Proposed development of the

Gullen Range Wind Farm

Southern Tablelands
New South Wales

Environmental Assessment

Prepared for Gullen Range Wind Farm Pty. Ltd. a subsidiary of

EPURON
POWER FOR PORTFOLIOS

prepared July 2008 by

ngh environmental
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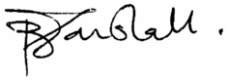
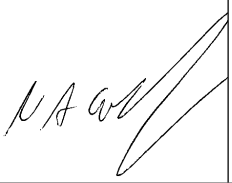
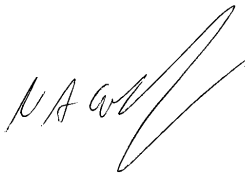
		Sign.		Sign.		Sign.	
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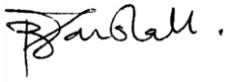
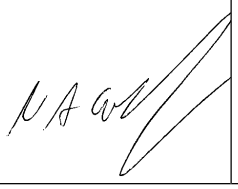
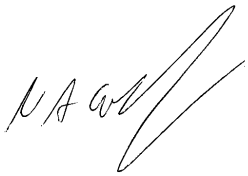
		Sign.		Sign.		Sign.	

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Authors' qualifications

Nicholas Graham-Higgs

Bachelor of Applied Science

Director **ngh**environmental

Nick has worked as an environmental planning consultant since 1992, specialising in environmental impact assessment and natural resource management. His work demands an in-depth knowledge of current planning and environmental legislation coupled with a comprehensive understanding of development-related impacts, especially those relating to the development of sustainable power generation facilities, including hydro and wind generated electricity. Nick has acquired his knowledge in this field over the last 17 years, during which he has worked with a number of land management organisations within and outside Australia.

Much of the work undertaken has been within sensitive areas, including major works for infrastructure development; the augmentation of water supplies at Perisher Range and Adaminaby, the development of mini-hydro plants at Jounama, Khancoban and Geehi and environmental assessment for wind farms on the Snowy Plains and Southern Tablelands of NSW.

Brooke Marshall

Bachelor of Natural Resources (Hons)

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Since joining **ngh**environmental in 2004, Brooke has prepared impact assessment reports relating to residential developments, road construction, water supply infrastructure, telecommunications infrastructure, river modification, wind farms and prescribed burning activities.

Brooke has prepared Development Applications under Parts 3A, 4 and 5 of the EP&A Act, as well as Biodiversity Assessments, Environmental Management Plans, Rehabilitation Plans and Community Consultation Plans associated with these proposals. Brooke has prepared strategic reports assessing natural values for local government (Snowy River Shire and Bega Valley Shire) and has authored Species Impact Statements and EPBC Referrals. Brooke's work has been focussed on the South Coast, Southern Tablelands and Snowy Mountains regions of NSW.

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1 EXECUTIVE SUMMARY

1.1 Introduction

This Environmental Assessment (EA) has been prepared by **ngh**environmental on behalf of Gullen Range Wind Farm Pty. Ltd. (the Proponent) to assess the potential environmental impacts associated with the development of a wind farm on the Gullen Range, on the Southern Tablelands of New South Wales. Gullen Range Wind Farm Pty. Ltd. was established as a special purpose company for the development of this wind farm and is a 100% subsidiary of Epuron Pty. Ltd.

The proposal is to be assessed as a Part 3A Major Project, under the NSW *Environmental Planning and Assessment Act 1979*. The proposal is consistent with the criteria of *Critical Infrastructure* under this Act, as it is a power generator with capacity to generate in excess of 250 megawatts.

This assessment:

- Describes the proposed wind farm project
- Identifies statutory assessment and approval requirements in relation to the proposal
- Identifies and assesses the environmental impacts of the proposal, with a focus on key issues identified by stakeholders (including the Department of Planning, local and state government agencies and the local community)
- Identifies measures to manage risks and avoid or mitigate potential impacts

1.2 Proposal outline

The proposal would involve the construction and operation of a wind farm in the Southern Tablelands region of NSW. The project would have the capacity to generate in excess of 250 megawatts. The proposal includes:

- Up to 84 wind turbines, each with three blades mounted on a tubular steel tower. Wind turbines proposed have a maximum tip height of 135m
- Electrical connections between wind turbines using multiple step-up transformers and a combination of underground cable and overhead concrete or timber pole power lines
- A substation and transmission connection linking the wind turbines to the existing TransGrid 330kV transmission system located onsite
- An onsite control room and maintenance facilities
- Internal access tracks and minor upgrades to site access via Gurrundah Road, Range Road, Grabben Gullen Road, Bannister Lane, Prices Lane and Storriers Lane, required for the installation and maintenance of wind turbines and associated infrastructure

Additional temporary construction activities and infrastructure would be required during the construction and refurbishment or decommissioning phases.

A number of wind turbines are currently under consideration for the site. In general, different characteristics of turbine types require different turbine layouts. However, to simplify the environmental assessment of the project a single layout with 84 potential turbine locations has been developed that reflects the characteristics of a large range of turbine types. The final turbine selection would be determined following a competitive tender process pending Project Approval.

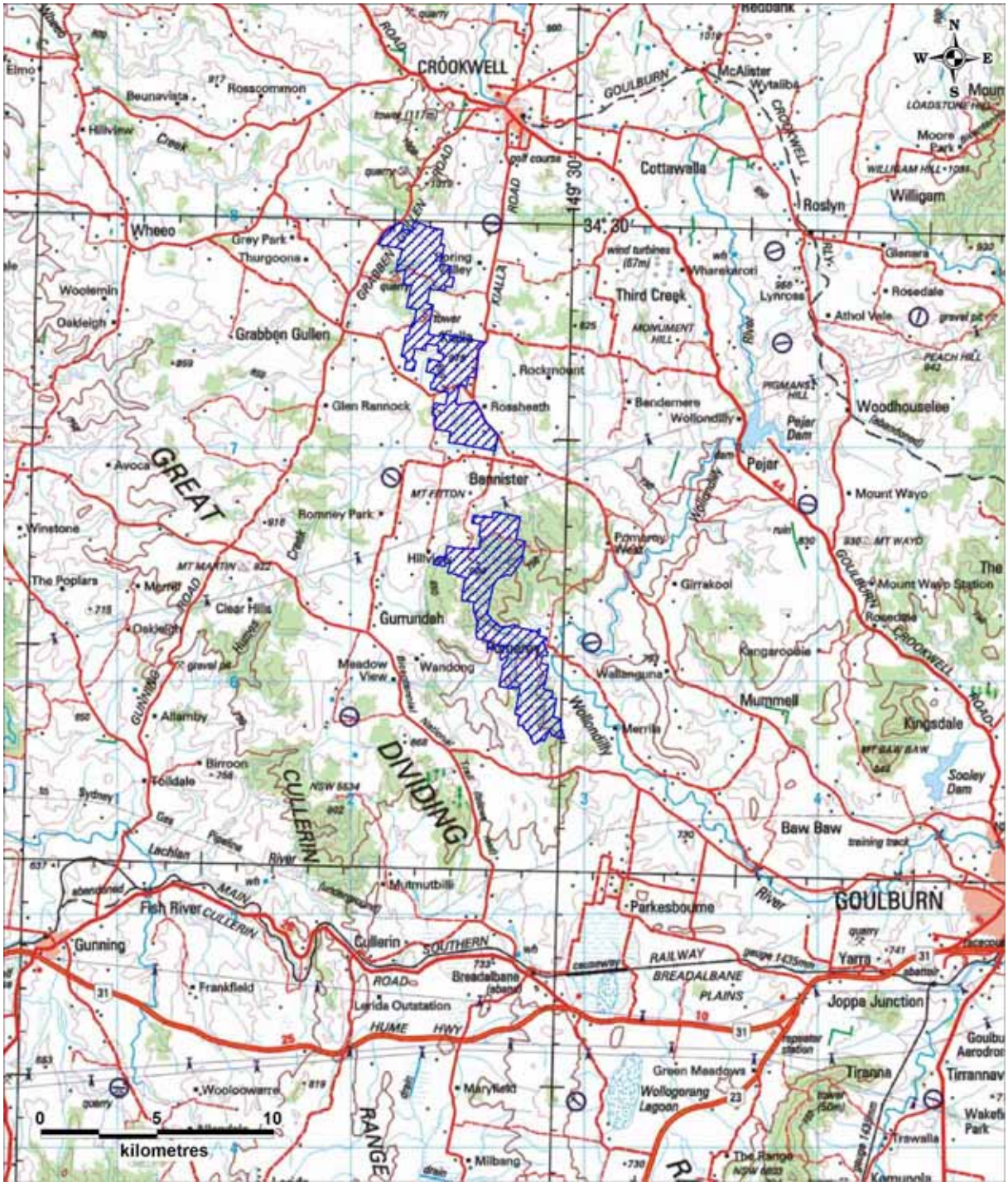


Figure 1-1 Site location

The site (hatched in blue) is located along a north-south running ridge system of the Great Dividing Range between Gunning, Crookwell and Goulburn in NSW's southern tablelands.

