- The nature of the receiving aerial e.g. design, height, directionality, power.

The level of radio broadcast interference experienced can be influenced by a variety of variables including:

- Abnormal weather conditions;
- Multipath distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.);
- Overloading (occurs when an FM receiver receives too strong a signal);
- Electrical interference from household appliances etc;

In general, the potential for interference at receiver locations can increase with distance of the receiver from the transmitter, as signal strength decreases with increasing distance from the source. As such, a wind farm in an area of already poor signal strength may potentially have a greater impact on reception than the same wind farm in an area of relatively strong signal strength. In addition, reception in the vicinity of the wind farm can vary with the degree of topographic obstruction of the signal.

**Wind turbine interference zone**

The zone of interference for a single wind turbine is primarily an elongated zone extending from the turbine structure in the direction away from the transmitter and a zone of shorter but wider extent on the transmitter side. This is shown in 7.15 below, reproduced from the Gunning Wind Farm Environmental Impact Statement – Chapter 11.

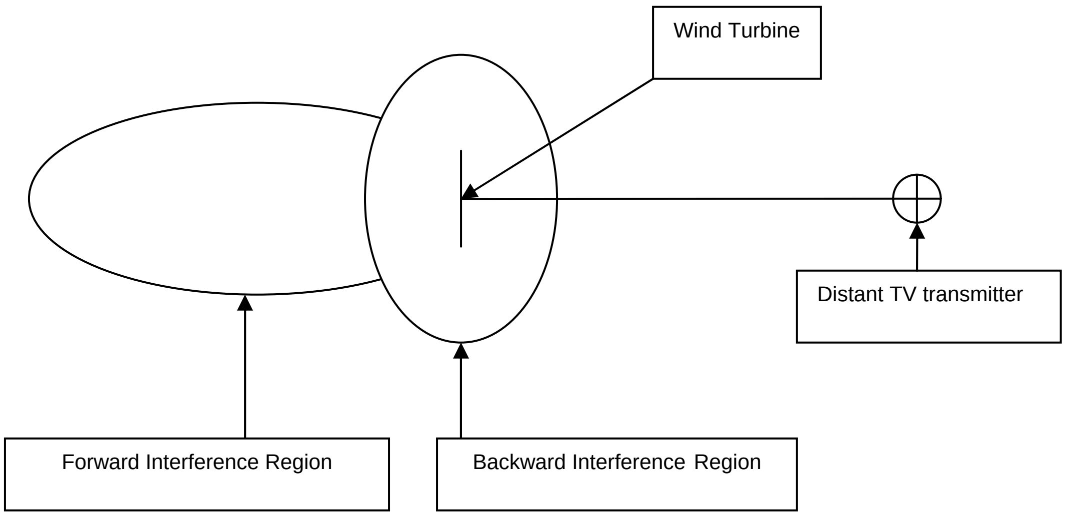



**Figure 7.12 Schematic diagram of television signal interference zones around a wind turbine.**

The zone of potential interference for a wind farm is the resultant total of the effects from the individual turbines.

The International Telecommunications Union Recommendation ITU-R BT.805 states that impacts beyond 5 kilometres are unlikely. It also indicates that interference may extend beyond 5km where the receiver location is shielded from the direct signal, but in direct line-of-sight to the turbine (Delta Electricity 2004).

The form of interference, if experienced, will depend on the relative positions of the wind farm, the transmitting station and the receiver. Television interference can take the form of either a “ghost” image that pulsates horizontally at the “blade pass” frequency or a fluctuation in picture brightness, also at the “blade pass” frequency (Delta Electricity 2004).

There are approximately 33 houses within a 5km radius of the proposed wind farm. The location of the wind farm with respect to Black Mountain communications tower can also be seen in the following diagram.

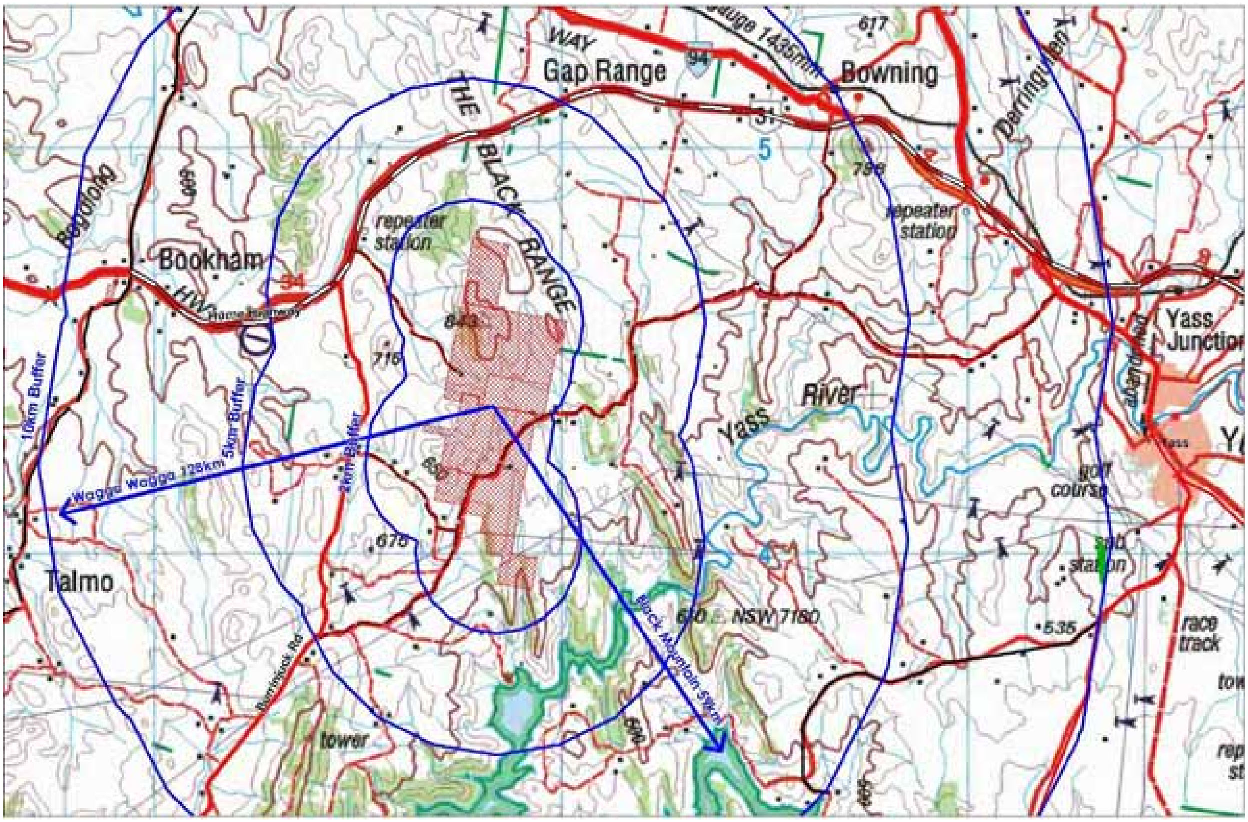



**Figure 7.13 Television tower locations with respect to site**

It is difficult to assess the likely impact on these specific house locations, and once the wind farm is operational it is possible that television reception could be affected at some of these locations unless some form of mitigation is introduced.

Houses further than 5km from the site are unlikely to be affected.

The proponent will undertake a monitoring program of houses within 5km of the wind farm to determine any loss in television signal strength, once the wind farm is operational.

In the event that TVI is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference will be investigated by Taurus Energy. Should investigations determine that the cause of the interference is due to the wind farm, Taurus Energy will put in place mitigation measures at each of the effected receivers in consultation and agreement with the landowners.

**Radio communication services**

A fixed link radio transmission is a point-to-point transmission path typically between two elevated topographical features. The transmission path may become compromised if a wind farm is located within the direct line-of-sight or what is known as the 'Fresnel Zone' around the line of sight between the sending and receiving antennae.

The potential impact zone will vary with the distance between the transmitter and receiver, frequency of transmission and the location of any particular point along its path. Communications are only likely to be affected if a wind farm is in the line-of-sight between two sending and receiving antennae or within a zone of the line-of-sight of these antennae.

Where a potential exists for interference to line-of-sight links, an obstruction analysis can be undertaken to ensure that no part of a wind turbine assembly will enter the Fresnel Zone of the microwave link. The maximum extent of the Fresnel zone occurs at the midpoint along the path of the microwave link.

Taurus Energy identified and mapped the point-to-point communication links in the vicinity of the proposed wind farm site to establish the line-of-sight path. Figure 7.17 provides details of the locations of fixed microwave links around the Conroys Gap site (prepared by Taurus Energy based on data contained in the ACMA RadCom database.)

In order to ensure that no obstruction to transmission paths occurs, calculations of the 2nd Fresnel Zone of the point-to-point communications links in proximity to the site were undertaken. It is suggested that beyond the 2nd Fresnel Zone the power of a scattered signal from a structure such as a wind turbine would be small enough such that it would not result in significant interference at the receiver (Bacon 1999).

In order to determine whether a radio link could be affected by the wind turbines, Taurus Energy defined an ‘exclusion zone’ beyond which the level of interference will not disrupt the radio link, based on the concept of the Fresnel Zone, as previously described. These zones (as well as the zone showing the 100m set-off from the communications tower mobile phone antennae) are shown cross hatched in the following diagram.

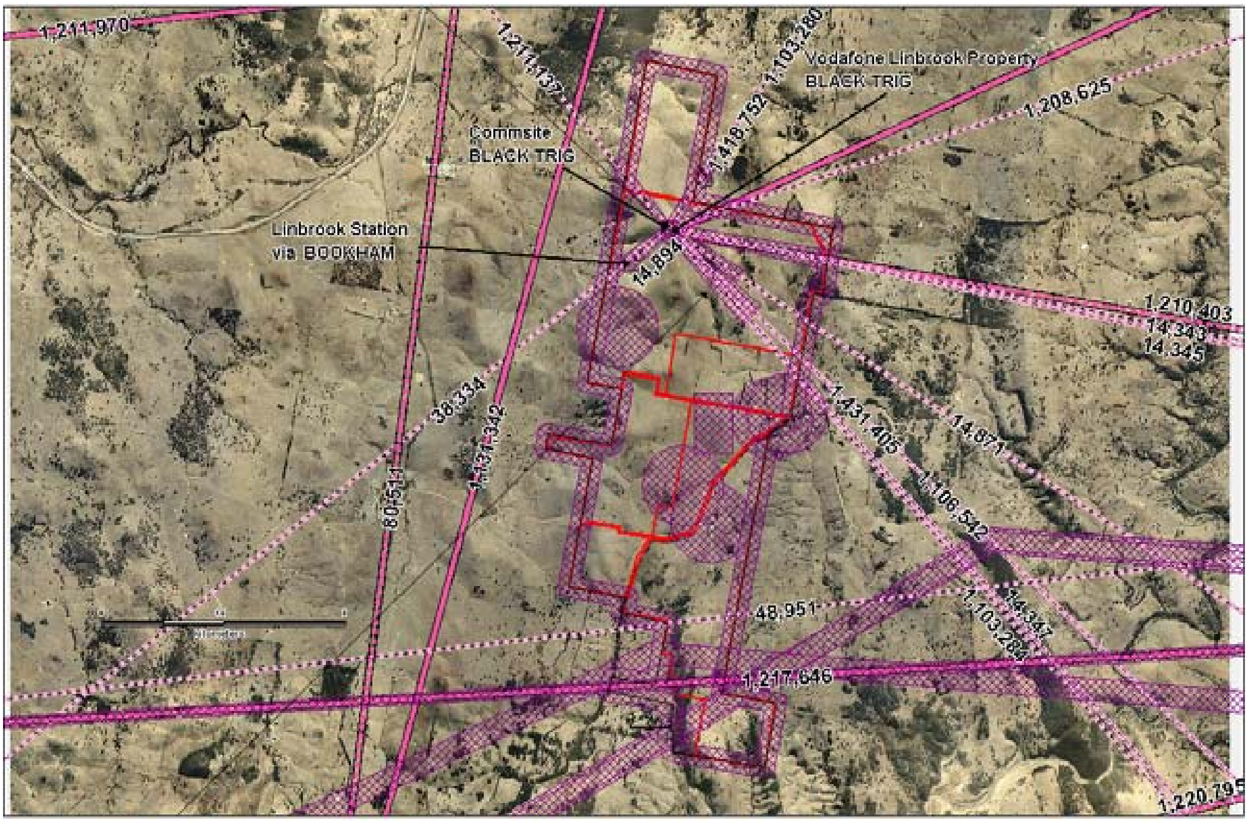



**Figure 7.14 Radio communication links and exclusion zones**

The following point-to-point links were identified in the vicinity of the site.

- The link transmitting from site 12km SE of Bigga Snowy Mountain to Commsite Black Trig (license number 1103280), operated by the National Parks and Wildlife Service, passes across the site. This link operates at 413.7 MHz.
- The link transmitting from Commsite Black Trig to Minjary Trig via Tumut, (license number 38334), operated by the Roads and Traffic Authority, passes across the site. This link operates at 460.4 MHz
- The Link transmitting from Commsite Black Trig to Linbrook Station via Bookham, (license number 14894) operated by the NSW Rural Fire Service passes across the site. This link operates at 460.85 MHz.

- The Link transmitting from Shire Council Site Boundary Rd 7km SSE of Young to Commsite Black Trig, (license number 1211137), operated by the NSW Rural Fire Service, passes across the site. This link operates at 414.325 MHz
- The Link transmitting from Bowning Hill Trig Yass to Vodafone Linbrook property Black Trig, (license number 1211961), operated by Optus Mobile Pty Ltd, passes across the site. This link operates at 23,390.5 MHz.
- The link transmitting from Commsite Mt Mary to Commsite Black Trig, (license number 1208625), operated by the NSW Rural Fire Service, passes across the site. This link operates at 413.800 MHz.
- The link transmitting from Commsite Mt Manton to Vodafone Linbrook (license number 1210403), property Black Trig, operated by Vodafone Network Pty Ltd, passes across the site. This link operates at 7,589 MHz.
- The link transmitting from Commsite Black Trig to 76 Pritchett St Yass, (license number 14343), operated by NSW Rural Fire Service, passes across the site. This link operates at 460.850 MHz.
- The link transmitting from 209 Comur St Yass to Commsite Black Trig, (license number 14345), operated by NSW Rural Fire Service, passes across the site. This link operates at 451.350 MHz.
- The link transmitting from Fire Tower Mt Budawang BUDAWANG to Commsite Black Trig, (license number 14871), operated by NSW Rural Fire Service, passes across the site. The link operates at 404.725 MHz.
- The link transmitting from Commsite Black Trig to Pacific Power Site Mt Spring Canberra, (license number 1106542), operated by NSW Rural Fire Service, passes across the site. The link operates at 460.575 MHz.
- The link transmitting from Commsite Black Trig to Dundoos Park Station MURRUMBATEMAN, (license number 14347) operated by NSW Rural Fire Service, passes across the site. The link operates at 460.850 MHz.
- The link transmitting from Fire Tower Mt Cronin to Commsite Black Trig, operated by National Parks and Wildlife Service, (license number 1103284), passes across the site. The link operates at 413.7 MHz.
- The link transmitting from Telstra Site Mt Carroll to Telecom Site Conroys Gap, operated by Telstra Corporation Ltd, (license number 1131342), passes to the west of all turbines. This link operates at 7,624 MHz.

As a result of the exclusion zones established in planning the wind farm, no significant impacts will occur to existing point-to-point links. Accordingly, no additional mitigation measures will be required.

**Additional radio communication licenses**

In addition, Taurus Energy contacted all organisations identified as operating radio communication licences (including fixed link communications) within 25km of the wind farm. Each was asked to provide independent comments / advice on the possibility of the wind farm development interfering with their communications links. Of the organisations identified within the 25km radius only the Rural Fire Service raised concerns. Optus, Vodafone and Telstra provided general guidelines to assist in the planning of the wind farm.