1.3 Project benefits

The Proponent is committed to developing the Gullen Range wind farm in a way which minimises adverse local impacts and maximises the benefits of the project to the local community and broader population.

The project would reduce the current dependency on the consumption of fossils fuels for electricity and would therefore reduce the impacts of climate change resulting from the emission of greenhouse gases. 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).

Based upon an 84 turbine layout, the project offers the following broad benefits:

- Production of approximately 588,000 MWh of renewable electricity per annum, sufficient for the average consumption of up to 73,500 homes
- Reduction in greenhouse gas emissions of approximately 588,000 tonnes of carbon dioxide (equivalent) per annum, the equivalent of taking 117,600 cars off our roads
- Savings in water consumption of approximately 774 Million litres per annum of potable water (this is the amount of water required to produce the same amount of electricity from coal fired power stations)
- Annual savings in pollution from coal fired power stations of up to 3,150,000 kilograms of sulfur dioxide, 1,405,000 kilograms of nitrogen oxides and 88,200 kilograms of particulates
- Provision of a community fund of $75,000 per annum for local community and environmental projects including a Clean Energy Program
- Provision of local jobs and injection of up to $200 Million into the Australian economy and approximately $60 - $90 Million into the local economy
- Improved security of electricity supply through diversification

1.4 Community support and consultation

Studies in the region have shown that adult residents are concerned about global warming and are aware of the alternatives available. They have illustrated that respondents understand what a wind turbine is and how wind farms appear in the landscape. Respondents in surveys are generally supportive of wind farms. Moreover, when it comes to the location of wind farms, respondents support having wind farms in their immediate locality, and a majority would still approve of a wind farm within one kilometre of their home.

Community consultation with neighbours and local residents of the Gullen Range site has identified key issues and concerns of the local community. Results of a questionnaire indicate the top three issues in order of priority to be impact on the rural landscape, community division and operational noise levels. These and other issues identified by the local community are addressed in this EA, together with a specific section evaluating impacts on community wellbeing.

1.5 Outline of assessment

Key issues were identified in consultation with stakeholders (including the community, local Councils, agency representatives and the consent authority) and formalised in the Director General's Requirements for the preparation of the Environmental Assessment. Investigation of these issues forms the major part of this Environmental Assessment. These issues were investigated via specialist reports and by desktop assessment.

Specialist investigations were carried out in the key areas of:

- Visual impacts
- Operational noise impacts
- Biodiversity impacts
- Aboriginal archaeological impacts
- Aviation hazard impacts
- Communication impacts
- Land value impacts
- Traffic and transport impacts

These investigations are appended to the EA in full and are summarised in the body of the EA. They characterise the potential visual, noise, archaeological, biodiversity and traffic and transport impacts of the proposal and outline mitigation measures required to accompany the proposal to manage the identified impacts.

Additional issues were considered by desktop assessment and consultation. These included:

- Electromagnetic fields (EMFs)
- Hydrological impacts
- Economic impacts
- Lifestyle impacts
- Agricultural impacts
- Historic heritage
- Resource impacts
- Fire and bushfire impacts
- Mineral exploration impacts
- Community wellbeing
- Tourism impacts
- Health and safety impacts
- Physical impacts
- Cumulative impacts

These assessments indicate that potential impacts are manageable with the implementation of specific mitigation measures.

1.6 Results of assessment

The results of the assessments are provided in the body of this report, with further details in the appendices. The following issues are highlighted due to their significance:

Visual

- The major impact of wind turbines on residential properties occurs where wind turbines are within 1.5km of the residence
- The greatest potential impact is on neighbouring non-participatory residential properties. That is, residential properties whose owners have not elected to be part of the wind farm

- There are 32 non-participatory residences within 1.5km of the nearest wind turbine. There are 86 non-participatory residences more that 1.5km and less than 3km from a wind turbine
- Landscape mitigation would be implemented to lessen the visual impact on residential properties on a case by case basis in consultation with landholders to minimise adverse impacts
- The landscape and visual impact assessment demonstrates that the site and its surrounds have a low visual sensitivity to wind farm development and that it is a suitable landscape for the construction of a wind farm

Noise

- Construction noise is manageable with the implementation of mitigation measures
- Construction noise mitigation would include limiting the hours of high noise generating activities, appropriate selection and siting of machinery, employment of a site representative to be responsible for all noise and vibration issues and establishing communications with local residents and relevant authorities
- Operational noise modelling indicated that compliance with the relevant noise criteria can be achieved using the layout and the turbines proposed
- Noise assessment would be required to be carried out on the turbine ultimately selected for construction and on the final layout proposed taking into account any minor changes in turbine location to ensure compliance with noise criteria

Biodiversity

- Vegetation was identified during the site assessment which falls within the definition of two Endangered Ecological Communities (EECs); White Box, Yellow Box, Blakely's Red Gum Woodland and Tableland Basalt Forest
- One plant species listed nationally was identified from a single non-flowering plant in pasture on Gurrundah; the Hoary sunray
- Five threatened fauna species were recorded during the field work: Common Bent-wing Bat, Large-footed Myotis, Eastern False Pipistrelle, Powerful Owl and Squirrel Glider
- Key biodiversity constraints were identified including: vegetation of conservation significance, mature vegetation with high potential for threatened mammals, isolated mature paddock trees, woodland fragments with a moderate level of connectivity, areas of high potential for threatened reptiles and water bodies
- Constraints mapping was prepared concurrent with project site planning, to avoid impacts on these areas of conservation value
- The final site layout has been assessed to minimise biodiversity impacts. Mitigation measures centre on avoiding the identified constraints where possible, implementing weed, sediment and erosion controls, considering the design of all infrastructure to minimise potential for collisions, design and implementation of an adaptive management monitoring program to monitor collision impacts

Archaeology

- The field survey and assessment was undertaken in partnership with Pejar Local Aboriginal Land Council (PLALC) and Onerwal Local Aboriginal Land Council (Onerwal)
- Aboriginal objects in the form of stone artefacts were recorded in a number of locales
- It is predicted that additional stone artefacts are likely to be present in either low or very low density in a subsurface context across the majority of the proposal area
- All areas were assessed as having low Indigenous archaeological potential and sensitivity
- The majority of the archaeological resource in the proposal area would be excluded from impact
- It is concluded that the proposed Gullen Range wind farm would result in insignificant impacts to the Aboriginal archaeological resource
- The Pejar LALC have expressed interest in these artefacts and propose to collect artefacts located within proposed impact areas as a form of mitigation prior to the commencement of construction

Economic benefits

- The project would provide local jobs and inject up to $200 Million into the Australian economy and approximately $60 - $90 Million into the local economy
- The project would provide a community fund of $75,000 per annum for local community and environmental projects

Renewable energy generation

- The project would generate approximately 588,000 MWh of renewable electricity per annum, sufficient for the average consumption of up to 73,500 homes
- The project would reduce NSW greenhouse gas emissions by approximately 588,000 tonnes of carbon dioxide (equivalent) per annum, the equivalent of taking 117,600 cars off our roads
- The project would reduce water consumption by approximately 774 Million litres per annum of potable water (this is the amount of water required to produce the same amount of electricity from coal fired power stations)
- The project would save pollution from coal fired power stations of up to 3,150,000 kilograms of sulfur dioxide, 1,405,000 kilograms of nitrogen oxides and 88,200 kilograms of particulates

1.7 Environmental management and impact mitigation

This environmental assessment includes the proposed methods of mitigating potential for adverse impacts of the project. These specific mitigation measures are summarised in the form of a draft *Statement of Commitments* to which the Proponent would commit if the proposal receives Project Approval.

Environmental management principles that would be applied during the construction, operation and decommissioning of the proposal are outlined in Section 9 of this Environmental Assessment.

The implementation of all mitigation measures would be by way of a **Project Environmental Management Plan** (PEMP), comprising a **Construction Environmental Management Plan** (CEMP) and an **Operation Environmental Management Plan** (OEMP). 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. The monitoring program would clearly identify any residual impacts after mitigation. Adaptive management would ensure that improvements were consolidated in the updated EMPs.

1.8 Conclusion

This Environmental Assessment (EA) documents the likely environmental impacts that may result from the proposed Gullen Range wind farm. The proposal has incorporated the environmental constraints identified in an iterative manner throughout the project design to determine the most appropriate site layout. It has also incorporated measures to proactively address identified environmental risks throughout the construction, operation and decommissioning of the project. Impacts must be considered in balance with the broader public benefits of the proposal.

Benefits of the proposal have been identified at the global, regional and local scale. While operational, the proposal would provide a greenhouse gas emission-free source of locally generated electricity. Approximately 588,000 MWh of energy would be produced (sufficient for the average consumption of up to 73,500 homes), resulting in a greenhouse gas emission reduction of approximately 588,000 tonnes of carbon dioxide (equivalent) per annum, the equivalent of taking 117,600 cars off the road.

Therefore, the proposal would directly address a New South Wales listed Key Threatening Process, Anthropogenic Climate Change, by reducing the proportion of the electricity demand supplied by burning fossil fuels, with resultant benefits to water use and pollution generation that accompanies coal fired power stations. Furthermore, the impacts of human-induced climate change are particularly relevant in Australian agricultural production environments, lending support to the appropriateness of the development for the region.

The success of the proposal in mitigating environmental impacts hinges on the development and implementation of the Project Environmental Management Plan and its associated Construction and Operation Environmental Management Plans. The Proponent is committed to ensuring the measures developed in these plans are best practice and is committed to working to ensure the best possible result is achieved for the Gullen Range site. This not only has immediate benefits for the site and locality which would house the project, it would also set a high standard for the development of wind energy resources in the region.

2 INTRODUCTION

2.1 About this report

This Environmental Assessment has been prepared by **ngh**environmental on behalf of Gullen Range Wind Farm Pty. Ltd. to assess the potential environmental impacts associated with the development of a wind farm on the Gullen Range, on the Southern Tablelands of New South Wales. The proposal is to be assessed as a Part 3A Major Project, under the NSW *Environmental Planning and Assessment Act 1979*.

This Environmental Assessment (EA):

- Describes the proposed wind farm project
- Identifies statutory assessment and approval requirements in relation to the proposal
- Identifies and assesses the environmental impacts of the proposal, with a focus on key issues identified by stakeholders (including the Department of Planning, local and state government agencies and the community)
- Identifies measures to manage risks, and avoid or mitigate potential impacts

This EA is intended to meet the assessment requirements of the Part 3A provisions of the *Environmental Planning and Assessment Act 1979* and the Major Projects State Environmental Planning Policy 2005.

This EA draws together a number of specialist studies investigating potential impacts in detail. The findings of these studies have been incorporated into the EA and are included as stand alone documents in the Attachments section of this EA. This EA concludes with a *Statement of Commitments* to which the Proponent would commit, pending approval of the proposal, in order to manage the identified impacts.

A Project Application was submitted to the Department of Planning for this project on 27 August 2007. Director General's Requirements were received from the Minister on 21 September 2007. Refinements to the project design have occurred as a result of the specialist environmental and engineering studies undertaken since the Project Application was submitted. The current EA assesses the same site boundaries and essentially the same turbines as presented in the Project Application and it is therefore considered to be essentially the same project.

2.2 Overview of the planning 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).

Part 3A of the *Environmental Planning and Assessment Act 1979* came into force on 1 August 2005. Part 3A 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. The associated State Environmental Planning Policy (Major Projects) 2005 defines wind power developments with a capital cost of $30 million dollars or more as Major Projects. The proposed Gullen Range wind farm would have a capital cost in excess of $30 million and is therefore considered a Major Project under Part 3A.

Following a declaration by the Minster for Planning on 27 February 2008, the Gullen Range wind farm would be considered *Critical Infrastructure* under the *Environmental Planning and Assessment Act 1979* as it has the capacity to generate in excess of 250 megawatts.

The assessment process for this proposal is as follows. The Proponent of a major project first submits a Project Application for the approval of the Minister for Planning. For more complex projects, 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 and the level of assessment required and consultation requirements. The Director-General's requirements may also require the Proponent to include in an Environmental Assessment a statement of the commitments the Proponent is prepared to make for environmental management and mitigation measures on the site.

After an Environmental Assessment has been prepared and accepted by the Director-General, the Report 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 the consultation period, the Director-General may require the Proponent to respond to the comments, revise the proposal or revise the *Statement of Commitments*.

Consistent with the Part 3A reforms, this assessment 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 15th August 2007, involving representatives from Upper Lachlan Shire Council, Goulburn Mulwaree Shire Council, Department of Planning (DoP), Department of Environment and Climate Change, Hawkesbury Nepean Catchment Management Authority (CMA), Department of Primary Industries (Minerals), Crookwell Rural Fire Service and Country Energy, Department of Lands, as well as the Proponents and **ngh**environmental. A Project Application identifying and prioritising issues relating to the project was submitted to DoP on 27 August 2007. DoP responded on 21 September 2007 with the Director–General's Requirements for the Environmental Assessment (refer to Section 5.1.3).

2.3 The Proponent

The Proponent for this proposal is Gullen Range Wind Farm Pty. Ltd. which is a wholly owned subsidiary of Epuron Pty. Ltd. Gullen Range Wind Farm Pty. Ltd. was established as a special purpose company for the Gullen Range wind project and all permits and approvals would sit with this company.

Epuron Pty. Ltd. is the Australian subsidiary of Conergy AG, a significant international group of companies which develop, finance, build and operate major projects in the field of renewable energy. Epuron and Conergy AG have many years of experience in the development of solar photovoltaic, wind power, bioenergy and solar thermal energy projects. Epuron has established Gullen Range Wind Farm Pty. Ltd. as the corporate entity for the project development and financing of the Gullen Range wind farm. In addition to this proposal for the Gullen Range wind farm, Epuron is concurrently working on an additional wind farm project to the north-west of Broken Hill and has a significant pipeline of potential wind farm sites in NSW.

Prior to January 2007, Epuron was formally known as Taurus Energy, a NSW-based renewable energy company established in 2002 to explore wind energy projects primarily in NSW. Taurus Energy previously proposed three wind farm projects in NSW; one to the Snowy River Shire Council (Snowy Plains wind farm, approved 2005) and two to the Department of Planning as Part 3A assessments (Cullerin wind farm and Conroy's Gap wind farm, Southern Tablelands of NSW, both approved 2007).

2.4 Regional context of the proposal

The Gullen Range, part of the Great Dividing Range, is located south of Crookwell, between Goulburn to the east and Gunning to the west (Figure 3-1). The region has a unique cultural history, reflecting Aboriginal and pastoral settlement and the natural resources of the area. Today's social and economic context has been shaped by these elements.