In response to these inquiries, the Rural Fire Service noted:

> "*Our investigation shows that at least one of the wind turbines (T15) may be obstructing the path to Mt Spring. This is a 2 way link and would be degraded by the location of the turbine. T14 may also be problematic, however this is for receive only at Black Trig and may be OK, however it is still recommended that this turbine be repositioned to keep the path clear*." (pers. comm. Mr Roman Rybak NSW Rural Fire Service).

Optus Mobile noted:

> "*Provided wind turbines are located well outside the 2nd Fresnel zone of the point to point microwave links, no interference to communications is expected*" (pers. comm. Mr. Trong Ho, Optus Mobile).

Vodafone noted:

> *"Clearance criteria is the same for all carriers. Please use the same criteria as proposed by Optus"* (pers. comm Mr. Ganesh Ganeswaran, Senior Engineer / Transmission, AAP Communications Services 22/11/05).

Telstra noted:

> "*Provided wind turbines are greater than 100m away from Mobile tower (or in the case of directional panel antennae) not in direct line of site for panel antennas, wind turbines will have minimal effect on existing coverage. Your proposal appears to satisfy these conditions, thus I see no issues with this proposal*." (pers. comm. Mr. Ivan D'Amico, Area Team Manager (Country) - NSW&ACT, Telstra Services, Wireless Access Solutions, Mobile Coverage Delivery).

In consideration of the feedback obtained, the turbine layout has been adjusted to eliminate the issues raised by the Rural Fire Service. Furthermore, due to the exclusion zones established in planning the wind farm, no significant impacts will occur to other existing point-to-point links and therefore no mitigation will be required.

In the event that any issues with additional license links are identified as a result of the wind farm, whether prior to or post construction, Taurus Energy will consult with the operator and undertake appropriate remedial measures, which may include:

- Modifications to or relocation of the existing antennae;
- Installation of a directional antennae; and/or
- Installation of an amplifier to boost the signal.

**Mobile phone services**

All companies were contacted by Taurus Energy regarding potential impacts and asked to provide feedback as to any potential conflicts with their existing networks.

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2-10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells (URS 2004).

At Taurus Energy's request, Optus Mobile / Singtel Optus, Telstra and Vodafone each carried out independent investigations of the potential impact to their mobile phone systems. The following responses were received:

- Optus Mobile/Singtel Optus

  "With regards to Conroys Gap Wind Farm, Optus' preference is for an unobstructed view towards the Hume highway in an anti-clockwise direction from 340° to 25°" (Mr. Maxi Victoria RNP NSW SDO, Optus).

- Telstra

  "Main concern from Telstra's point of view would be physical obstruction of radio path which would in turn alter existing mobile coverage in the area. Provided wind turbines are greater than 100m away from Mobile tower and not in direct line of site for panel antennas wind turbines will have minimal effect on existing coverage.

  Your proposal appears to satisfy these conditions. The closest Telstra Mobile Base station is Conroys Gap which is approx 3.83km away from T1, thus I see no issues with this proposal." (Mr. Ivan D'Amico, Area Team Manager (Country) – NSW & ACT Telstra Services, Wireless Access Solutions, Mobile Coverage Delivery).

- Vodafone

  Vodafone is currently investigating and Taurus Energy will continue to work with Vodafone to ensure interference to mobile phone services is avoided. It is anticipated that Vodafone would have the same requirements as for other mobile phone carriers; therefore it is likely that the constraint conditions identified by Telstra would be sufficient to eliminate impacts to the Vodafone network.

In preparing the proposed turbine layout, it was identified that a small number of wind turbines may encroach into the zone which Optus prefers an "unobstructed view towards the Hume Highway". Optus has been notified of this and at the time of writing, a response had not been received. As the layout satisfies Telstra's requirements, it was concluded that there is only a very low risk (if any) that mobile communications may be affected in the area.

In order to avoid impacts to mobile phone services, Taurus Energy will implement a (turbine) set off distance for omnidirectional antennae of 100m from the tower and for panel antennae Taurus Energy propose a 100m (turbine) set-off for 30 degrees either side of the line of sight from the panel. Accordingly, no additional mitigation measures are required.

**Potential interference with aircraft radar navigation systems**

On 13 April 2006, Taurus Energy commissioned Airservices Australia to conduct a study of the effects of the proposed Conroys Gap wind farm development on the operation of the Mount Bobbara Air Traffic Control (ATC) radar facility located 6km north east of the township of Binalong, NSW. The Mt Bobbara radar is currently operating as the secondary radar to Mt Majura for the Canberra International Airport. Airservices Australia completed the study on 21 June 2006.

The scope of the study included:

1. Provision of comments on known literature relating to the impact of wind farms on secondary surveillance radar; and
2. Results of modelling conducted into the impact the proposed Conroy's Gap wind farm will have on the performance of the Mount Bobbara radar and potential implications that may result to aviation safety.

The proposed wind turbine locations were plotted using geographical information system (GIS) software and perspective views of the radio horizon were generated for each siting option. The radar coverage was modelled using a worst case scenario which treated the turbines as solid objects (i.e. the circular area swept by the turbine blades was considered to be a solid object for the purposes of the study).

The following conclusions on radar coverage were drawn from the study:

1. The radar coverage will be reduced in the narrow sector between 146.4deg and 153.2deg. This will affect radar performance by increasing the minimum coverage from 5000' to 6000' in the runway 35 approach path. Aircraft on instrumented landing (ILS) approach to Canberra Airport runway 35 will be at 3000' at the outer marker. At this altitude the aircraft will no longer be in surveillance coverage of Mount Bobbera. Therefore, the wind farm will not impact the instrumented landing (ILS) approach to Canberra Airport runway 35.
2. Radar reflections are likely to occur from the turbine and turbine components. The reflection path will be variable depending on turbine orientation with respect to the radar. Reflections are likely to be very short term, possibly of one interrogation in duration. These isolated interrogation responses should be filtered by the radar plot/track creation process and not passed to the operators display.
3. For transmit path reflections from the turbines, the transmit power of the radar interrogator can be reduced on a sector by sector basis. This will reduce the chance of an aircraft replying to a reflected interrogation.

4. If split track generation becomes an operational concern, the radar receiver sensitivity can be reduced in the affected area.

The Airservices Australia study concluded that critical coverage areas are unlikely to be impacted. If effects in critical areas do become apparent; mitigation strategies are available to reduce the operational impact by optimisation of the radar facility.

Taurus Energy will continue to liaise closely with Airservices Australia in order to ensure air safety is maintained.

The proponent will ensure that the requirements of both organisations are met in the development of the Conroys Gap wind farm.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Radio and television broadcast interference** | In the design of the project, the proponent will use wherever practical, equipment complying with the Electromagnetic Emission Standard, AS/NZS 4251.2:1999 to help minimise TVI. |
| | Once the wind farm is operational, the proponent will undertake a monitoring program of houses within 5km of the wind farm to determine any loss in television signal strength. |
| | In the event that TVI is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference will be investigated by Taurus Energy. Should investigations determine that the cause of the interference is due to the wind farm, Taurus Energy will implement mitigation measures at each of the effected receivers in consultation and agreement with the landowners.<br>Specific mitigation measures may include:<br>• Modification to or replacement of receiving antenna;<br>• Provision of a land line between the effected receiver and an antenna located in an area of favourable reception;<br>• Improvement of the existing antenna system; or<br>• In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at Taurus Energy's cost. |
| **Mobile phone interference** | In order to avoid impacts to mobile phone services, Taurus Energy will implement a (turbine) set off distance for omnidirectional antennae of 100m from the tower and for panel antennae Taurus Energy propose a 100m (turbine) set-off for 30 degrees either side of the line of sight from the panel. |
| **Radio communications interference** | In the event that any issues with additional license links are identified as a result of the wind farm, whether prior to or post construction, Taurus Energy will consult with the operator and undertake appropriate remedial measures, which may include:<br>• Modifications to or relocation of the existing antennae;<br>• Installation of a directional antennae; and/or<br>• Installation of an amplifier to boost the signal. |
| **Aircraft navigation interference** | Taurus Energy will continue to liaise closely with Airservices Australia in order to ensure air safety is maintained. The proponent will ensure that the requirements of Airservices Australia and CASA are met in the development of the Conroys Gap wind farm. |

## 7.3.8. Bushfire impacts

### EXISTING ENVIRONMENT

The study area is largely native and exotic pasture, with few trees and shrubs. Summer conditions in the Yass district can be dry and hot with high wind speeds, producing a local grass fire hazard. Potential ignition sources include farm machinery, hay storage and embers blown from occasional forest fires to the south-west. The elevated position of the subject site may also increase the frequency of lightning strike. The steep topography and absence of built areas or natural fire breaks such as large watercourses and waterbodies may assist the rate of spread of wildfires. Factors mitigating fire risks at the site include the sparse and fragmented nature of woodland and forest remnants, the low density of human settlement and assets, the local presence of the Rural Fire Service (an appliance is kept on the Springvale property) and a grazing regime which keeps paddock fuels low.

### IMPACT ASSESSMENT

#### Construction and decommissioning phases

Flammable materials and ignition sources brought onto the site, such as fuels, would increase the risk of fire during the construction period. Correct handling and storage procedures would mitigate against the risk of ignition. Appropriate fire fighting equipment would be held on site when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use. The Rural Fire Service would be consulted in regard to the adequacy of bushfire prevention procedures to be implemented on site during construction, operation and decommissioning. These procedures would in particular cover hot-work procedures and response measures to control any incident.

#### Operational phase

##### Turbine ignition

Zilkha Renewable Energy (2002) reports that records from a leading insurer show that fires due to equipment failure are very rare in modern wind turbine designs. In 15 years and with over 12,000 insured turbines, the insurer has had only one case of third party damage from fire caused by a turbine, which was limited to a large haystack. Turbines would automatically shut down if ambient temperatures exceed the safe operating range, or if components overheat.

There remains however a remote possibility that electrical failure could produce a fire within a turbine tower. This has been recorded in two cases worldwide. In the event of a turbine igniting onsite, the generally low fuels levels in surrounding pasture, ready visibility of the majority of the turbines and local presence of RFS equipment and personnel would reduce the intensity of wildfire and assist detection, response and control.

The turbines would be fitted with lightning protection, which is designed to effectively earth any lightning strike. The risk of turbine ignition is assessed as low, based on the low likelihood of electrical failure or over-heating and a range of factors mitigating the fire hazard.

##### Aerial cables

Aerial cables would be installed to connect the wind farm to the Transgrid system and across the McCullums Creek valley to avoid impacts to significant flora and fauna values. The cable would be routed to avoid trees and forest patches, avoiding the need for clearing and eliminating ongoing fire risks from tree growth. Cable routes would be periodically inspected to monitor any regrowth or spread of eucalypts.

##### Substation and control room ignition

The transformer in the substation facility would contain transformer oil for the purpose of cooling and insulation. The facility would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. In the event of a fire, the NSW fire brigade would have responsibility for control, with the RFS involved in a support role.

The facility would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). Transformer oil would be changed at appropriate intervals by qualified staff to minimise the potential for fire caused by contaminated oil. The oil would be removed from the site and disposed of appropriately.

The substation and control building would be surrounded by a gravelled and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation area would also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress.

A further perimeter area within 25 metres of the substation and control room of mixed native-exotic pasture will be managed as an Asset Protection Zone (APZ) to maintain low fuel levels. The APZ is based on topography, vegetation and structural vulnerability, and is consistent with the minimum specifications for grasslands contained in the Planning for Bushfire Protection guidelines issued by the NSW Rural Fire Service (2001).

Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.

**Lightning strikes**

Lightning rods are installed in turbines to ground lightning strikes and minimise damage and fire risks to the turbines. The presence of lightning rods on the turbines would in fact reduce the general risk of wildfire at the site caused by lightning strikes. Relatively minor damage to turbines is expected from lightning strike. At Crookwell, east of the site, a direct strike resulted in damage to one of the turbine blades, which was able to be repaired onsite. No fires were ignited. The risk of fires being caused by lightning strikes to turbines is remote.

**Impacts on fire-fighting operations**

The turbines have the potential to present a hazard to firefighting helicopters and planes. Given the absence of large waterbodies, these aircraft are unlikely to fly close to the turbines to obtain water for firefighting.

RFS and Council would be consulted regarding safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, and also in the event of an external wildfire threatening the wind farm. The wind farm could be shut down in the event of a fire situation.

Wind farms have been found to influence temperature and wind speed around turbines and have the potential to influence bushfire behaviour. A distance of up to 1.25km (SEDA 2002) around each wind turbine is likely to experience warmer night temperatures and faster wind speeds on average, although this attenuates rapidly with distance from the turbine. While the amount of increase is small (approximately 0.7$^{o}$C increase and approximately 0.6 metres/second increase at ground level; Baidya, *et al.* 2004) these factors may enhance bushfire conditions, slightly increasing the intensity or rate of spread of a bushfire at the site.

Given the already low fire hazard at the site, this minor increase in fire intensity is not considered likely to create problems in terms of the rate of spread or controllability of wildfires.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Prevention** | The Rural Fire Service will be consulted in regard to the adequacy of bushfire prevention measures to be implemented on site during construction, operation and decommissioning. These measures will in particular cover hot-work procedures, asset protection zones, and safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, or in the event of an external wildfire threatening the wind farm. |
| | Flammable materials and ignition sources brought onto the site, such as fuels, will be handled and stored as per manufacturer's instructions. |
| **Preparation, protection, and suppression** | Appropriate fire fighting equipment will be held on site when the fire danger is very high to extreme, and a minimum of one person on site will be trained in its use. |
| | The substation facility will be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facility will be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). |
| | The substation will be surrounded by a gravelled and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation area will also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. |
| | Asset protection zones, based on RFS advice, will be maintained around the control room, sub-station and in electricity transmission easements. Workplace health and safety protocols will be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities. |
| | Shut down of turbines will commence following notification of a bushfire event in the locality, in extreme fire conditions and if components reach critical temperatures. |
| | Water and fire extinguishers will be stored onsite in the control building. |

## 7.3.9. Traffic and transport impacts

The Traffic Impact Report was prepared by Bega Duo Designs in January 2005 to conform to the Guide to Traffic Generating Developments, as recommended by the NSW Roads and Traffic Authority. The report provides a preliminary technical appraisal of the traffic and safety implications arising from the proposed wind farm and recommends measures for minimising traffic impacts. The full assessment report is included as Attachment 12, and key findings are summarised below.

### EXISTING TRAFFIC CONDITIONS

An assessment of the physical constraints, traffic volumes and safety issues was undertaken in December 2005-January 2006. The route to the proposal site from Yass via the Hume Highway and Paynes Road, Burrinjuck Road, Sutton Grange Road and Black Range Road were examined.

#### Hume Highway

The Hume Highway is dual carriageway with two lanes in each direction and a design travel speed of 110 km/h. The Hume Highway in the Conroys Gap Area has an average annual daily traffic count of 12,900 vehicles per day (2003 RTA counter). This equates to 1935 vehicles per hour in the peak hour (two directions).

The lanes are separated by a vegetated median approximately 20 metres wide. Auxiliary lanes are provided at the Paynes Road junction. Safe intersection sight distances for 110 kilometres per hour are available from all legs of the junction. The approach from the northwest is a long descending grade from Conroys Gap. The sight distance for vehicles departing from Paynes Road is restricted to the northwest by an overhanging tree.

### Paynes Road

A bitumen sealed road 6.0 metres wide connects the Hume Highway Junction to the cattle grid at the entry to the Quarry. The responsibility for the road as far as the quarry is determined by an agreement between the quarry owners and Yass Valley Council. The number of trucks to and from the quarry is irregular depending on the length of haul and size of the construction project. The quarry manager estimates the range to be between four and twenty trucks per day. The length of the sealed section is 1.32 kilometres. The surface of the bitumen road is deformed at several locations causing the bitumen to crack and potholes to form.

From the cattle grid at the end of seal Paynes road has a gravel surface of 4 to 5 metres in width which reduces in width and condition as it approaches the cattle grid at 'Linbrook'. The total length of the road to the stock grid at 'Linbrook' is 3.88 kilometres (1.32 km sealed, 2.56 km gravel).

The gravel section has a depth of pavement in some locations whilst the remainder of the road appears to be formed on the natural surface. This surface appears to be sound in dry conditions.

The largest culvert at 2.6 kilometres from the Hume Highway is a corrugated metal structure which has been damaged by corrosion in the invert and may have insufficient earth cover to resist heavy loads. There are two barrels of 1500mm and 900mm diameter forming the culvert.

The road reserve is not fenced and is provided with five stock grids between the Hume Highway and 'Linbrook'. Most of the grids appear to be in good condition but may not be designed for heavy loads.

### Black Range Road

Black Range Road intersects with Yass Valley Way approximately 2 kilometres west of Yass. Black Range Road provides access to properties along the route from Yass and very few vehicles travel beyond 18km from the Yass Valley Way junction as the remaining properties gain access from Burrinjuck Road.

Black Range Road is sealed from Yass for a distance of approximately 6.0 kilometres with another sealed section between 8.4 kilometres and 11.9 kilometres from Yass. The remaining 8.6 kilometres is a gravel surface of varying standard. The alignment and grading would be in the range of 40 to 60 kilometres per hour design speed. There are three narrow bridges on the 18 kilometre section from Yass to the entrance to 'Ferndale'. The standard of road provided reflects the number of property owners requiring access and the road deteriorates to a 20 kilometre per hour standard beyond 18 kilometres from Yass.

Observations on Black Range Road near the proposed wind farm location showed that no traffic used the route over a two hour period on 31 December 2005. Observations on Black Range Road near the proposed wind farm location showed that no traffic used the route over a two hour period on 31 December 2005. In general, traffic in the vicinity of the wind farm is expected to be light.

#### IMPACT ASSESSMENT

Traffic safety impacts encompass collision risk, traffic noise, shadow flicker, collision risk during fog, driver distraction, obstruction by long loads, wet weather, road surface deterioration and structural failure of bridges and culverts. These impacts have been addressed for the key roads accessing the proposal site.

It is proposed that the wind farm will operate unattended, with maintenance by a small crew operating an average of 2-3 days per week. Traffic generation therefore will be at the maximum during construction and ongoing generation from maintenance operations is considered to be negligible.

The maximum volume is expected during the concrete pouring phase. Each footing may contain up to 250 cubic metres of concrete to be poured over an eight hour period. This results in a rate of up to 12 mixer truck movements per hour (to and from the site). It is probable that a concrete batching plant will be located on or near the construction site (refer Section 3.4.1 and Figure 3.11). The project batching plant does not however form part of the current proposal. Concrete mixer trucks would access the works site via Paynes Road if a project batching plant is established at the Bogo Quarry (off Paynes Road) or a commercial batching plant in Yass.

Other major construction activities which would generate traffic include civil works for upgrading of access roads and establishment of site office, civil works for construction of internal tracks, excavation for footings and trenching for cables, establishment and operation of a concrete batching plant and pouring of footings, transportation to site and installation of wind turbines, construction of substation, lines, cables and facilities building, restoration of site and completion of on site buildings.

### Design vehicle and estimated traffic volumes

The design vehicle for the construction of intersections and design of parking and turning areas generally will be the "Austroads" Single Unit Truck/Bus 12.2m long. Provision will be made on site at an area for the turning of semi trailers.

As most of the work will be carried out by specialised crews consisting of less than 10 workers it is assumed that the maximum volume of vehicles entering the proposed development will be 10 vehicles per hour from any direction during the peak hour. During the concrete pouring phase an additional 12 concrete trucks movements per hour can be included.

Turbine blades up to 46 metres long would be transported on purpose designed steerable trailers making 24 trips to the site. These vehicles will be capable of negotiating small radius curves provided that areas free of obstructions are available on the inside of curves. Tower sections would measure up to 30 metres long and weigh up to 36 tonnes (estimated as approximately 80 trips to transport all turbines). The remaining wind tower components are up to 10 metres long weighing up to 75 tonnes. These loads would be transported as platform loads with trailers up to 4.2 metres wide to spread the load (estimated as 40 trips). The total volume of traffic in each weight category during the construction phase has been estimated in Table 7.8 below. Note that some of these activities may overlap.

It is assumed that most of the heavy and oversized deliveries will take place over eight weeks, at a rate of 4 vehicles per day. Design of access roads and junctions will need to allow for widths of up to 4.2 metres and weights complying with Roads and Traffic Authority maximum loading.

**Table 7-8 Total predicted traffic movements on roads to the site (one-way movements)**

| Activities | Number of traffic movements (one way) | | | |
|---|---|---|---|---|
| | **Approximate time period (weeks)** | **Light vehicles** | **Heavy vehicles** | **Oversize and overweight vehicles** |
| Civil works including trenching for cables | 6 | 600 | 800 | |
| Establish batch plant (if required) and pour footings | 4 | 400 | 550 | |
| Installation of turbines | 4 | 400 | 200 | 230 |
| Construction of substation, cables and facilities building | 8 | 800 | 300 | 2 |
| Restoration of site and completion of buildings | 6 | 300 | 200 | |
| **Totals** | | **2500** | **2050** | **232** |

### Traffic Circulation and Parking

Level areas will be provided around the site of each turbine for the safe operation of large cranes. These areas will provide turning opportunities for delivery vehicles. Four wheel drive vehicles will be able to access the main ridgeline via the internal access roads.

### Traffic impacts at key locations

### Hume Highway

The wind-towers are sufficient distance from the Hume Highway (2 to 3 kilometres minimum) to ensure that motorists are not distracted by the construction activities or subject to 'shadow flicker'. Shadow flicker is considered to have an impact up to 500 metres diminishing towards 1000 metres from the wind tower site. The junction with Paynes Road is constructed to a standard which is considered to be sufficient for an increase of traffic of up to 20 vehicles per day.

The manoeuvring of long wide loads will introduce additional high-speed manoeuvres by motorists on the Hume Highway. An increase in the number of potential vehicle conflicts will have an impact on the safety of a junction generally. In fog conditions on the Hume Highway safe travel speeds are often exceeded and the potential impacts of additional vehicle movements are multiplied.

### Paynes Road

Because of the potentially large increase in the number of vehicles using this route there are many impacts to be considered. The volumes are likely to increase from several vehicles to over 100 per day during concrete pouring operations. There are currently no speed restrictions and additional traffic may increase speed-related collision risks. The low standard of horizontal and vertical alignment will assist in controlling speed on many sections of the road thereby reducing the severity of any collisions. The larger vehicles will occupy the full width of the roadway beyond the quarry gate increasing the chance of 'head on' collisions. The road reserve is not fenced and an increase in traffic will increase the chance of collisions with stock. There will be an increase in traffic noise and dust nuisance for property owners.

After the Bogo Quarry, the road does not lead to any properties other than the involved property "Linbrook" and the "Bogo" property. Accordingly, the majority of traffic on the road will be linked to the development of the wind farm. Appropriate traffic procedures will be confirmed with all construction staff, in liaison with the owners of "Linbrook" and "Bogo". The failing pavement sections on the sealed length will rapidly deteriorate under heavy loads.

The gravel road surface may deteriorate and potholes may form under the increased traffic loads particularly during wet weather when water ponds in drains and potholes. Structural damage may occur to some of the culverts and the stock grids. The location of trees and other roadside objects have the potential of obstructing the passage of long wide loads. Lack of roadside delineation may impact traffic safety during periods of poor visibility.

### Black Range Road

Black Range Road is a historic route with many deficiencies in alignment and grading which would impact on traffic safety if volumes were to increase significantly. Some smaller vehicle traffic may use the Black Range Road route from Yass, particularly to access the turbine sites to the south. A significant increase in traffic is possible during the construction period, exposing the relatively low number of existing road users to a much greater risk of collision.

Shadow flicker may have an impact on traffic safety. Information from the Danish Wind Industry Association suggests that this effect diminishes beyond 500 metres from the wind tower site and is not noticed beyond 1000 metres. The effect is only present when the sun is directly behind the wind turbines. At some points on the road, southbound users within 1000 metres of turbines may be exposed to shadow flicker for brief periods during the late afternoon. The flicker effect will be reduced by roadside vegetation and other obstructions.

## Conclusion

The Traffic Impact Study concludes that the adoption of the recommended measures for minimising traffic impacts outlined in the report (see below) should reduce the risk of traffic accidents to an acceptable level and minimise structural and environmental damage.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **General** | The traffic impacts outlined in the Traffic Impact Study will be discussed with Yass Valley Council and the Roads and Traffic Authority. |
| | Traffic Control Plans and Oversize Vehicle Permits will be prepared and submitted to the Roads and Traffic Authority for all the operations of over size and over weight vehicles on all the public roads involved in the transport of materials to the site. |
| | A procedure will be established to monitor the traffic impacts during construction, such as noise, dust nuisance and travel times and work methods modified to reduce the impacts. |
| | Regular scheduled maintenance of gravel pavements such as grading, dust suppression and drainage control will take place during the construction period. |
| | Traffic impacts will be reduced by the scheduling of high impact movements to account for varying traffic flows on the Hume Highway. These movements if possible should be scheduled for periods when heavy fogs are unlikely. |
| **Hume Highway** | The roadside vegetation will be cleared on the verge of the Hume Highway on the southbound carriageway northeast of Paynes Road to increase the intersection sight distance. |
| | The Roads and Traffic Authority are generally not in favour of speed restrictions on the Hume Highway because of the loss in efficiency of the route. Any use of speed controls for specific short-term activities will be included in a Traffic Control Plan. |
| **Paynes Road** | The pavement, drainage structures and stock grids on Paynes Road require inspection and probable upgrading. The existing narrow pavement requires widening at specific locations to permit opposing traffic to pass safely. |
| | A speed limit will be placed on the Paynes Road at least for the period of construction. The speed restriction will be included in the traffic management plans to be submitted to the Yass Council. |
| | The clearances to objects on the inside of curves will be checked to ensure the safe passage of long loads up to 46 metres (turbine blades). |
| **Black Range Road** | A traffic management plan will be required for the intersection of the construction track with Black Range Road to ensure the safe crossing of construction vehicles. |
| | A procedure will be established to ensure that all construction and related traffic are aware of the preferred site access route via the Hume Hwy and Paynes Rd. |
| | The effects of 'shadow flicker' will be monitored from Black Range Road to determine the degree of impact on southbound motorists. |

## 7.3.10. Aviation impacts

### EXISTING ENVIRONMENT

The nearest airfield providing instrument landings is Canberra airport, approximately 70km south east of the site. Yass airfield is approximately 20km ENE of the site, but is not classified for instrument landings. Minor private airstrips are also present in the district. In addition to recreational and commercial flights, aircraft may pass over the study area during agricultural operations such as aerial spraying, or during electricity line inspections.

### IMPACT ASSESSMENT

The development of Conroys Gap wind farm would involve the construction of 15 wind turbines that each have a height of up to 126 metres to the blade tip. Due to the height of the structures, the potential implications for aviation safety have been examined. The potential for aircraft hazard would occur only during the operational phase only of the wind farm. Potential aviation impacts that have been assessed for the proposed project include:

- proximity of the proposed wind farm to landing fields,
- potential intrusion into air traffic zones and regulatory requirements, and
- potential effects on activities such as aerial spraying of agricultural areas.

The potential for the wind farm to interfere with telecommunications and aircraft navigation is assessed in section 7.3.7.

**Proximity of the proposed wind farm to landing fields**

Landing fields may be classified according to whether instrument landings are available. The nearest airfield providing instrument landings is Canberra airport, approximately 70km south east of the site. Yass airfield is approximately 20km ENE of the site, but is not classified for instrument landings.

Obstacle Limitation Surfaces (OLS) are conceptual surfaces associated with a runway, which identify the lower limits of the aerodrome airspace. Above these limits, features can become obstacles to aircraft operations and must be reported to CASA.

The operator of a certified aerodrome must monitor the airspace around the aerodrome to ensure that buildings and structures do not infringe the OLS. The Conroys Gap site and wind turbines would be well beyond and below the OLS for Canberra airfield. The proposed structures are not expected to represent hazards or obstructions to this airfield. The Yass airfield will have an OLS of lesser extent than those with instrument landings and is therefore also unlikely to be affected by the development.

The minor, private airstrips in the local area rely on visual rather than instrument based landings and as the turbines are clearly visible structures it is unlikely that the development would pose any additional hazard to the users of these airstrips.

**Potential intrusion into air traffic zones and regulatory requirements**

Under Civil Air Safety Regulations any person who proposes to construct a structure 110m or more above ground level must inform CASA of that intention and the proposed height and location of the structure. The proponent has advised CASA of the Conroys Gap proposal. Taurus Energy is currently in consultation with CASA regarding their requirements for the marking of turbines at the site.

The turbines will have aircraft warning lighting which would comprise a red flashing beacon on the top of the nacelle to meet the requirements of the Civil Aviation Safety Authority (CASA). CASA draft guidelines for aviation warning lighting for a group of wind turbines require that sufficient wind turbines should have red obstacle beacons to indicate the extent of the group. The interval between beacons should not exceed 900m. Accordingly, we expect that 4 to 5 turbines in the proposed project would require aircraft warning beacons.

**Potential effects on activities such as aerial spraying of agricultural areas**

The wind turbine structures are not considered to be safety hazards to aerial agriculture operations as the structures are clearly visible and pilots can easily avoid them. However, they may limit the areas of paddock that can be treated using aerial methods. The ridge top and immediate slopes of the site would not be able to be treated using aerial based methods after the installation of the turbines, an area of approximately 7km x 3km (210ha). This land is owned by involved landowners who would be compensated by way of lease agreements entered into with the proponent. The Australia Aerial Agriculture Association has been notified of the proposal and invited to comment. No response has been received at the time of writing.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| **Intrusion into air traffic zones** | Taurus Energy will ensure aircraft warning lighting is provided that meets CASA's requirements. |
| | Taurus Energy will provide the location and height of each tower to CASA and the RAAF once constructed for inclusion in relevant databases, maps and charts. |
| **Aerial agricultural spraying** | Taurus Energy will provide the location and height of each tower to the Australian Aerial Agriculture Association. |
| | Taurus Energy will liaise with landowners whose properties would not be able to be treated using aerial methods. |

## 7.3.11. Archaeology and cultural heritage

### Aboriginal heritage

An Aboriginal archaeological assessment of the study area was undertaken by NSW Archaeology, in consultation with the Buru Ngunawal Aboriginal Corporation and the Onerwal Local Aboriginal Land Council. The findings and conclusions of this assessment are summarised below. The assessment report is at Attachment 9.

#### EXISTING ENVIRONMENT

The high relief ridges of the proposal area are subject to strong winds, are flanked by steep slopes and are distant from resources such as water. Generally, such landforms are known to be of low archaeological potential. The area would have been used for low levels of occupation during hunting and gathering forays away from base camps located near reliable water sources. The skeletal soils of the ridgetops are not likely to contain subsurface artefact deposits. The proposal area is assessed to be of low archaeological potential and sensitivity.

Fieldwork was undertaken in November 2005. Nine locales containing a total of 22 stone artefacts were recorded. All locales and the associated survey units contain low density artefact distributions. The survey results are assessed to be in accordance with the predictive model of site location relevant to the proposal area. The proposal area is assessed as being of low archaeological potential and sensitivity. No further archaeological assessment is required in relation to the project.