The area was occupied and used by Aboriginal people from the late Pleistocene onwards. The area would have been used by Aboriginal people for activities which may have included hunting and gathering and travel through country (NSW Archaeology 2005). The area was settled by Europeans for agricultural production in the early 1800's. The explorers Hume and Hovell pioneered the route through Gunning to Melbourne in 1824 (Upper Lachlan Shire Council 2006a), initiating a transport route that continues to the present day.

The ecology of the area has been substantially altered since European settlement by clearing for agriculture, transport infrastructure, electricity and natural gas easements and urbanisation around town centres. Nonetheless, the NSW Southern Tablelands retains important natural ecological and biodiversity assets. It is diverse within the biogeographical context and represents the limit of distribution for many species (Fallding 2002). The area represents a cross-over point of eastern and western woodland types and of the species associated with them, with the high elevation resulting in the occurrence of some species or forms of species more commonly associated with alpine areas (pers. com. R. Falconer, 6, 7 Dec. 2005).

Approximately 14% of the bioregion is managed in conservation tenures. National parks and nature reserves occupy 596,638 hectares or 12.22 per cent of the bioregion. Three conservation reserves occur within 50km of the site; Tarlo River National Park, Morton National Park and Mundoonen Nature Reserve. The area proposed for this development falls on the boundary of the Hawkesbury Nepean Catchment Management Authority (CMA), Upper Wollondilly River Subcatchment, and the Lachlan CMA, being most relevant to the former. The Upper Wollondilly River Subcatchment is the highest point in the catchment and is located adjacent to the westward flowing Lachlan River Subcatchment. There are two

reservoirs and several weirs within the subcatchment. The CMA note that there are no reserved lands in the subcatchment, much of the land within it has been historically cleared of its riparian and floodplain vegetation for grazing and rural-residential development and that the lower reaches near Goulburn are more severely impacted than the upper reaches. There is also a willow and serrated tussock threat (Hawkesbury Nepean CMA 2006).

Today, the region retains a rural landscape character. The site proposed for development is surrounded by the towns of Gunning, Crookwell and Goulburn, the smaller village of Grabben Gullen, as well as the localities of Kialla, Bannister, Pomeroy and Gurrundah. Traditionally, the local economy has been reliant on wool production. The area now includes potato production, olive production, alpaca and horse enterprises, as well as chicken and fish farms.

The Upper Lachlan Shire remains largely agricultural however tourism and rural residential land uses are of increasing economic importance. Tourism is the third largest industry behind agriculture and retail. Tourist activities promoted in the area include historic buildings and bridges, museums, memorials and galleries and nature-based recreation. Crookwell is the administrative centre of the Upper Lachlan Shire. Goulburn is a regional service centre.

One wind farm, Crookwell I, has been constructed in the region (eight turbines). Approvals have been granted for six additional wind farms (15 – 62 turbines; refer to Section 4). Features including the high quality wind resource, sparse settlement, general compatibility with existing land uses and the close proximity to electrical transmission infrastructure continue to make the area attractive to wind resource development.

3 DESCRIPTION OF THE PROPOSAL

3.1 General description

The proposal would involve the construction and operation of a medium scale wind farm in the Southern Tablelands region of NSW. The proposal includes:

- Up to 84 wind turbines, each with three blades mounted on a tubular steel tower
- Electrical connections between wind turbines using multiple step-up transformers and a combination of underground cable and overhead concrete or timber pole power lines
- A substation and transmission connection linking the wind turbines to the existing TransGrid 330kV transmission system located onsite
- An onsite control room and maintenance facilities
- Internal access tracks and minor upgrades to site access via Gurrundah Road, Range Road, Grabben Gullen Road, Bannister Lane, Prices Lane and Storriers Lane, required for the installation and maintenance of wind turbines and associated infrastructure

Additional temporary construction activities and infrastructure would be required during the construction and refurbishment or decommissioning phases.

Wind turbines proposed have a nameplate capacity of up to 3.3 megawatts. Accordingly the project would have the capacity to generate up to 278 MW.

A number of alternative turbines are being considered for the site within the broad physical parameters identified above. A list of turbines being contemplated is included in Table 3-1. The final turbine selection would be carried out through a competitive tender process pending Project Approval.

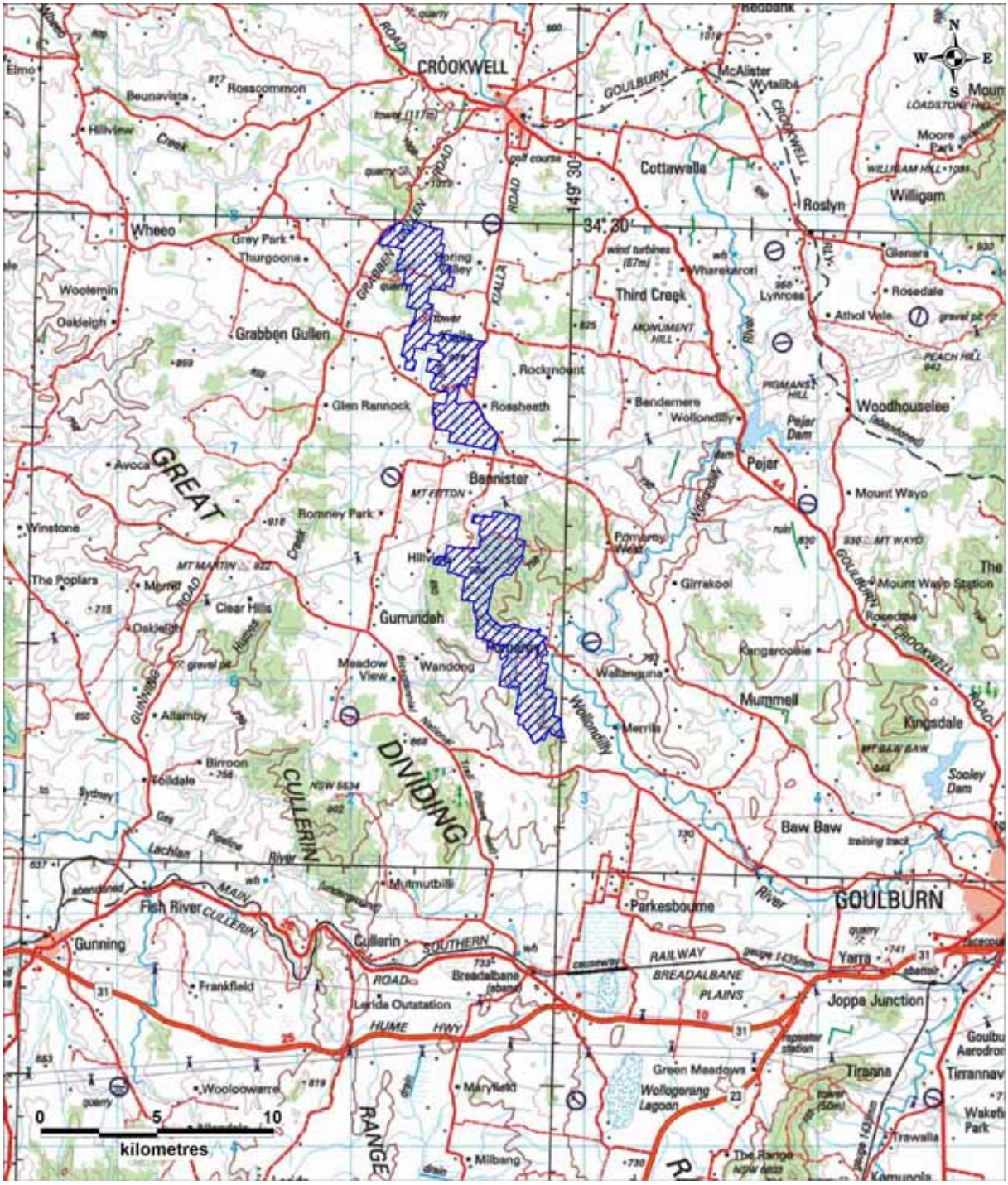


Figure 3-1 Site location

The site (hatched in blue) is located along a north-south running ridge system of the Great Dividing Range between Gunning, Crookwell and Goulburn in NSW's southern tablelands.