#### IMPACT ASSESSMENT

The proposal would result in ground disturbance to a small area of the 370 hectare proposal site. Impacts can be considered minor in nature. The removal of the eastern ridge from the proposal (refer Figure 7.1) would mean that four of the locales would not be impacted by the proposal. It is likely that some of the remaining five locales would be avoided during the construction of the wind farm. The proposal would therefore result in a low level of impact to the archaeological resource in the proposal area.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Mitigation measures |
|---|---|
| **Construction phase** | The proponent will give due consideration to the discussion in regard to management and mitigation of Aboriginal artefact locales and Survey Units as outlined in the attached Aboriginal Archaeological Assessment, Section 11. |
| | The four locales containing Aboriginal stone artefacts recorded in the proposal area do not surpass any scientific significance thresholds which will act to preclude impacts which may ensue as a result of the construction of the proposed wind farm. Accordingly, if impacts to any of the four stone artefact locales recorded in the proposal area are proposed unmitigated impacts are justified. |
| | Copies of the archaeological assessment report will be forwarded to Dr Phil Boot (DEC, Queanbeyan), the Buru Ngunawal Aboriginal Corporation and the Onerwal Local Aboriginal Land Council. |

## Non-indigenous heritage

### EXISTING ENVIRONMENT

Hamilton Hume was the first non-indigenous person to explore the Yass Plains in 1821, returning in 1824 with William Hovell. Following Hume and Hovell's expedition, other settlers followed bringing flocks of sheep, which initiated local wool industry (Yass Valley Council 2005). By 1835, Yass had developed as a small village on the south bank of the Yass River.

The region has strong links to its agricultural and settlement history. Tourism in the area is largely based on the region's historic land use and settlement patterns (tourist drives, farm stays, bed and breakfasts, agricultural festivals and shows, tours of historic buildings, museums and memorials). Yass in particular is noted for its historic buildings.

The Yass Valley Local Government Area contains 309 places of known heritage value, including 117 places listed on heritage registers (ACT Government 2004), including 8 places listed in the Register of the National Estate under cultural criteria and 10 places on the State Heritage Register, 16 places on State agency s.170 registers, 39 places listed in the LEP and 49 places listed by the National Trust.

The Commonwealth Protected Matters search tool (http://www.deh.gov.au/erin/ert/epbc/) indicates that no World Heritage properties are located within 30 kilometres of the proposal area. Four National Estate properties listed under non-indigenous cultural criteria are located within 30 kilometres of the proposal area; Cooma Cottage (landscape)(south of Yass), Cooma Cottage buildings and surrounds (south of Yass), Reedy Creek Homestead and Vale View Homestead (Old Hume Highway, Berremangra, east of Jugiong), buildings and landscape (Murrumbateman).

The NSW Heritage Council maintains a State Heritage Register for natural and cultural items which meet at least one of seven criteria, covering historical importance, association with significant people, aesthetics and technical achievement, special associations with community or cultural groups, importance to research, uncommon rare or endangered characteristics or importance in demonstrating a particular class of places or environments. These heritage items, and other items of local or regional significance may be listed by Councils in Local Environmental Plan.

Heritage places listed or proposed for listing in local or state heritage registers (including the Yass Valley Council draft LEP) include buildings and places in and around Bookham, Bowning and Burrinjuck (ACT Government 2004). These items are listed in Attachment 10.

### IMPACT ASSESSMENT

Heritage and cultural landscape issues have been a central concern of communities when considering wind farm applications in the past (NSW Heritage Council 2003). The NSW Heritage Council (2003) has provided specific advice on the potential impacts of wind farms on heritage items. The Heritage Council supports renewable energy development, but recognises that poorly planned wind farm developments can adversely affect heritage items and cultural landscapes. An adverse impact is one that leads to the loss of heritage value.

The Heritage Council encourages strategic approaches to renewable energy planning, development and management to eliminate or minimise adverse affects. A heritage item needs to be considered in the context of the history and historical geography of the area surrounding it. When identifying the heritage items of a given area, a purely visual approach is inadequate. It is important to understand the underlying historical influences which have shaped and continue to shape the area (Heritage Office and DUAP 1996).

The Heritage Council recommends that proponents review the Local Environment Plan and State Heritage Register to identify any listed heritage items within the vicinity of the proposed development. If the proposed wind development is sited in the vicinity of heritage items or potential heritage items, the proponent should contact the heritage consent authority (NSW Heritage Office, or local government) early in the process. Proponents should also consider heritage items which have potential for listing which could be affected by the proposal.

Heritage items on state and/or local heritage registers in the vicinity of the Conroys Gap site are listed in Attachment 10 (from ACT Government 2004).

Heavy vehicles used during the construction phase would access the site via the Hume Highway, and would not pass through the main street of Yass or close to built heritage items.

The wind turbines proposed for Conroys Gap would affect the visual landscape for up to 15 kilometres, beyond which they are difficult to perceive.

The proposal is unlikely to be significantly visible from National Estate heritage places or from their near approach routes. These places are located more than 15 kilometres from the subject site.

Depending on topography, vegetation and other obstructions, the proposal may be visible from some of the heritage places gazetted under the LEP (ACT Government 2004), particularly places located to the north, near Bookham (8 kilometres from the site) and Bowning (9 kilometres from the site). However, given the extensively modified agricultural landscape, with obvious modern features such as the Hume Highway close to the Bowning and Bookham heritage sites, the visual impacts of the wind farm are not expected to detract from the heritage values or experiences currently available at the sites. Site-specific heritage impacts caused by the visibility of the wind turbines could be mitigated using landscaping or vegetation screening.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Operational phase: visual impact | The proponent will make funds available for vegetation screening in cases where the wind farm is visible from heritage items and detracts from heritage values or visitor experience. |

## 7.4. Removal of infrastructure

The expected life of the wind turbines are 20-30 years. At the end of this period, the turbines may be removed or replaced during a potential recommissioning phase. Therefore, the timing of turbine removal cannot be predicted at this stage.

#### IMPACT ASSESSMENT

Failure to remove the wind farm infrastructure at the end of the life of the whole facility or individual turbines would create potential safety and pollution hazards and impose costs on landholders or government. Failure to adequately rehabilitate the site would create ongoing losses in terms of agricultural production and potentially ongoing site degradation.

As part of the project EMP, the wind turbines, substation, control building, and the associated above ground electricity infrastructure would be removed and the site restored once the wind farm is decommissioned. The value of the wind turbines in scrap metal is considered by the proponent to be adequate to pay for their removal and site rehabilitation.

**IMPACT AVOIDANCE AND MITIGATION**

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Ensuring safe, timely and effective infrastructure removal and site rehabilitation at the end of the operational life of the wind farm | Individual wind turbines not used to generate electricity for a continuous period of 12 months will be removed unless extenuating circumstances apply. |
| | Prior to construction, written evidence will be provided to the Director General, that the lease agreement(s) with the site landowners have adequate provisions to meet the decommissioning requirements, that the site be restored to a similar condition as existed before the development. |

## 7.5. Cumulative impacts

There is considerable electrical infrastructure present in the locality, including major transmission lines and the electrical substation and power line infrastructure south of Yass. The construction of a substation and a single pole powerline is not considered likely to significantly add to the impacts of existing electrical infrastructure.

The construction of the wind turbines would introduce a new and distinctive suite of impacts on the biological, visual and acoustic environment. The general range of influence for visual values for wind turbines extends over a radius of 15 kilometres (Scenic Landscape Architecture 2005). For noise, impacts are confined to a radius of 2 kilometres, beyond which noise from the turbines attenuates to below background levels. Biological impacts can be more far-reaching, because of the mobility of migratory, nomadic and territorial fauna species such as bats and birds.

The cumulative impacts on local climate, water and soils, telecommunications reception and roads are not considered to be significant; these impacts are addressed in sections 8.1 and 7.3.

The cumulative impacts of the proposal relate to an accumulation of similar and dissimilar impacts, from other wind farm developments and from other sources of environmental impact. The negative cumulative impacts of wind farms on these inter-related themes are addressed below.

**1. THE CUMULATIVE IMPACTS OF A NUMBER OF WIND FARMS ON THE BIODIVERSITY, VISUAL AND ACOUSTIC ENVIRONMENT**

A range of environmental attributes combine to make the Southern Tablelands a preferred location for wind farm development. Hence, there are a number of wind farms operating, approved for construction or proposed in the region (refer Table 7.8). There also exists strong potential for further wind farm proposals in the region.

The locations of other proposed and operating wind farms in the region are shown on Figure 7.18 and described in Table 7.8. Most of the existing operations or proposals are reasonably distant from the Conroys Gap site. The Conroys Gap wind farm proposal is the first for the locality west of Yass. The closest wind farm proposal in an easterly direction is located near Gunning, around 55 kilometres from the Conroys Gap site. To the south-east, a wind farm is also proposed for the Murrumbateman area, approximately 35 kilometres from the Conroys Gap site.

### Visual impacts

There is unlikely to be a cumulative visual impact from other wind farms because of the distance between the proposal site and other existing, approved or proposed wind farms (Scenic Landscape Architecture 2006, Attachment 8).

Both the Conroys Gap and (possibly) the Gunning/Cullerin developments would be visible to Hume Highway traffic. However, the separation between the sites (at least 30 minutes travel time) should be sufficient to avoid any substantial accumulation of intrusions on the visual environment for road users. The proposed Murrumbateman wind farm would be visible from the Barton Highway, which connects with the Hume Highway at Yass. The distance between Murrumbateman and Conroys Gap following these highways is around 40 kilometres, giving a travel time of at least 25 minutes. Again, this separation is considered sufficient to avoid any impression of accumulated visual intrusion for road users.

### Acoustic impacts

The Conroys Gap proposal is located well outside the noise impact zone of other wind farm developments. There would be no accumulation of noise from a number of wind farms.

### Biodiversity impacts

The operational and proposed wind farm localities in the district may involve overlapping raptor territories and bird and bat migration routes.

Based on habitat in the local area and elsewhere in the district, and known bat and bird movements, the Conroys Gap site is not likely to be located on a major migratory route. Visits from migratory or nomadic species are expected to be infrequent and sporadic. The wind farm is not likely to significantly add to risks to these species.

Other wind farms in the region are located well outside local raptor breeding territories and foraging ranges. The impacts of the Conroys Gap wind farm on raptors are addressed in the Biodiversity Assessment (Attachment 6). Continuing losses of some raptor species with low reproductive rates (such as Wedge-tailed Eagles) could represent a ‘mortality sink’ which has the potential to affect region-level populations. The Conroys Gap site does not provide nesting habitat, but does provide foraging resources for a range of raptor species. Mortalities are possible, but, given the low rate of bladestrike recorded at other Australian wind farms, are not expected to affect local or regional populations by outstripping the reproductive capacity of any species. For this reason, the proposal is not expected to significantly add to the collective impacts of wind farms in the region. The ongoing monitoring and assessment of the operational impacts of wind farms operating in the region should however be consistent, centrally analysed and published to ensure cumulative impacts remain within acceptable limits.

**Table 7-9 Existing and proposed wind farms on/near the Southern Tablelands**

| Proponent | Location | No. turbines | Distance from Conroys Gap |
|---|---|---|---|
| **PROPOSED** | | | |
| Taurus Energy | Evandale near Goulburn | up to 15 | 75 km |
| Taurus Energy | Cullerin near Goulburn | 15 | 60 km |
| ACTEW | Spring Range, Murrumbateman | 10-15 | 35 km |
| Marubeni Power | Bannister/Gurrundah/Kialla | unknown | 70 km |
| EHN (Oceania) | Molonglo Range, near Queanbeyan | Up to 60 | 70 km |
| **APPROVED** | | | |
| RES Southern Cross | Taralga | 50 | 110 km |
| Gamesa Energy Australia | Crookwell II, near Goulburn | 50 | 80 km |
| Delta Electricity | Gunning | 32 | 55 km |
| Woodlawn Wind Energy JV | ‘Woodlawn’, near Tarago | 25 | 80 km |
| **OPERATING** | | | |
| Eraring Energy | Crookwell I | 8 | 80 km |
| Eraring Energy | Blayney | 15 | 150 km |

Sources: Company websites, media releases and published Environmental Impact Statements

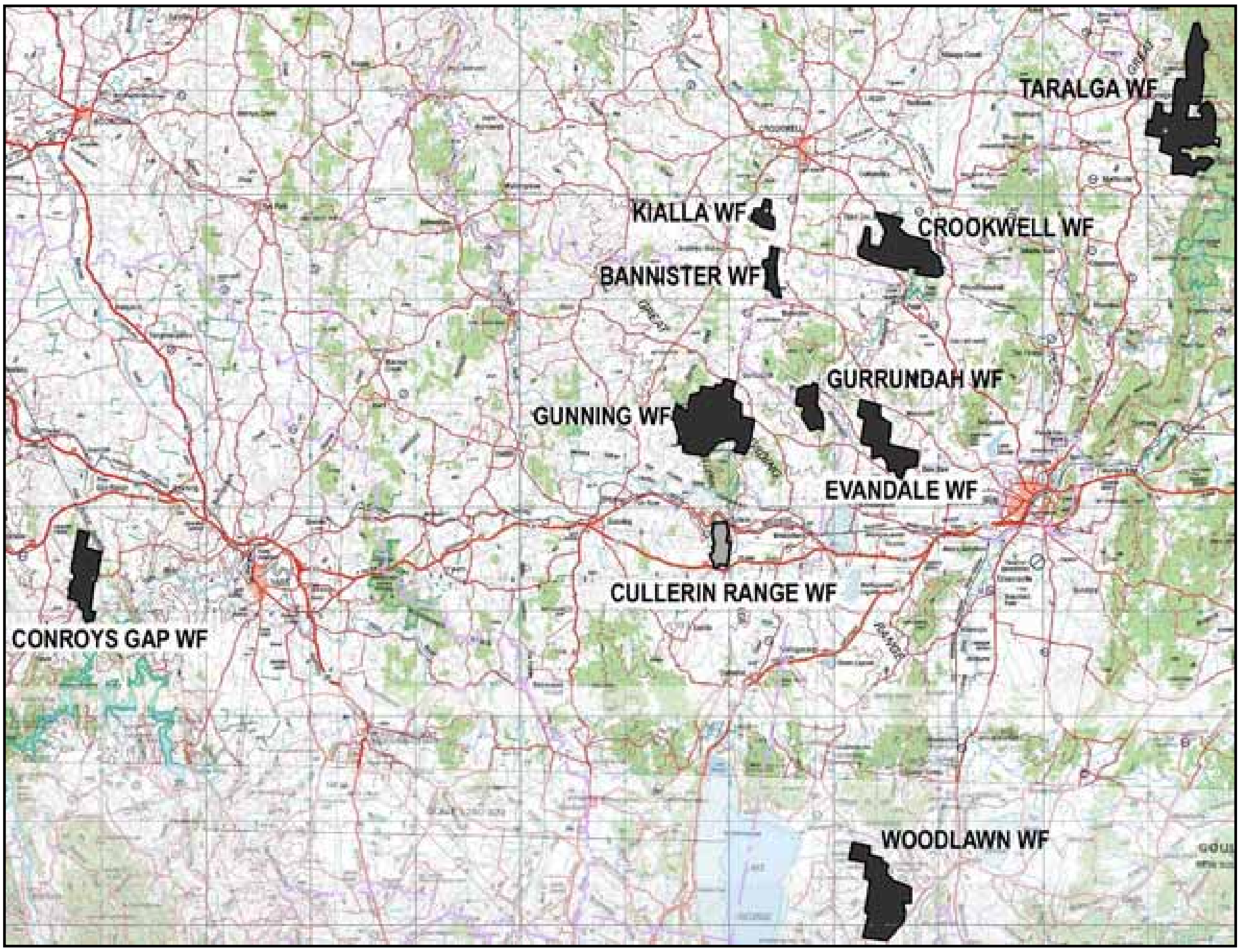



**Figure 7.15 Location of other proposed and operating wind farms in the region**

### 2. THE CUMULATIVE IMPACT OF THE WIND FARM AND OTHER DEVELOPMENTS AND DISTURBANCES ON THE LOCAL BIODIVERSITY, VISUAL AND ACOUSTIC ENVIRONMENT

The wind farm impacts may combine with impacts from other developments and sources to produce cumulative visual, acoustic and biodiversity impacts.

Existing developments and sources in the Conroys Gap locality which may contribute to these cumulative impacts include farm sources, powerlines, roads and a gravel quarry.

The agricultural landscape is highly modified, with few areas carrying natural woodland or forest cover. Farm structures such as houses, sheds, fences, yards and service infrastructure are intrinsic elements of the local rural environment. The combination of the wind farm infrastructure with other structural developments is not likely to be a significant factor in terms of the visual impact of the wind farm.

Within two kilometres of the wind farm turbines, the noise emitted by the turbines would combine with emissions from the gravel quarry located between the northern turbine sites and the Hume Highway. The Highway would also produce intermittent noise that would combine with the turbine emissions. Operational noise impacts have been characterised by contour modelling, summarised in Section 7.3. These levels and the conclusions arising from the assessment take into account the existing background levels.

The impacts of the wind farm on biodiversity values would combine with existing impacts resulting from land clearing, agricultural activities, weeds and hazards. It is important to recognise that the district has experienced extensive losses to ecosystem integrity and stability. Woodland and grassland communities in particular, which coincide with prime agricultural land, and riparian and wetland communities have been heavily simplified and destabilised. It is likely that many woodland flora and fauna species have become locally extinct, and many are in continuing decline.

There is a time lag, or 'extinction debt', operating which will mean that decline and extinction will continue for many species for decades to come, regardless of management responses. Further impacts on lowland environments are expected from soil and water salinisation, soil erosion and sedimentation, weed invasion and spread, disruption to river hydrology due to farm dam construction and water extractions and habitat fragmentation and clearing resulting from residential sub-division and building.

When the cumulative impacts of all disturbances are considered, it is clear that any significant addition to stresses experienced by lowland flora and fauna need to be avoided. The location of the proposed wind farm turbines on a disturbed ridgetop site, outside the natural distribution of lowland environments, should restrict the potential to affect declining woodland or wetland species.

The presence of the turbines and powerline would provide additional obstacles and hazards to birds and bats. Existing hazards include electricity transmission lines, and air, rail and road traffic. These hazards at this site are not known to produce significant or unusual impacts on local fauna.

The likely impacts on bird and bat species are assessed in the Biodiversity Assessment (Attachment 6). The Conroys Gap site is not expected to form part of the migration routes for wetland birds, seasonally migrating birds or microchiropteran bats. The wind farm is also not anticipated to significantly affect local raptor populations. The project therefore is considered unlikely to produce significant cumulative impacts, in combination with existing obstacles and hazards. An adaptive monitoring and management program would be implemented to ensure that any unforeseen impact on these species are detected and addressed in a timely manner.

### POSITIVE CUMULATIVE IMPACTS

#### Contributing to greenhouse-gas emission free electricity generation

The proposal would provide an additional source of greenhouse-gas emission free electricity to consumers. The installation of remote generation operations also reduces the amount of energy lost during power line transmission over long distances. This contributes to cleaner and more efficient energy production. The cumulative impact of additional wind turbines in the region is a net gain both in terms of climate and air quality when set aside energy generated by fossil fuel combustion. There area is not suitable for hydro-electricity generation and solar generation has so far not appeared to be cost-effective on a large scale.

#### Social and economic contribution

The proposal would have economic benefits to the local community. These include lease payments to landowners, employment for local contractors during the construction and decommissioning phases and increased demand for services such as accommodation, food and fuel during the construction and decommissioning phases. Additionally, the proponents would establish the Community Fund which would help to address the inequitable distribution of financial benefits. The cumulative impact of additional wind power developments or similar sized industries is a net gain in terms of the economic injection it provides to the local community.

# 8. ASSESSMENT OF LOWER PRIORITY ISSUES

## 8.1. Physical environment

### 8.1.1. Climate and air quality

**EXISTING ENVIRONMENT**

**Climate**

The proposal site is located near the boundary between the South Eastern Highland Bioregion, and the South Western Slopes Bioregion at approximately 700 metres above sea level. The weather station at Linton Hostel, Yass, at around 500 metres ASL records a highest mean daily maximum temperature of 29.3°C in January, and a lowest mean minimum 1°C in July. The mean annual rainfall is 648.5 mm, relatively evenly distributed through the year but with a slight peak in spring and a slightly reduced monthly average in summer (Bureau of Meteorology 2004). The Conroys Gap locality experiences lower rainfall than Yass (Cathy Kaveney, landholder pers. comm.).

The annual mean 3pm windspeed in Yass is 11.9 kph, peaking in December (14.8 kph) and a reduced average in June (8.6 kph). The annual mean 9am windspeed is 6.7 kph, peaking in November (9.0 kph) and a reduced average in June (4.4 kph). The mean relative humidity at 3pm ranges from 37% in December to 69% in June (Bureau of Meteorology 2004).

Climate is erratic between years (Yass Valley Council 2004). Diurnal summer conditions in the Yass district can therefore be dry and hot with high wind speeds. This has the potential to produce dusty conditions, particularly during drought when heavily grazed paddocks are prone to wind erosion.

**Air quality**

The absence of heavy industry or traffic concentrations ensures that pollutant loadings are relatively low in the study area. However, temperature inversions can occur in local valleys, particularly during winter, which trap gaseous and fine particle pollutants, such as wood smoke from domestic fireplaces, heaters and stoves and carbon monoxide and particulate matter from motor vehicles (Yass Valley Council 2005).

Smoke hazes caused by inversions are visible as drivers approach the Yass township in winter months (Yass Valley Council 2005).

**IMPACT ASSESSMENT**

**Dust and atmospheric emissions**

Dust and emissions would be generated during excavation works, road works and the transport of machinery. Dust/emission impacts would be temporary, largely restricted to the 6-9 month construction period and the decommissioning phase. Similarly, the area that would be impacted would be limited in extent (works areas indicated on Figures 3.7 – 3.12). The limited use of a light service vehicle during the operational phase is not expected to cause unacceptable dust impacts. The wind farm infrastructure would not generate emissions that would impact air quality during the operational phase.

### Local climate

Local climate may be affected to a minor degree by the increase in turbulence caused by the wind turbines, while the wind farm is operational. Modelling and experimentation on real wind turbines has shown that the mixing effect of thermal layers has very little effect on temperature during the day (Baidya *et al.* 2004). Recordings taken below wind turbines and averaged over a 24 hour period were observed to be greater than existing ground level wind speeds by approximately 0.6 metres/second and to raise temperatures by approximately 0.7$^{o}$C (Baidya, *et al.* 2004).

Wind speed impacts have been suggested as being confined to a distance from each turbine equivalent to 10 times the vertical height of the turbine (SEDA 2002). For the proposed turbines (126m from the ground to blade-tip), an effect up to 1.25km from each turbine may be expected, attenuating with distance from the turbines. The anticipated change in wind speed and temperature at the ground level is not considered large enough to impact vegetation or conflict with the continued agricultural uses of the land at the site. This impact would be ongoing but minor and is not considered to require mitigation.

### Greenhouse gases

The proposal would make a contribution to the reduction in greenhouse gas emissions by providing an alternative to electricity sourced from fossil fuels. This represents the chief environmental benefit of the proposal. Benefits to long-term climate change may be afforded by the development of non greenhouse gas emitting energy sources. The electricity supply capacity of the proposed wind farm and benefits in terms of reduced fossil fuel use and carbon dioxide emissions are quantified in section 4.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Dust: blasting | Nearby residences will be informed prior to any blasting taking place. |
| | Blasting will conform to relevant safety and noise and vibration control standards. |
| Dust: possible use of a concrete batching plant and/or rock-crushing plant | The batching plant will not be located near residences. |
| | Dust levels at stockpile sites will be visually monitored. Dust suppression (eg. water sprays) will be implemented if required. |
| | Product stockpiles will be protected from prevailing weather conditions. |
| | Loads of dry materials will be covered where appropriate. |
| | Dust filters will be installed on silos. |
| | Only machinery compliant with emission standards will be used. |
| | Machinery and vehicles will not be left running or idling when not in use. |
| Dust and emissions generated by vehicle traffic. | Should dust generation be of a high level during the transport of machinery near residences, watering of sections of the route will be undertaken to reduce dust. |
| | The works timetable including periods of potential dust generation will be given to local residents and advertised on site signage and in the local press. |
| | Vehicles and motorised equipment will be maintained so that emissions are minimised. |

## 8.1.2. Water quality and water resources

#### EXISTING ENVIRONMENT

The proposal site is situated in the Upper Murrumbidgee River catchment, on a ridge between the south-flowing Yass River sub-catchment and the north-flowing Talmo Creek/Jugiong Creek sub-catchment. There are no major watercourses at the subject site. McCullums Creek, Woolgarlo Creek and an unnamed watercourse on the 'Ferndale' property drain the southern half of the site, flowing south to Lake Burrinjuck. Stony Creek and tributary drainage lines drain the northern part of the subject site, flowing north-west to Bogolong Creek and then Jugiong Creek.

The Yass River flows into Lake Burrinjuck downstream of the proposal site. Burrinjuck Dam impounds the Murrumbidgee River and the lower sections of the Yass and Goodradigbee Rivers to provide irrigation water for the Murrumbidgee Irrigation Area. The Murrumbidgee River catchment is a major component of the Murray-Darling Basin, joining the Murray River at Balranald, with an area of 84,000 square kilometres. The Murrumbidgee catchment has a diverse range of landscapes, and significant agricultural, social and conservation values.

The Yass River system is listed as highly hydrologically stressed, with extensive catchment modification due to the construction of a large number of farm dams (Yass Valley Council 2005), sedimentation and pollutants from farmland, unsealed roads and urban stormwater, flow modification due to runoff interception with small dams and extractions and rising saline watertables due to past clearing. Approximately 75% of the Yass Valley LGA falls within unregulated subcatchments. Five of these eight unregulated subcatchments are considered to be under high hydrological stress, implying that demand for water already equals or exceed supply.

Dryland salinity and salination of waterways are major agricultural and environmental issues in the Yass Valley, particularly in areas on sedimentary geology. The Yass River regularly experiences high salinity levels, which have at times exceeded drinking water standards (Yass Valley Council 2005). Virtually all of the groundwater within the Yass Valley area has been identified as saline, with salt concentrations estimated to be between 1000 and 3000 milligrams per litre (EPA 2000 in Yass Valley Council 2005).

Developments can exacerbate soil and water salinity problems if vegetation and soils in recharge areas are extensively impacted, producing rising groundwater levels lower in the landscape. The northern part of the study area occurs on sedimentary geology and is one of the most heavily cleared areas in the district. The exposure of saline water tables has caused scalding in the local area. The proposal area is not included within the mapped current high salinity risk or forecast high risk by 2050 mapped at the broadscale by the National and Water Resources Audit for the Australian Dryland Salinity Assessment 2000.

The site access tracks would cross higher order watercourses. Drainage lines and watercourses in the district are commonly incised and actively eroding.

#### IMPACT ASSESSMENT

Impacts to water quality would primarily relate to the transport of equipment and vehicles within close proximity to drainage lines and the generation of mobile sediment and potentially pollutants, during construction. While the proposed turbine development would be largely confined to ridgelines, watercourses may be potentially impacted indirectly from run-off from the construction sites.

Measures would be implemented to control erosion and sedimentation during and following the works. Given the limited area affected by the proposal and the cleared and modified nature of the existing site, the proposal is not expected to substantially affect watertables or salinity in local soils or waterways. No further clearing of trees on ridges is expected to be required in the construction of the turbines and access roads.

Approximately 8.5 kilometres of new track would be created as part of the proposal. In addition, up to 6 kilometres of existing roads and tracks may require upgrading and widening. The increased area of hard surfaces would increase the amount and turbidity of runoff to a minor extent. While traversing these tracks, there is potential for the leakage of fuels or other hydrocarbons which could find their way in to drainage lines.

Subject to further assessment, a culvert on a drainage line on Paynes Road may require replacement (refer Attachment 12). During excavations for this work, there is potential for concentrated runoff, drainage line erosion and sedimentation in Stony Creek. Erosion and sediment controls measures would be required to avoid impacts to Stony Creek.

Any boggy areas on tracks would be crossed using formalised crossings designed to minimise soil and water disturbance. The use of bound fill for minor drainage line crossings would be an appropriate means to distribute the weight of heavy vehicles.

Dust, mobile sediment and vehicle emissions generated during transport, excavation and blasting works may also find their way into drainage lines. This could lead to elevated levels of sediment and turbidity in stormwater discharged and therefore reduce water quality. The associated increase in nutrients could lead to eutrophic conditions in still water areas. Eutrophication of downstream waters could also be caused by the use of fertiliser during revegetation.

There is a risk that construction materials such as alkaline concrete wash could escape from the construction sites. Chemicals are found in paints, acids for cleaning surfaces, cleaning solvents, concrete products, soil additives used for stabilisation and other purposes, concrete-curing compounds, fuels as well as other sources. When used or stored improperly, these chemicals can become mixed with stormwater and carried by sediment and runoff from construction sites.

Water required during the construction phase for road watering and concreting would be obtained from off-site. All extractions would be permitted under required licencing and assessment arrangements. This temporary use would not place stress on human or ecological requirements.

The potential impacts on water quality are considered manageable using a range of mitigation measures.

#### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Sedimentation and turbidity | All vehicles onsite will follow established tracks or routes. Work flow will be organised to minimise the number of vehicular movements across the site and thereby minimise soil compaction and the generation of mobile sediment. |
| | All bridges and culverts used will be assessed prior to works to ensure that they are able to bear the projected loads of the laden vehicles. |
| | Permanent and temporary road construction will employ best practice drainage and erosion/sedimentation control measures. |
| | Moderate-high use tracks will be upgraded and constructed in compliance with DNR Guidelines (DLWC 1994). |
| | Sediment traps will be installed wherever there is potential for sediment to collect and enter waterways. |
| | Excavation will only be commenced during stable, dry weather conditions, operational requirements permitting. |
| | Where possible, excavation will be excluded from wet drainage lines. |
| | On slopes check banks will be installed across the trenchline, 20-50 metres apart, following closure of the trench. These will discharge runoff to areas of stable vegetation. |
| | Stabilisation and rehabilitation of disturbed ground will be carried out as soon as practicable after works. |
| | Stockpile sites will be identified and turbid water discharged from these treated by a combination of silt fencing and temporary mulching/seeding. |
| | Prior to decommissioning, the state of creek and drainage line crossings will be inspected and upgraded where required to minimise the impact of vehicle crossings. |
| | Where required, formalised crossings using bound fill will be designed to allow vehicle access across rivers and wet drainage lines to minimise soil and water disturbance. |
| Pollution hazard: transformers, vehicles and machinery (fuels and other hydrocarbons), concrete batching, fertilisers, herbicides | Site storage areas will be identified, and be bunded to prevent loss of any pollutants. |
| | The transformer site will be securely bunded and regularly inspected and maintained. |
| | Hydrocarbon spill kits will be stored at the site. |
| | Machinery will be operated and maintained in a manner that minimises risk of hydrocarbon spill. |
| | All vehicles will remain on established roads, tracks and routes. |
| | |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| | Maintenance or re-fuelling of machinery will be carried out in hard-stand areas (ie. existing or proposed road surface or hard-stand areas beneath turbines, not on areas that either contain native vegetation, or will be revegetated). |
| | Where chemicals are utilised, their application and disposal will comply with manufacturers recommendations. |
| | Turbines and the substation will be bunded to contain a volume greater than the total volume of pollutants in the facility. |
| | The concrete batching plant, if required, will not be located near residences. Concrete wash will be deposited in an excavated area, below the level of the topsoil. |

### 8.1.3. Soil and landforms

#### EXISTING ENVIRONMENT

The proposal site occurs on steep, rounded ridgelines and valleys, at an elevation of around 700 metres ASL and a local relief of up to 220 metres. The underlying geology in the northern part of the site is metasediments with steeply dipping strata. The powerline and turbine sites south of Black Range Road occur over granitic geology.