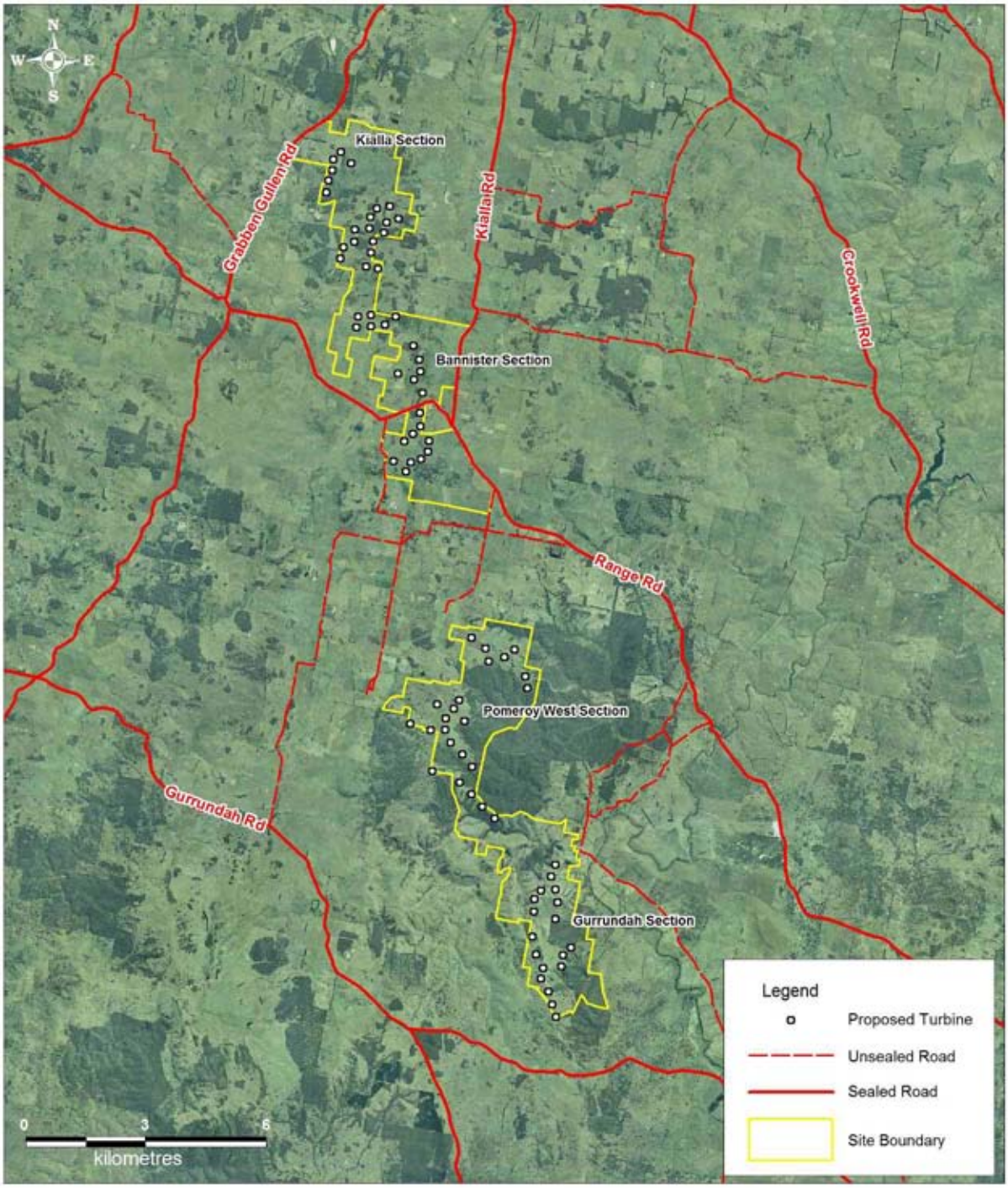


Figure 3-2 Site boundaries

The site involves four broad groupings of turbines located near the localities of Kialla in the north, Bannister, Pomeroy and Gurrundah in the south.

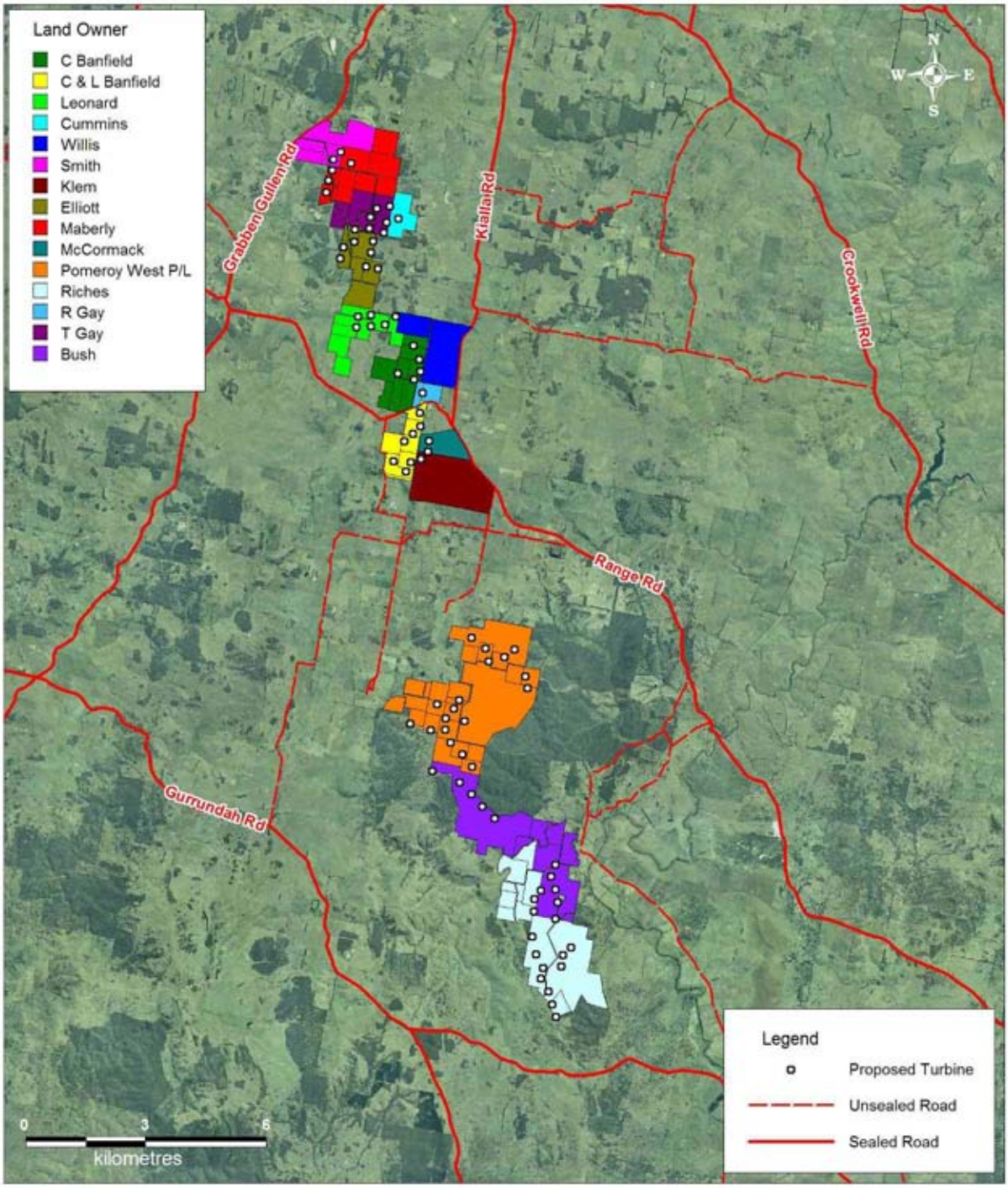


Figure 3-3 Landholdings

Up to 15 families would potentially be involved in hosting turbines. Depending on final turbine layouts, it is possible that not all families noted would host turbines.