Soil landscapes are areas of land that have recognisable, describable and mappable topography and soils (Tulau 1998). The proposal would impact on three soil landscapes, as indicated on Figure 8.3. The soil and topographic characteristics of these soil landscapes are discussed below, based on descriptions in the Goulburn 1:250,000 Soil Landscapes mapsheet (Soil Conservation Service 1991).

#### Barrenjack soil landscape (bj)

This landscape is characterised by steep hills on volcanic greywacke, slate, conglomerate, rhyolite, tuff and limestone. Local relief is 100-400 meters, slopes range from 30% to greater than 50%. The soils are shallow, stony, sandy to loamy soils on crests and side slopes with minor stony, red and yellow podzolic soils or colluvial soils on lower slopes. The land is subject to minor to moderate sheet erosion, soil creep and gullying and stream bank erosion hazard.

#### Conroys Creek soil landscape (cy)

This soil landscape unit features valleys between rolling hills formed on volcanic rocks and shales of Black Range. Soils are acidic and duplex with deep, bleached, massive A2 horizons on mid and lower slopes similar to yellow podzolic soils, lithosols and red and yellow earths on upper slopes with yellow solodic soils in drainage lines. Gullying of drainage lines is extensive. Sheet erosion is significant following dry periods. Top soils have poor water holding capacity and dry out rapidly.

In the proposal area, these soil landscapes show moderate to severe sheet erosion and stream gullying. Sheet erosion is most marked on steep slopes either side of McCullums Creek, to the immediate east of the northern turbine cluster (refer Figure 8.1). Streambed erosion is advanced in McCullums Creek, and Stony Creek to the west.

**Figure 8.1 Sheet erosion on slopes east of the northern turbines**

**Figure 8.2 Gully erosion on granitic soils east of the southern turbines**

### Burrinjuck soil landscape (bk)

This landscape occurs in the proposed powerline route through the 'Ferndale' property. It features shallow stony lithosols on crests and sideslopes, together with shallow stony yellow earths. Yellow podzolic soils and yellow solodic soils are found on an organic mat at the surface making the soils hydrophobic when dry. Rock fields are typical. The landscape has minor sheet erosion and some gullying of drainage lines, and is saline in some low lying areas.

Topography is typically undulating rises and rolling low hills with elevations 500-540m ASL. Slope is 3-15%. Local relief is 10-40 metres. Permanent erosional stream channels are closely to very widely spaced and form a non directional tributary pattern.

On the Ferndale property, granitic bedrock is exposed on a ridge face falling steeply to the west. Gully erosion is active in granitic soils in a drainage line east of the proposed southern turbine sites (Figure 8.2).

Land quality in the Yass Valley LGA has extensively declined, primarily due to clearing for agriculture (Yass Valley Council 2005). Over 80% of Yass Valley has been cleared, which has contributed to sheet and gully erosion and dryland salinity. The combination of fragile and low fertility soil types (lithosols, red podzolics and yellow podzolics) and extensive land clearing has resulted in the formation of large gullies and extensive sedimentation in creeks (Yass Valley Council 2005).

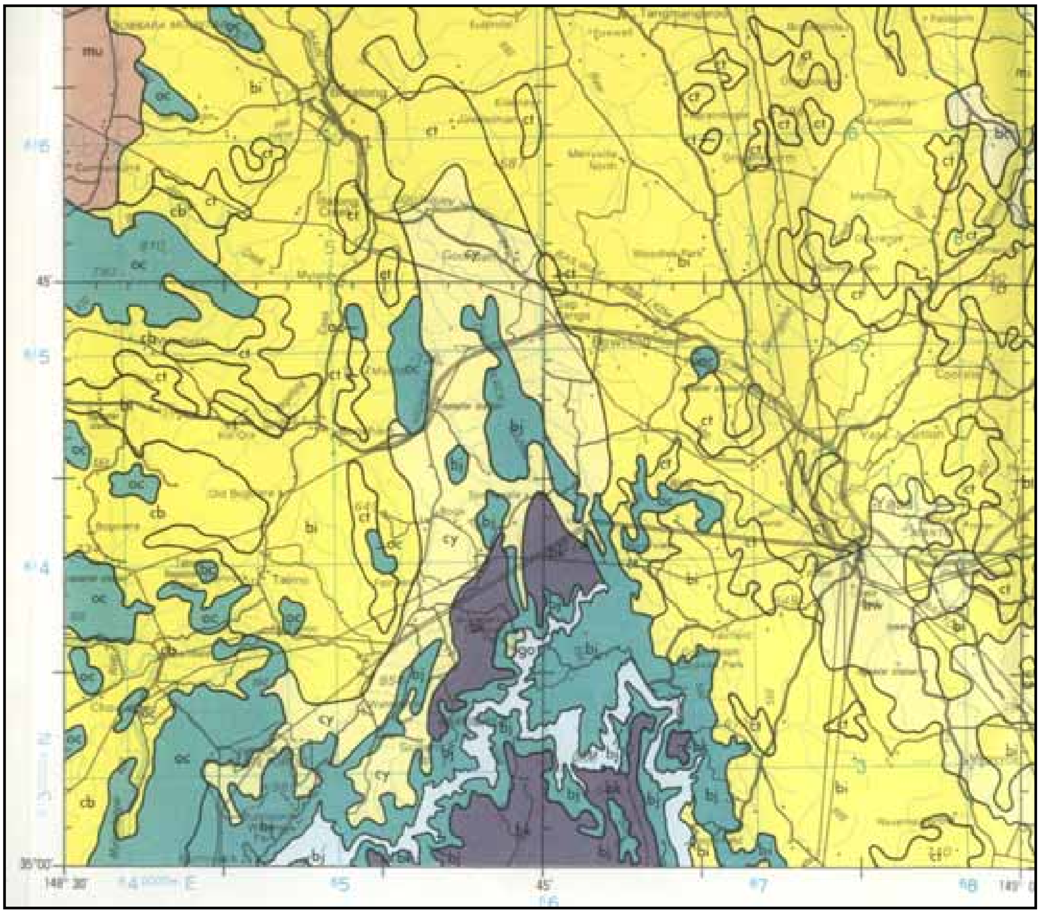



**Figure 8.2 Soil landscapes in the study area**

### IMPACT ASSESSMENT

Soil compaction and erosion could occur during excavation works, road works and the transport of machinery. Some soil compaction would occur as a consequence of the transport of heavy equipment. Compaction can reduce infiltration capability and the biotic soil binding mechanisms provided by bacteria and micro invertebrates and leave surface layers of soil more susceptible to wind and water erosion. In lower slope positions, compaction of saturated soils may cause slumping, affecting slope stability and water quality.

Impacts would be greatest during the construction and decommissioning phases. Impacts would be temporary, occurring largely during the 6-9 month construction period. The works areas are indicated on Figures 3.7-3.12. Toilet facilities would be provided at the site for staff.

Hydrocarbons would be used at the site; the contractor would implement a Spill Control Plan as part of an Erosion and Sediment Control Plan. Spill Control Plans would identify persons responsible for implementing the plan if a spill of a dangerous or hazardous waste should occur. Any spill that occurs, regardless of size or type, would be reported to the Construction Manager. The event and clean up processes would be recorded and passed to the Yass valley Council. If the spill or hazard reaches surface waters, the EPA would be notified.

While the soils at the site are prone to erosion, they are not considered to be unstable given appropriate control and rehabilitation measures. Site-specific issues include the potential to aggravate:

- existing sheet erosion on slopes beside the northern turbine ridges;
- existing streambed erosion east and west of the northern turbines; and
- existing gully erosion east of the southern turbines.

Soil erosion and sedimentation control measures will aim to avoid the concentration of runoff, and the discharge of runoff onto thinly vegetated slopes. The works will remove the minimum amount of grassy vegetation and ensure that revegetation is undertaken effectively and quickly following works at each site. Permanent flow diversion and energy dissipation structures may be required around roads and hardstand areas in sensitive areas.

Where required, formalised vehicle creek and wet drainage line crossings constructed of bound fill would be used to minimise soil and water disturbance. Particular care would be taken to ensure than runoff is not concentrated in the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines.

The impacts of the proposal are considered manageable with regard to soils and landforms. The identified impacts would be largely restricted to the construction and decommissioning phases of the proposal. Earthworks and road construction would comply with relevant guidelines including the NSW Guidelines for the planning, construction and maintenance of tracks (DLWC 1994), Urban Stormwater Management – Soils and Construction (Department of Housing 1998) and NSW Fisheries guidelines on creek crossings (NSW Fisheries 1999, 1999a).

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Hardstand establishment and stockpile sites | Landforms will be stabilised and rehabilitated as soon as practicable after works. |
| | Turbine and powerline placement will avoid impacts to mature trees, where possible. |
| Transport of heavy equipment | Tracks will be graded and drained to enhance stability. Tracks will be upgraded and constructed in compliance with DNR Guidelines (DLWC 1994). |
| | Routes will be confined to already disturbed areas, where possible. The existing Paynes Road will be upgraded to access the site from the Hume Highway for construction purposes. |
| Excavation of footings and trenches | Excavation will only be commenced during stable, dry weather conditions, operational requirements permitting. |
| | A minimum of vegetation will be removed during excavation and construction leaving as great a buffer between the ridgetop works area and steep sideslopes as practicable. |
| | Subsoil will be separated from topsoil for rehabilitation purposes. All topsoil from the excavation sites will be stockpiled and replaced to its original depth for seeding and fertilising. On steep slopes, topsoil will be stabilised using, for example, jute matting. Any excess subsoil will be removed from the site and disposed of at an appropriate fill storage site. |
| | On slopes check banks will be installed across the trenchline, 20-50 metres apart, following closure of the trench. These will discharge runoff to areas of stable vegetation. |
| | The eroding slopes east of the northern turbines, the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines will be protected from concentrated runoff. |
| Vehicle and machinery operation; pollution hazard and soil compaction | Site storage areas will be identified, and be bunded to prevent loss of any pollutants. |
| | Hydrocarbon spill kits will be stored at the site. |
| | Machinery will be operated and maintained in a manner that minimises risk of hydrocarbon spill. |

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| | Maintenance or re-fuelling of machinery will be carried out in hard-stand areas (ie. existing or proposed road surface or hard-stand areas beneath turbines, not on areas that either contain native vegetation, or will be revegetated). |
| | Where chemicals are utilised, their application and disposal will comply with manufacturers recommendations. |
| | Work flow will be organised to minimise the number of vehicular movements across the site and thereby minimise soil compaction and the generation of mobile sediment. Where possible, vehicles will be restricted to established tracks or routes. |
| | Where practicable, grass surfaces will be retained on infrequently used vehicle routes to protect soils. |
| Concrete batching plant operation; pollution hazard | Concrete wash will be deposited in an excavated area, below the level of the topsoil. |
| Transformer installation and operation; pollution hazard. | The transformer site will be securely bunded to contain any leakage of coolant. |
| Stabilisation and rehabilitation | An Erosion and Sedimentation Control Plan will be developed prior to the works, including maps of environmentally sensitive areas, parking and laydown areas, locations of environmental protection works and emergency response. The need for any permanent erosion and sedimentation control structures along roads and around hardstand areas will also be addressed. |
| | Stabilisation and revegetation of excavated areas will occur progressively following works to stabilise soil, to reduce impact on adjacent water bodies and drainage lines. |
| | The eroding slopes east of the northern turbines, the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines will be protected from concentrated runoff. |
| | Following the construction phase, track drainage will be inspected and repaired as required. Service tracks will have robust rollover drains installed (subject to vehicle access requirements), directing road runoff into vegetated areas away from watercourses. |
| | Disturbed areas will be seeded with native grasses, where appropriate. |
| | Stock will be excluded to prevent grazing and trampling in disturbed areas and areas being rehabilitated. Grazing should not occur following the rehabilitation works for 3-6 months. |
| | Soils will be mulched with chipped vegetation from the site (for areas located in woodland), fibre matting or sterile hay. |

## 8.2. Construction noise and vibration

### EXISTING ENVIRONMENT

Background acoustic conditions at and around the proposal site have been recorded by Heggies Australia Pty Ltd in its noise impact assessment (Attachment 7). Existing background noise includes periodic use of agricultural machinery, Paynes Road quarry operations and intermittent local and highway traffic noise.

The proposal site is located approximately 3.5 kilometres south of the Hume Highway, 4.5 kilometres east of the Burrinjuck Waters State Park access road and 15 kilometres north-east of the Burrinjuck Waters State Park.

Residences located around the proposal site are indicated on Figure 7.9. Other receptors include horse stables on neighbouring properties, horse riders and walkers using the Hume and Hovell walking track, which follows Black Range Road through the site.

### IMPACT ASSESSMENT

#### Noise from general construction activities

Depending on weather conditions, turbine erection can occur at a rate of 2-3 per week, suggesting a two month erection period. Additional time is required beforehand (for civil construction, site preparation, preparation and pouring of footings etc) and after (for site rehabilitation). This total period could be in the order of 6-9 months, depending on weather conditions and staging of works.

The NSW Environment Protection Authority's Environmental Noise Control Manual applies criteria for noise emissions during construction projects. The EPA criteria relating to construction projects of less than 4 weeks duration have been used to assess the project. This is because, while the total construction period may exceed this period, the intensive civil works which would produce high noise emissions would shift between locations within the proposal site so that each receiver would be impacted for a relatively short period.

For projects of less than 4 weeks duration, the EPA criteria applies a construction noise limit of 20dB(A) above background noise levels.

The EPA Guideline identifies noise-sensitive locations as residential premises, schools, hospitals, places of worship, parks and wilderness areas. Apart from the transport of machinery, which can be routed to avoid sensitive locations, the works would not occur within close proximity of residential areas, schools etc.

Several residences occur within one kilometre of the site and may be within audible distance of construction works. The NSW EPA construction noise guidelines recommend noise level goals and hours for work. The hours of work for construction sites are restricted to between 7:00 am and 6:00 pm weekdays and 7:00 am and 1:00 pm on Saturdays, with no construction taking place on Sundays or Public Holidays.

The impacts of construction noise was assessed by Heggies Australia Ltd (Attachment 7), based on NSW EPA criteria for construction noise. Using a worst case scenario, modelled construction noise levels were found to be acceptable. Based on ANZECC guidelines for assessing residential disturbance caused by blasting, the potential impact of blasting was also found to be acceptable in terms of human comfort and building impact.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Construction noise impacts on residential and recreational receivers | NSW EPA construction noise guidelines regarding work times and emission levels will be applied. Hours of work will be limited to 7am-6pm weekdays and 7am-1pm on Saturdays. No construction will occur on Sundays or Public Holidays. |
| | Machinery will use appropriate and effective exhaust mufflers and compressor silencers. |
| | Noise complaints will be responded to rapidly using monitoring equipment. If EPA criteria are exceeded, appropriate noise reduction strategies will be implemented, such as re-positioning of machinery, rescheduling works, installation of temporary noise barriers, improved vehicle noise control, reduced work times, 'quiet work practices' and the provision of respite periods. |
| | The timing, nature and need for the works will be well publicised in the local community. |

## 8.3. Land use and management

### EXISTING ENVIRONMENT

The majority of land in the Yass Valley LGA is used for agriculture, predominantly wool production. There is also an increasing demand for uses such as viticulture, horticulture and rural residential development (Yass Valley Council 2004). The relative value of the major industrial sectors in the Yass LGA is provided in Table 8.1.

**Table 8-1 Value of industry sectors in Yass LGA (CRDB 2005)**

| Industry sector | $ million |
|---|---|
| Tourism | 23.0 |
| Retail | 35.4 |
| Manufacturing | 4.6 |
| Agriculture | 39.0 |

This section examines the potential impacts of the proposal on agriculture and recreation/tourism in the study area and surrounding locality. Potential impacts on residential and lifestyle uses centre on noise, visual impact, telecommunications interference and other issues which are addressed in individual sections of this report. Residential property development potential is also addressed in a separate section.

The subject site is located on land zoned 1(a) Rural Agriculture in the Yass Valley Local Environmental Plan (LEP). Wind farm developments are permissable under the LEP, subject to Council approval.

### Agriculture and Landcare

Agriculture in the region is dominated by wool production. Approximately five million kilograms of wool are produced annually from 331 properties (Capital Region Development Board 2005). A sideline industry has developed in fat lambs for the meat industry using Merino-Border-Leicester cross. Yass Valley LGA is diversifying its rural products; many new agricultural industries are emerging including wine, alpaca studs, olives and berries. The close proximity of Canberra to Yass Valley LGA is assisting the establishment of these new enterprises (Yass Valley Council 2005).

The study area is zoned 1(a) Rural Agriculture, which has the objective of setting aside land for agricultural purposes. The land subject to the proposal is used for grazing sheep and cattle. Four landholders would be involved in the project. Landholdings and house locations in the proposal area are shown on Figure 7.9.

There are fifteen Landcare Groups in the Yass area. Their activities focus on the major issues of dryland salinity, streambank and gully erosion, declining remnant vegetation, streambank condition and weed infestation (YANLG 2005).

### Recreation and tourism

Tourism is a growing industry in the Yass district. In 1999 the Yass Visitors Information Centre was visited by over 41,000 people and the value of tourism in 1996 was over $23 million (Capital Region Development Board 2005). Yass Shire functions as an inland stopover for domestic tourists, with a range of accommodation types and standards.

Tourist activities promoted in the Yass district include historic buildings, museums, memorials, water sports such as fishing and water skiing (Lake Burrinjuck) and nature-based recreation (Burrinjuck Waters State Park, Hume and Hovell Walking Track). Carey's Caves, in the Wee Jasper Valley provides visitors access to 7 limestone caves.

The study area is used for private recreation. During the Open House consultation session held in Yass in November 2005, respondents indicated that the study area was used for recreational horse-riding.

The Hume and Hovell walking track follows Black Range Road through the study area. There are no track use counters on this section of the walking track. Walker use levels are likely to be low, in the vicinity of 10-20 per year (Warwick Hull, DoL pers. comm.). Because the route in this area is entirely on road, the track is used by horse-riding groups. This use may average around 50 riders a year, mainly in groups (Warwick Hull, DoL pers. comm.).

South of the study area, Lake Burrinjuck is used for fishing and water sports. The primary access road to Burrinjuck Waters State Park, a popular camping and boating destination, is located 3-4 kilometres west of the subject site. Black Range Road is a secondary access route to the park from Yass. The Hume Highway, located around 3.5 kilometres to the north of the project, also carries recreational and tourism traffic.

### IMPACT ASSESSMENT

### Agriculture

#### Construction and decommissioning impacts

Adverse impacts to agricultural use would be greatest during the construction and decommissioning phases of the development. During these periods, stock would need to be excluded from the works area. Rehabilitation of the site (soil stabilisation and potentially revegetation) would also require stock access to be temporarily restricted while vegetation is re-established on disturbed areas. This is considered to be a minor impact, occurring over 6-9 months during the construction and decommissioning phases. Affected land owners would be compensated for this loss by way of the lease arrangements they enter into with Taurus Energy. Consultation and liaison would be undertaken with involved landowners to restrict stock access to the construction zones during the period of construction.

The proposal has the potential to affect agriculture by introducing or spreading weeds, restricting weed or introduced fauna control activities, producing a pollution hazard from chemicals used during construction and transformer coolant, and disturbance to stock. Best practice mitigation measures would be adequate to reduce weed and pollution risks to an acceptable level. The proposal is not expected to disrupt weed and introduced fauna control programs.

#### Operational impacts

A minor amount of vegetation would be removed from agricultural use to accommodate the wind farm infrastructure (estimated to be around 5 hectares including hardstand areas beneath turbines, control building, substation and access tracks). The operational wind farm is not anticipated to have adverse impacts upon the agricultural use of the site and would provide a benefit as a supplementary income stream, particularly during drought periods.

The Biodiversity Assessment recommends that lambing not be undertaken on turbine ridges, to avoid attracting Wedge-tailed Eagles into the bladeswept area. For the same reason, the Assessment recommends that poisoning and fencing be used to exclude rabbits from the turbine ridges. The Assessment also suggests that sheep grazing on these sites may be preferable to cattle to avoid generating insect populations which may attract insectivorous bats and birds. These restrictions are not anticipated to significantly affect farm operations, including grazing patterns, accessibility and weed control.

#### Livestock

Sheep and cattle are grazed on and around the Conroys Gap subject site. Wind energy organisations promote the ability to continue to graze stock right to the base of wind turbines without ill effect (Union of Concerned Scientists 2005; AusWEA). Given the number of wind farms and duration of their operation on grazing land and the lack of data available to indicate adverse impact, it is assumed that the turbines will have minimal impact on livestock grazing at and around the site. A ‘settling in period’ is likely to occur during which livestock become accustomed to the turbines (I. Newton, Wind Farm Manager, Eraring pers. comm. Jan 2005; *AusWEA;* British Wind

Energy Association). There is no evidence to suggest that this would be drawn out or adversely impact animal welfare or agricultural productivity.

#### Agricultural benefits

The proposal would provide a drought resistant supplementary income stream for involved land holders. By way of the lease agreements negotiated with Taurus Energy, land managers could afford to manage the land more sustainably (lesser stocking rate, increased funds to address erosion gullies, benefiting erosion and water quality on and offsite).

There is potential for wind power to become a new rural industry, providing a significant new income stream for rural communities at a time when traditional land uses are under pressure (Warren *et al*. 2005). This point is particularly relevant to the Yass region where agricultural returns have been greatly impacted by recent drought and where anticipated climate change is projected to result in a continuation of this trend.

Pittock (2003) observed that a significant proportion of Australian exports are agricultural products sensitive to changes in climate, water availability, carbon dioxide, fertilisation, and pests and diseases. General warming will increase potential evaporation and water demand, potentially reducing the capacity of the land. While plant growth and water-use efficiency may be enhanced as a result of increased carbon dioxide levels initially, after increases in temperature of 2–4 °C and associated rainfall decreases, net effects are projected to be negative by the mid to late 21st century (Pittock 2003).

As well as direct impacts, agricultural profits could be affected by a projected increase in agricultural production in mid to high latitude Northern Hemisphere countries and the subsequent commodity price and world trade impacts (Pittock 2003). The development of land uses compatible with agricultural activities, such as wind power, have potential to provide increased economic security to rural industries. As well, they provide a substitute for carbon emission producing electricity generation that is stable (not dependent on other countries) and renewable.

### Recreation and tourism

#### Construction and decommissioning impacts

Construction traffic would use Paynes Road to access the subject site. Black Range Road carries recreation traffic accessing Burrinjuck Waters State Park, and infrequent foot traffic using the Hume and Hovell track. Given the relatively short duration of the construction period, and is unlikely to cause significant disruption to tourist traffic or recreational uses. Traffic management and safety is addressed in section 7.3. Depending on the precise locations of horse-riding routes, some disruption may occur to horse-riding opportunities during the construction phase.

#### Operational impacts

#### Horse-riding

Horses can be adversely affected by wind storms and therefore there is concern among members of the community that the proposal may have an adverse effect on horses in close proximity to the operational wind farm.

The British Horse Society has prepared a wind farm advisory statement (British Horse Society 2005). This statement suggests that wind farms have safety implications for horses and their riders and drivers of horse drawn vehicles during the construction and operational stages. This arises due to the natural instinct of the horse, when faced with a perceived threat, to flee. Equally important, the statement notes, is the riders/drivers ability to handle the horse.

The characteristics listed by the British Horse Society as potentially eliciting a dangerous response include:

- the sudden appearance of the turbines in the horses line of sight,
- low frequency noise emitted by operational turbines,
- shadows caused by the operational turbines, and
- the unexpected start up of turbines.

The statement goes on to suggest that all of these features are diminished with distance from the turbines. A 200 metre buffer was suggested, based on turbines up to 50 metres in height. For the 126 metre high turbines proposed for Conroys Gap, this may more accurately equate to a 500 metre buffer zone. The impact of the development on rights of way or other access routes is also suggested as requiring consideration. A 200 metre minimum buffer distance from access ways is suggested by the British Horse Society.

While low frequency noise was a feature of some early wind turbines designs that had blades down-wind of the tower, modern turbine designs have reduced the level of low frequency noise to below human perception (AusWEA fact sheet number 6). The effect of 'chopping the light' or shadow flicker attenuates with distance and is not considered, by modellers (Danish Wind Energy Association) to be noticed beyond 500-1000m from a turbine (refer sections 7.3.4 and 7.3.6).

Participants at the Open House consultation session indicated that recreational horse-riding occurs over hills to Lake Burrinjuck to the south. The precise routes or home properties of the horses are not known. The Black Range Road section of the Hume and Hovell track also carries rider traffic, possibly around 50 riders per year, mostly in groups (Warwick Hull, DoL pers. comm.).

Based on the British Horse Society recommendations, routes within 500 metres of the turbines may no longer be available to riders. The potential turbine location closest to Black Range Road would be approximately 760 metres north of the road. This well exceeds the buffer requirement determined by the British Horse Society, and Black Range Road is likely to remain a useable riding route. The impact of this turbine may be mitigated with tree and shrub planting along the road reserve. Other mitigation options may include developing alternative trails. When a final turbine layout is developed, further consultation with affected landholders and riding clubs is required to determine routes and mitigation options.

#### Recreation and tourism traffic

Black Range Road carries recreation traffic accessing Burrinjuck Waters State Park. The Hume Highway, located around 3.5 kilometres to the north of the project, also carries recreational and tourism traffic. Some of the wind farm turbines would be visible from each of these routes. The visual impact of the wind farm on these and other users is addressed in section 7.3.4. The wind farm is sited in a highly modified rural landscape, and their transient appearance is unlikely to significantly affect vehicle-based recreation and tourism experiences.

#### Hume and Hovell walking track

Black Range Road, running east-west through the study area, forms part of the Hume and Hovell heritage walking track. Some of the wind turbines would be visible over a range of distances to walkers using this section of the track. Near the Ferndale property, the turbines may occasionally be audible. Because it is a vehicular road passing through farmland, the road is unlikely to carry high levels of walker traffic, estimated to be in the vicinity of 10-20 per year (Warwick Hull, DoL pers. comm.). Higher levels of use could be expected to occur in timbered and off-road sections of the 440 kilometre route.

In view of the low use levels and limited area of impact involved, the proposal is not expected to significantly detract from the Hume and Hovell walking track recreational experience. Walkers may in fact experience the views of the turbines positively as something different and perhaps of interest (Warwick Hull, DoL pers. comm.). If necessary, visual impacts along this route could be mitigated using tree and shrub plantings.

#### District and regional tourism impacts

The number and type of visitors to the area is not anticipated to be negatively impacted by the development of a wind farm at Conroys Gap. The development is not incongruous with the production-based economy of the area and the heavily modified local landscape.

Depending on demand and interest, the wind farm may be promoted by Taurus Energy as a local tourist attraction using information leaflets and viewing platforms.

**IMPACT AVOIDANCE AND MITIGATION**

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Impact on agriculture | Consultation and liaison will be undertaken with involved landowners regarding site fencing, weed control and stock access during the construction period and grazing during the operational phase. |
| Impact on recreation and tourism | When a final turbine layout is developed, affected landholders and riding clubs will be consulted regarding horse-riding impacts and mitigation options, such as tree and shrub planting and the development of alternative trails. |
| | Depending on demand and interest, the wind farm may be promoted by Taurus Energy as a local tourist attraction using information leaflets and viewing platforms. |

## 8.4. General economic impact

**EXISTING ENVIRONMENT**

The wind farm proposal is located approximately seventeen kilometres west of Yass, a town with a population of 12,938. Residential numbers in Yass Shire have consistently risen over the 20 years between the 1981 and 2001 censuses (ACT Government 2004).

The 2001 census in the Yass Statistical Local Area recorded that 95.7% of the labour force was employed (2,650 males and 2,176 females). 14.7% was employed in the agriculture/forestry/fisheries sector, 13.7% in the retail trade industry, 9.4% in the property and business services industry, 8.2% in the health and community services sector, 7.6% in the construction industry, 6.7% in education and 4.3% in the manufacturing industry (ABS 2002).

**IMPACT ASSESSMENT**

Wind farms are an economically viable means to generate electricity and whilst providing several potential environmental benefits, when compared to currently available alternatives. Potential for gains exist in the provision of local employment. Approximately 50 full time jobs would be provided during the construction phase of the development and up to five during the operational phase, for maintenance and monitoring activities. Local staff and contractors would be selected where they can demonstrate the capacity to undertake the works effectively. Other economic benefits would result via the provision of services to these workers; such as accommodation, food and fuel from local service centres.

Economic benefits will vary depending on final site design, turbine suppliers, timing of works, and other details. Taurus estimates that up to $10 million could be spent within the region as a result of the wind farm and over its life, broadly split with approximately $5 million during the construction phase and $5 million during the operation phase.

The project would be privately funded by Taurus Energy. There would be no ongoing financial expenses to the community or to the Yass Valley Council. The development would be of direct economic benefit to landowners who enter into leasing arrangements with Taurus Energy. This would provide a steady stream of income to involved landowners, with flow-on benefits to local businesses. Wind farm development has not been shown to adversely impact property values in New South Wales, and would not affect the underlying productive capacity of farmland (refer section 7.3).

A feature of wind farm developments is that the distribution of benefits can be limited to a small number of landowners, while the impacts (particularly the ongoing visual impact and specific noise impacts) can have a much larger sphere of influence. The proponents intend to allocate funds in each year of operation for community projects (refer sections 4 and 7.3). These would provide additional benefits to the local community, and could include;

- weed management, landcare and conservation activities,
- sporting and community facilities,

- sponsorship of local organisations and events,
- improvements to local telecommunications services.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Distribution of economic benefits | The proponent will establish a Community Fund to finance community projects (refer section 7.3.1) |
| | The proponent will liaise with local industry representatives to maximise the use of local contractors and manufacturing facilities in the construction of the wind farm. |

# 8.5. Resource and waste impacts

## 8.5.1. Wind farm Life Cycle Analysis

### ENERGY PAYBACK

Life cycle analysis (LCA) is based on careful accounting of all energy and material flows associated with a system or a process. This approach covers the whole project life cycle, from the extraction of raw materials to the disposal of materials at the end of the project's life. LCA is particularly relevant for renewable technologies, where it is often argued that the energy used to produce the technology is not 'paid back' during the lifetime of the technology (Schleisner 2000). For all the materials used in the process, LCA estimates of energy and emissions based on the total life cycle of the materials, i.e. the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner 2000).

In Schleisner's (2000) analysis of two wind farms in Denmark, the energy 'payback' time was modelled to be 0.26 years for a wind farm on land. That is, in approximately 3 months, the energy produced by the wind farm had 'paid back' the energy consumed in producing, installing and decommissioning that wind farm. It was found that 94% of the materials used for construction of a wind turbine could be recycled (Schleisner 2000). Furthermore, the value of the materials able to be sold for reuse can be used to offset the cost of decommissioning the wind farm and rehabilitating disturbed areas.