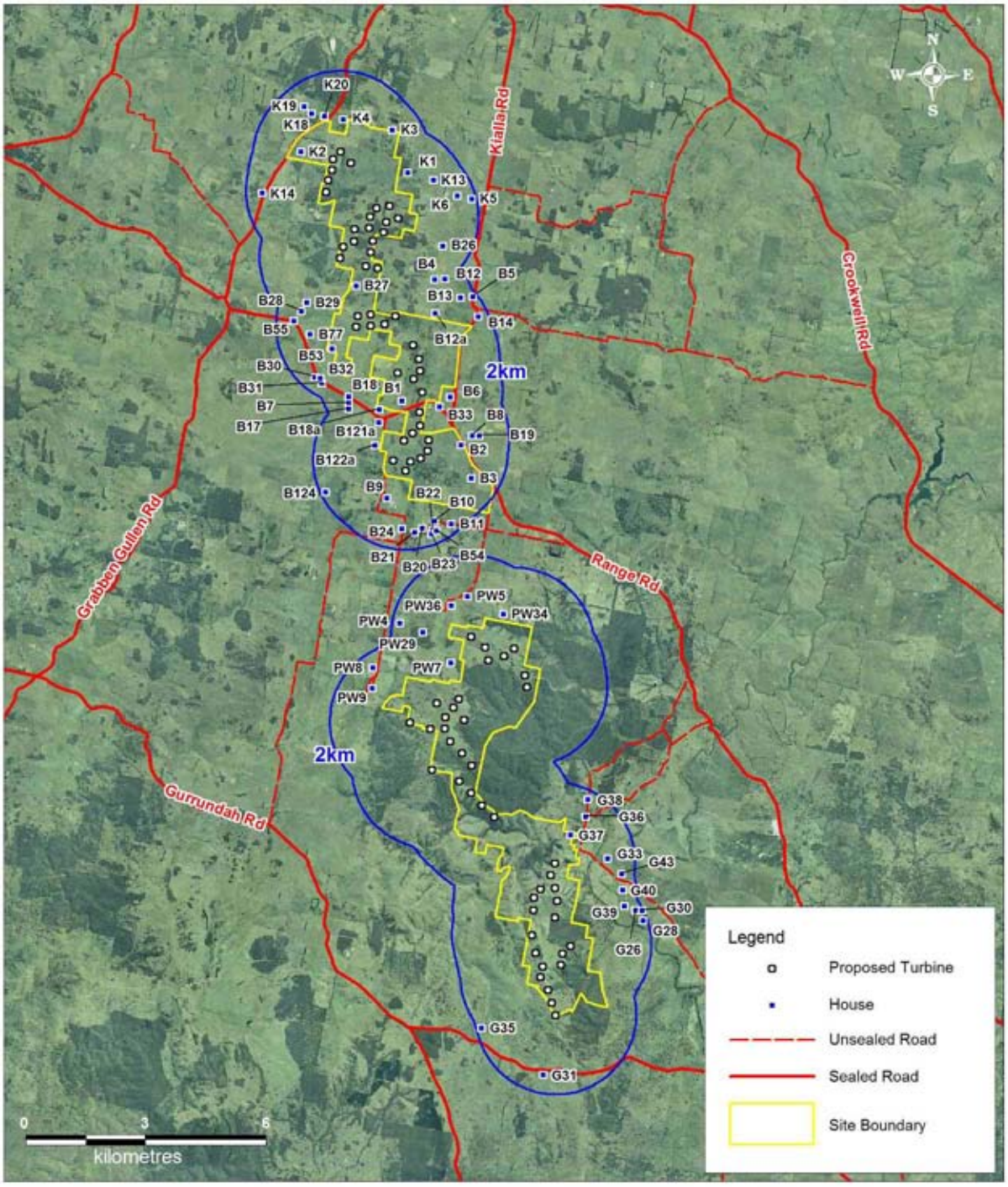


Figure 3-4 House locations (houses within 2km)

Approximately 71 houses are located within 2 kilometres of proposed turbines, 12 of which are landowners involved with the development.

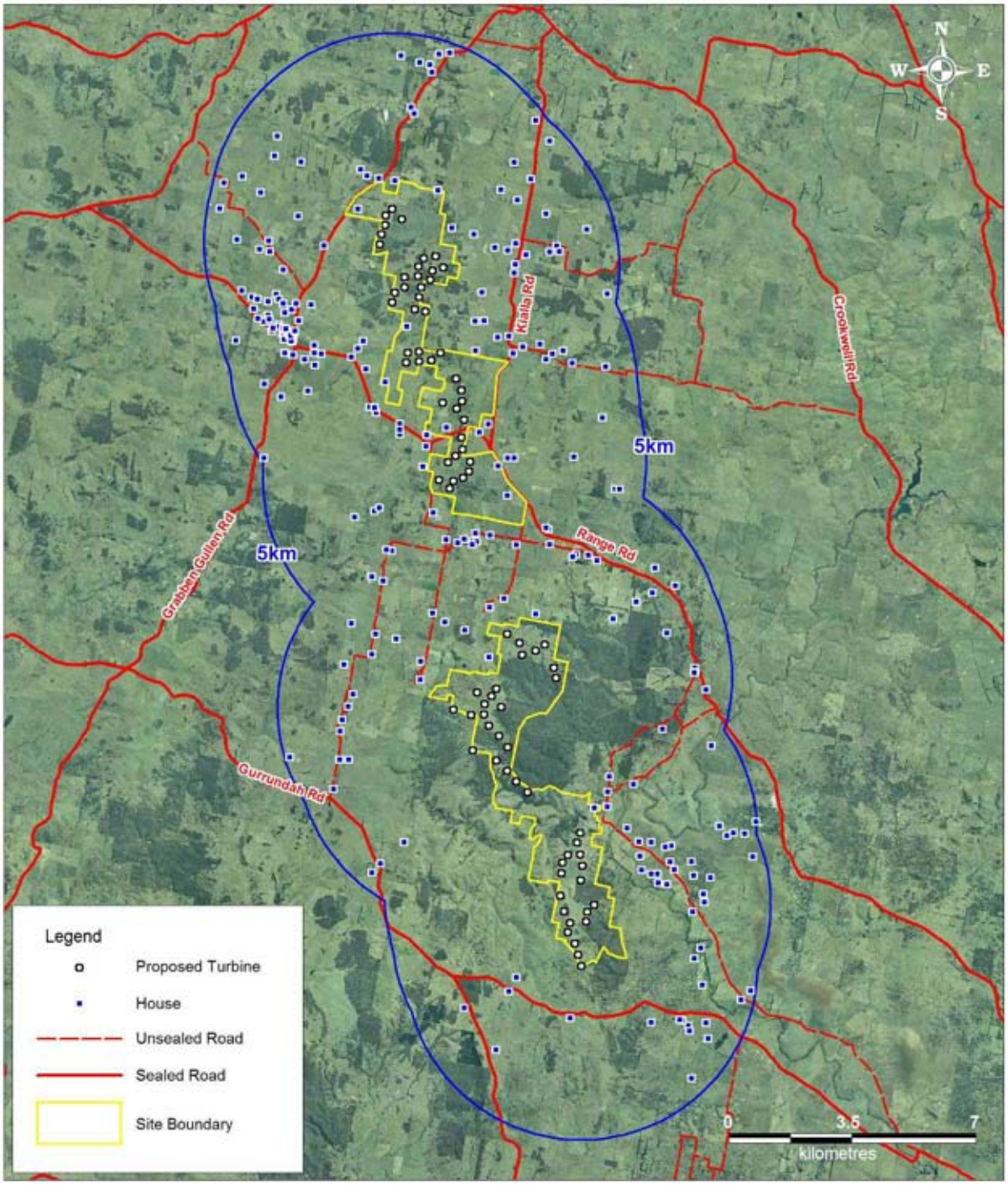


Figure 3-5 House locations (houses within 5km)

Houses more distant from the site are generally located within the communities of Grabben Gullen, Kialla, Pomeroy, Bannister and Gurrundah.

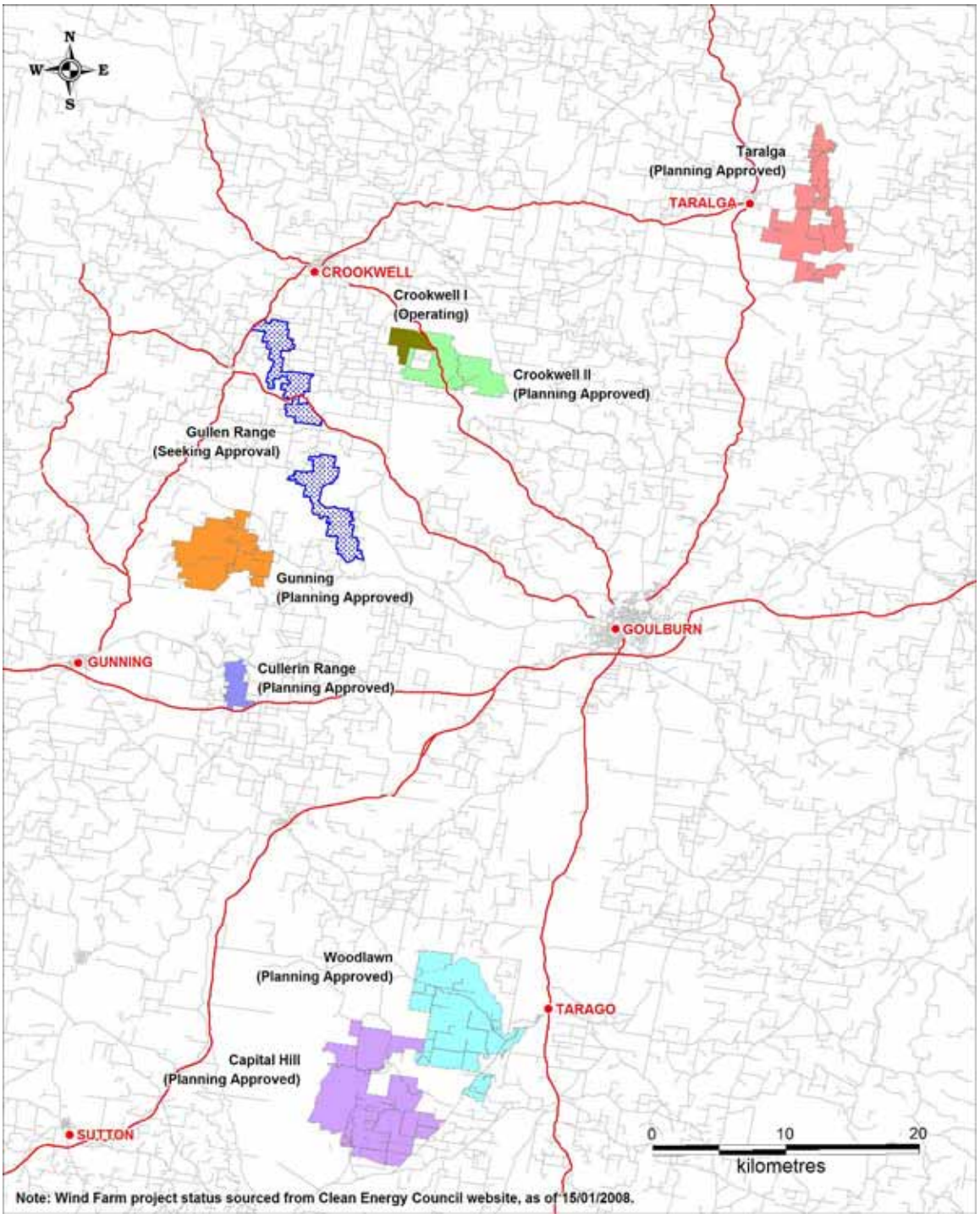


Figure 3-6 Proposed wind farms in NSW southern tablelands

One constructed and several approved wind farms occur in the region.

3.2 Wind farm infrastructure

3.2.1 Wind turbines – general description

Wind Turbines

The wind turbines currently under assessment have a diameter of 80 to 105 metres and a hub height in the range of 78 to 85 metres. Examples of turbines currently under consideration are outlined in Table 3-1. New turbines are continually coming onto the market, therefore it is possible that minor variations to these typical dimensions could occur prior to final turbine selection.

The maximum tip height proposed for the site is 135 metres above ground level. Any turbine selected would meet this overall tip height limit.

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.

Each wind turbine would be a three bladed type of the “up-wind” design, i.e., facing up into the wind and in front of the tower. This design reduces noise impacts.

Wind turbine blades are typically made of glass fibre reinforced with epoxy or plastic (fibreglass) attached to a steel hub, and include lightning rods for the entire length of the blade. Blades are manufactured in one piece and are therefore the longest element transported to and around site.

Each wind turbine would have a rated power capacity of between 1.5 and 3.3 MW, depending on final turbine selection.

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 lifting 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 or tubular steel and concrete tower up to 85 metres high, tapering from around 5 metres at the base to around 3 metres at the top. Exact dimensions would depend on the wind turbine design selected. The tower is constructed in up to five 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).

Lattice towers would not be used as turbine towers in the project.

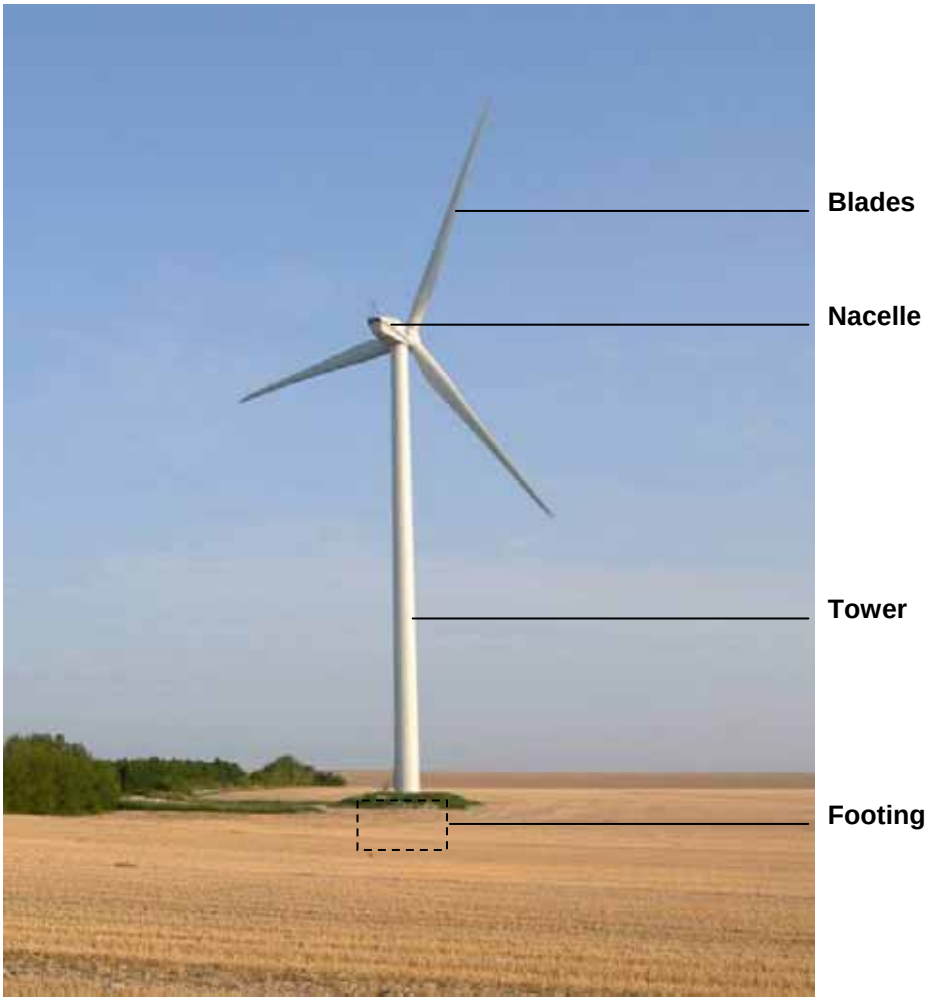


Figure 3-7 Typical wind turbine installed on an 80m tower

(Photo courtesy REPower Systems AG)

Access Tracks, Hardstands and Footings

The tower would be seated in a reinforced concrete footing and would require removal of rock and subsoil at the base of each turbine. 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.