### VESTAS WIND TURBINE LIFE CYCLE ANALYSIS

A life-cycle assessment has been conducted by Vestas for a Vestas V90-3.0MW wind turbine, similar to those that would be installed at Conroys Gap. Vestas divided the life-cycle into four phases: production, transportation, operation and disposal. This assessment looked only at the turbines and did not consider associated infrastructure such as transmission lines, substation and control building.

By far the greatest consumption of energy and resources occurred in the production phase. Raw materials required include iron ore of the construction of steel components and their casings as well as crude oil to make the epoxy materials used in blade construction. These resources are limited and considered non-renewable, when the rate of extraction is compared to the rate of formation.

In contrast, the transportation, operation and disposal phases were relatively minor. For the scale of the proposed Conroys Gap wind farm, which is located on a major transport corridor, the transportation resources related to the fuel consumed by vehicles transporting, installing and maintaining the turbines would be minor.

During the operational phase (based on a 20 year life-span and taking into account the maintenance required over this period) the costs begin to be offset by the operational capacity of the turbines. The turbines proposed for Conroys Gap have greater efficiency in producing energy than smaller sized turbines, due to the optimised comparative weight of the larger turbines.

Disposal encompasses the fuels required to dismantle and transport the turbines as well as the disposal of materials. Previously, 20% of the turbine blades would be deposited in landfill, the remaining 80% being reused. New blade types are now up to 100% recyclable, requiring no landfill disposal.

Using a functional unit of 1 KW hour as a basis for comparison, Vesta provide the following comparisons between phases of the 3 MW wind turbine life-cycle and CO2 emissions between other energy producing power stations (Tables 8.2 and 8.3).

**Table 8-2 Energy consumed during life cycle phases of the Vestas V90-3MW**

| Life cycle phase | Energy consumption |
|---|---|
| Production phase | 7,795 MWh |
| Transport phase | 74.00 MWh |
| Operation phase | 14.00 MWh |
| Disposal phase | -3,572 MWh |
| *Total energy consumption* | *4,311 MWh* |

**Table 8-3 Comparison of $CO_2$ emissions of different generation sources**

| Source | CO2 produced |
|---|---|
| Onshore Vestas V90-3MW turbine | 8 grams per kWh |
| Gas-fired power station | 467 grams per kWh |
| Coal-fired power station | 826 grams per kWh |

Hence, by comparison to major electricity generating methods employed in Australia, wind farms rate favourably based on:

- CO2 emissions produced per kilowatt hour of energy produced;
- Potential to reuse and recycle component parts; and
- Energy payback time in comparison to the life span of the project.

## 8.5.2. Resource use and waste management

### RESOURCE USE

The majority of resource use and waste generation would occur during the construction and decommissioning phases. The construction of the proposed wind farm, including associated infrastructure, would require the use of various resources, such as concrete and other masonry products (footing, slabs, hardstand areas, building elements), materials associated with the operation of machinery, and motor vehicles (fuels and lubricants) and other construction materials (metals, glass, plastics).

Resources required during the operational phase include fuel for maintenance vehicles, lubricants for oil changes in the turbines and replacement parts if required that may consist of metal and plastic based products. All wastes would be removed by contractors and maintenance staff. No local garbage service would be required.

The abovementioned materials are not currently depleted or restricted in supply however, increasing scarcity and environmental impacts are becoming apparent from the use of fossil fuels and other non-renewable resources.

The proposal therefore, would not place significant pressure on the availability of local or regional resources.

### WASTE GENERATION

Solid waste is one of the major pollutants caused by construction. Solid waste would be generated from a number of activities including limited vegetation removal and construction activities, including material from packaging, building materials, scrap metals, sanitary wastes, plastic and masonry products. Hazardous wastes would be present onsite; these include sanitary wastes, hydrocarbons and fertilisers. During decommissioning similar wastes would be generated.

A key strategy of construction and decommissioning works would be to minimise waste from the construction site, reuse or recycle waste where possible and implement protocols to minimise the risk of spills.

### IMPACT AVOIDANCE AND MITIGATION

| Activities and impacts | Avoidance and mitigation measures |
|---|---|
| Resource use efficiency and conservation | Excavated material will be used in road base construction and as aggregate for footings where possible, surplus material will be disposed of in appropriate locations on site (on agreement with the landowner), finished with topsoil, and revegetated. |
| | Surplus topsoil will be stockpiled on site during construction, and following construction will be spread on the site (particularly over hardstand areas and access roads) to assist in revegetation. |
| Waste minimisation and management | Waste will be reused or recycled whenever possible. Separate recyclable materials receptacles will be provided (eg. for glass, plastics and aluminium). |
| | Packaging materials and general construction wastes will be disposed, with Council's approval, at Council operated waste disposal centres. |
| | Toilet facilities will be provided for onsite workers and sullage from contractor's pump out toilet facilities will be disposed at the local sewage treatment plants or other suitable facility agreed to by Council. |
| | Risk of chemical spills will be minimised and protocols will be in place to ensure prompt and effective clean up of any accidental spills. |
| | The contractor will implement a Spill Control Plan as part of its Erosion and Sediment Control Plan. Spill Control Plans will identify persons responsible for implementing the plan if a spill of a dangerous or hazardous waste should occur. Any spill that occurs, regardless of size or type of spill, will be reported to the Construction Manager. The event and clean up processes will be recorded and passed to the Yass Valley Council. If the spill or hazard reaches surface waters the EPA will be notified. |

# 9. CONCLUSION

The Environmental Assessment has identified and assessed the significance of environmental impacts associated with the proposal to construct and operate a wind farm at Conroys Gap. The Conroys Gap locality is a moderate-high relief rural area with a long history of extensive grazing, but with a recent trend toward large lot residential subdivision.

Key issues relating to the proposal include the presence in the wider study area of threatened flora, fauna and communities, the presence at the subject site of raptors and raptor hunting habitat, and the presence of roads, recreation areas and residences within potential noise and visual impact zones.

The impacts of the proposal on physical values (air quality, soil and water) would be readily manageable using standard best-practice methods and measures to address site-specific issues. The vegetation that would be impacted by the proposal has low conservation significance and the impacts would not be significant. All bird and microbat species recorded at the site and most likely to be affected by the proposal are widespread and not considered threatened.

Based on experiences and assessments at operating wind farms elsewhere in Australia, blade collisions by birds and bats are expected to be rare. The Assessments of Significance conclude that the proposal is not likely to have a significant impact on threatened species, populations or ecological communities listed under the TSC Act or the EPBC Act. A dedicated pre-works survey and mortality and behavioural monitoring program, coupled with adaptive management would be implemented to account for residual risks to bird and bat species.

The visual landscape is substantially modified by farming practices and contains many built elements; there are no areas where the wind farm would create unacceptable contrast. Shadow flicker will be mitigated to ensure that it does not affect two existing houses and one proposed house site in the mornings or evenings. A screening program will be implemented to minimise visual impacts to surrounding residences. Visual impacts would be acceptable and manageable using a range of mitigation measures.

Operational noise emissions have been demonstrated to generally meet the relevant criteria. The proponent will model the final turbine selection and turbine layout and demonstrate that the layout meets the SA EPA Guidelines (with respect to non-involved houses) and World Health Organisation guidelines (with respect to involved houses). The results of this assessment will be provided to the Department of Planning and disseminated to the local community prior to construction.

Studies conducted overseas and elsewhere in Australia, including a study commissioned by the proponent into the effects of the Crookwell I wind farm on land values, suggest that the proposed wind farm would not have a significant impact on local land values and development potential. The potential for interference to telecommunications is difficult to determine with certainty, but impacts are likely to be readily manageable using a range of mitigation measures. Impacts on air traffic and safety are not likely to be significant. The Conroys Gap wind farm proposal is sufficiently distant from similar proposed and existing wind farms to avoid cumulative noise, visual and biodiversity impacts.

The planning and design of the Conroys Gap proposal has been informed by past experiences of wind farms in Australia and overseas. The proposal has been progressively adapted and refined in response to the findings of the specialist assessments and consultations with the community, private organisations and government agencies. This EA provides a series of impact avoidance and mitigation measures which have bearing on the design and planning, construction and operational phases of the project.

The proposal offers clear climate change benefits in reducing the current reliance on coal for electricity generation. In Australia, a third of total greenhouse gas emissions are produced during the generation of electricity, the vast majority from coal-fired power stations. Greenhouse gas emissions from these sources are increasing rapidly in New South Wales. The wind farm would reduce greenhouse gas emissions by 90,000 to 99,000 tonnes of $CO_2$ per annum, or a cumulative effect of 2.70 to 2.97 million tonnes of $CO_2$ over the life of the project. The State's electricity demand continues to grow, and new electricity sources will be required by 2008 to meet this demand and avoid power outages and blackouts (Transgrid 2005). Wind power provides reliable and decentralised electricity production.

For the local community, the proposal offers economic benefits. The proposal would inject over $10 million into the local economy. An estimated 50 jobs would be provided during construction and 5 jobs during the operational phase of the wind farm. The wind farm would also provide an opportunity to increase local tourism. A Community Fund of $25,000 per annum would be established with the project, offering ongoing benefits to the local community and local environment.

Assuming implementation of the avoidance and mitigation measures outlined in the EA, the proposal is not considered likely to significantly affect the environment in terms of cultural heritage, social, economic or biodiversity impact. Negative impacts relating to noise, visual impact, disturbance to recreation opportunities and biodiversity risks would be localised and restricted to the 30 year lifespan of the project. These impacts are considered to be outweighed by the broader benefits of wind power generation.

**Statement on ecological sustainability**

An assessment of the ecological sustainability of the proposed wind farm is presented below, against nationally-agreed Ecologically Sustainable Development (ESD) criteria (refer section 5).

**The precautionary principle**

There are acknowledged uncertainties and risks associated with the proposal. The assessment has involved a detailed risk assessment of key impacts. Flexibility and an adaptive approach has been used in the design and siting of the proposal. A degree of flexibility would also be available in the operation of the wind farm in response to unforeseen impacts.

A monitoring program would be implemented to record the environmental performance of the wind farm. The Environmental Management Plan would incorporate an adaptive management component. Specific management responses would be triggered by quantified and measurable impacts which exceed defined tolerance thresholds.

**Inter-generational equity**

The proposal would be readily reversible in terms of social, physical and biodiversity impacts. The proposal incorporates guarantees of infrastructure removal at the end of the life of the wind farm. Biodiversity monitoring and ongoing environmental management prescriptions would ensure that the wind farm does not produce irreversible damage to these values, such as local extinction or permanent habitat loss.

The generation of electricity using wind, rather than coal, would also assist with the reduction of carbon emissions and mitigation of anthropogenic climate change. Reducing carbon emissions is essential to conserve the diversity, productivity and liveability of the environment for future generations. The use of renewable energy sources would contribute to intergenerational equity by reducing the losses and costs associated with global warming which must be borne by future generations.

The impacts of the proposal are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations.

**Conservation of biological diversity and ecological integrity**

The biodiversity values of the subject site have been a key consideration in both broadscale wind farm site selection process and finescale siting of turbines and other infrastructure. The decision to exclude the north-eastern ridge site from the proposal was based, in part, on likely impacts on threatened species habitat and an Endangered Ecological Community. The Biodiversity Assessment has concluded that the proposal as currently presented would not significantly affect biodiversity values at the site or in the region. A monitoring and adaptive management approach would be used to manage residual risks.

In reducing reliance on coal-fired power generation, the use of wind power would also reduce climate change impacts to biodiversity values.

**Improved valuation, pricing and incentive mechanisms**

The viability of wind generation is assisted by the Government's MRET scheme. While this represents an intervention in the energy market, the subsidy is justified because of the 'public good' nature of the outcomes, and as a corrective to existing distortions caused by the failure to include the full costs of climate change in coal-based electricity prices.

Based on the social and environmental benefits accruing from the proposal from reduced dependence on fossil fuels, and the assessed impacts on the environment, it is considered that the development would be sustainable within the context of the above ESD principles.

# 10. ASSESSMENT PERSONNEL

This report was prepared by **ngh**environmental. Specific sections were drawn from consultants' reports or from material provided by the proponent. Contributions to relevant sections of the report are detailed in Table 10.1 below.

**Table 10-1 Authors involved in preparing the Environmental Assessment**

| | Section | Author |
|---|---|---|
| **1** | **Executive summary** | nghenvironmental |
| **2** | **Introduction** | nghenvironmental |
| **3** | **Description of the proposal** | |
| | 3.1 Site of the proposal | nghenvironmental |
| | 3.2 General description of proposed works | Taurus Energy |
| | 3.3 Wind farm infrastructure | Taurus Energy |
| | 3.4 Construction facilities and staging | Taurus Energy |
| | 3.5 Associated development and future implications | nghenvironmental |
| | 3.6 Statement of commitments | nghenvironmental |
| **4** | **Project justification** | Taurus Energy |
| **5** | **Planning context** | nghenvironmental |
| **6** | **Consultation** | nghenvironmental |
| **7** | **Assessment of key issues** | |
| | 7.1 Scoping and prioritisation of issues | nghenvironmental |
| | 7.2 Biological factors | |
| | 7.3.1 Community impacts | nghenvironmental |
| | 7.3.2 Land value impacts | Henderson and Horning, nghenvironmental |
| | 7.3.3 Services and infrastructure | nghenvironmental |
| | 7.3.4 Landscape character and visual values | Scenic Landscape Architecture nghenvironmental |
| | 7.3.5 Operational noise | Heggies Australia, nghenvironmental |
| | 7.3.6 Safety and health | nghenvironmental |
| | 7.3.7 Telecommunications interference | Taurus Energy |
| | 7.3.8 Bushfire impacts | nghenvironmental |
| | 7.3.9 Traffic and transport | Bega Duo Designs, nghenvironmental |
| | 7.3.10 Aviation impacts | Taurus Energy |
| | 7.3.11 Archaeological and cultural heritage | NSW Archaeology, nghenvironmental |
| | 7.4 Removal of infrastructure | nghenvironmental |
| | 7.5 Cumulative impacts | nghenvironmental |
| **8** | **Assessment of lower priority issues** | |
| | 8.1 Physical environment | nghenvironmental |
| | 8.2 Construction noise | Heggies Australia, nghenvironmental |
| | 8.3 Land use and management | nghenvironmental |
| | 8.4 General economic impact | nghenvironmental |
| | 8.5 Resource and waste impacts | nghenvironmental |
| **9** | **Conclusion** | nghenvironmental |

## Nghenvironmental staff involved in preparing the report

| Personnel | Role | Qualifications | Expertise and experience |
|---|---|---|---|
| Paul McPherson<br>**ngh**environmental | Primary author<br>Environmental assessment<br>Report writing and research | Bachelor of Applied Science (Natural Resources) | With **ngh**environmental since 1996 undertaking flora and fauna survey, planning assessment and environmental impact assessment. Prior to this, Commonwealth Government environmental policy, resource assessment and program delivery. |
| Brooke Marshall<br>**ngh**environmental | Environmental assessment<br>Report writing and research | Bachelor of Natural Resources (Hons) | Since joining **ngh**environmental, Brooke has prepared impact assessment reports relating to wind farms, road construction, water pipeline installation, river modification and prescribed burning activities. These reports have included threatened floral and faunal species assessments requiring research, fieldwork and GIS components. |
| Nick Graham-Higgs<br>**ngh**environmental | Client liaison<br>Editorial review | Bachelor of Applied Science | An environmental consultant specialising in environmental impact assessment and natural resource management since 1992. Much of the work undertaken has been within sensitive areas, including major infrastructure development works. |

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