Each wind turbine would require track access and cabling access to allow construction and connection to the site substation. Access tracks would typically be 6 metres wide (wider at bends) and be all weather graded tracks. Hardstand areas required beneath each turbine would be approximately 22m x 40m (900m^2).

Hardstands would be left in situ after construction to provide for ongoing maintenance and repairs if necessary. Access tracks would also be left in situ, however their width would be reduced to approximately 3 metres after construction is completed by covering with topsoil and revegetating.

Transformer

Each wind turbine generator would produce power at typically 690V, and up to 1,000V. This is then transformed 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

Civil Aviation Safety Authority (CASA) 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 turbines and obstacle beacons should not exceed 900m. Accordingly, if CASA considers that the project is likely to be a hazard to aircraft, it is expected that approximately 20 – 40 turbines in the proposed project may require aircraft warning lights. Requirements would be discussed with CASA once the final turbine layout is selected however it is assumed that aviation warning lighting will be required in accordance with CASA guidelines and the therefore the impacts are assessed in this EA. For a more detailed discussion on the requirement for night lighting, refer to Section 7.6.

Wind turbine controls and 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 controlled or shut down whenever these conditions are present.

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.

3.2.2 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 Clipper Wind (US), Vestas (Denmark), RE Power (Germany), Gamesa Eolica (Spain), Suzlon Energy (India), GE Wind (US), and Siemens (Germany). These suppliers are constantly bringing new turbines to market.

While all of the turbines under consideration meet the general description in Section 3.2.1, each wind turbine model is 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 project application has been determined and the conditions of approval are known.

Wind turbines under consideration

Table 3-1 shows the wind turbines currently under consideration for the site, together with key parameters of these turbines.

In general, different characteristics of turbine types require different turbine layouts, however to simplify the environmental assessment of the project a layout has been developed that reflects the characteristics of a large range of turbine types.

Every turbine has slightly different characteristics in terms of site suitability, physical size, energy production, and noise impacts. Further, some manufacturers provide different blade diameters for what is essentially the same machine. For example, REPower provides a nearly identical wind turbine with either 82m or 92m blades (MM82 or MM92 respectively). It is therefore possible to locate a combination of similar machines on the same site to provide the best overall outcome.

Final wind turbine selection would be carried out based on commercial considerations within the consent conditions stipulated by the Department of Planning. In particular, a final assessment of noise impacts would be undertaken prior to construction based on the final turbine selection and layout. The Proponent would ensure that noise predictions for the final turbine selection and layout meets the SA EPA Guidelines for non-involved houses or the WHO Guidelines for involved houses, as appropriate (refer to Section 7.3).

Table 3-1 Wind turbines under consideration

Turbine Supplier	Turbine Model	Turbine Capacity	Hub Height	Blade Diameter	Blade Tip Height
Clipper Wind	C89	2.5 MW	80m	89m	124.5m
Clipper Wind	C93	2.5 MW	80m	93m	126.5m
Clipper Wind	C96	2.5 MW	80m	96m	128m
Clipper Wind	C99	2.5 MW	80m	99m	129.5m
Gamesa	G80	2.0 MW	78m	80m	118m
Gamesa	G83	2.0 MW	78m	83m	119.5m
Gamesa	G87	2.0 MW	78m	87m	121.5m
Gamesa	G90	2.0 MW	78m	90m	123m
GE Wind	2.5xl	2.5 MW	75/85m	100m	125/135m
GE Wind	1.5sl/sle	1.5 MW	80m	77m	118.5m
GE Wind	1.5xle	1.5 MW	80m	82.5m	121.25m
Mitsubishi	MWT92	2.4 MW	70m	92m	116m
Mitsubishi	MWT95	2.4 MW	80m	95m	127.5m
Nordex	N90	2.5 MW	80m	90m	125m
RE Power	MM82	2.0 MW	80m	82m	121m
RE Power	MM92	2.0 MW	80m	92m	126m
RE Power	MM104	3.3 MW	78-80m	104m	130-132m
Siemens	SWT83	2.3 MW	80m	82.4m	121.2m
Siemens	SWT93	2.3 MW	80m	93m	126.5m
Suzlon	S88	2.1 MW	80m	88m	124m
Vestas	V80	2.0 MW	78m	80m	118m
Vestas	V82	1.65 MW	78m	82m	119m
Vestas	V90	1.8 MW	80m	90m	125m
Vestas	V90	3.0 MW	80m	90m	125m

Selection of representative wind turbines

The majority of issues identified with respect to this development are not impacted by specific turbine selection. However, the final turbine selection could have a material impact on some issues therefore a representative turbine has been selected to complete the analysis of these issues.

Representative turbines have been used for preparation of:

- Optimised wind turbine layouts
- Estimates of energy production and greenhouse gas reduction calculations
- Photomontages, Zone of Visual Influence, and Shadow Flicker analysis for the Visual Impact analysis
- Noise propagation assessment for the Noise Assessment

This Environmental Assessment and the related specialist studies consider scenarios based on turbines that provide representative impacts.

The noise assessment considers both the REPower MM82 and MM92. The physical and noise characteristics of these turbines are relatively indicative of the wind turbines available, and the analysis demonstrates that it is possible to achieve the noise limits set by the SA EPA guidelines and WHO guidelines as appropriate. The MM82 has noise characteristics that are representative of the smaller turbines (78 - 83m blade diameter) and a compliant layout has been developed. The MM92 represents the larger turbines (87-105m blade diameter). The layout, as presented in this EA, has been formulated to allow design responsiveness to achieve the noise criteria in relation to the final selected turbines specific noise characteristics. Accordingly by contemplating that turbines can be relocated within a reasonable distance of their proposed location or removed to achieve the SA EPA Guidelines, a single flexible layout can be presented and assessed. Additional analysis of the sensitivity of the physical dimensions (hub height and maximum tip height) on noise propagation and a worst case scenario, requiring mitigation, is presented in the noise assessment.

The approach undertaken simplifies the noise assessment process by avoiding a different layout for each proposed turbine. The Statement of Commitments (SoC 8) affirms that modelling of the final turbine on the final layout would be undertaken and measures would be taken to ensure compliance with the SA guidelines.

The visual assessment is conducted using the turbine with the largest tip height (a GE Wind 2.5xl) in the group. This turbine has 100m blade diameter on an 85m tower for a tip height of 135m, and therefore reflects a worst case visual impact.

3.2.3 Wind turbine layouts

Preparation of wind turbine layouts

The Proponent has prepared a wind farm layout which identifies 84 wind turbine locations (refer to grid co-ordinates, Attachment 4). This layout reflects the typical spacing required for wind turbines under consideration. This layout was prepared by wind energy consultants Garrad Hassan Pacific Pty. Ltd.

To prepare this layout, the Proponent provided Garrad Hassan with key site parameters and constraints, including:

- Site boundary
- Aerial photography of the site (for production of vegetation maps)
- High resolution topography of the site (5m contours)
- Wind speed data collected on site (4 separate monitoring masts)
- 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)
- Information on communications constraints caused by the location of the communications tower on site and related microwave/uhf links
- Operating parameters of selected representative wind turbines

Garrad Hassan then prepared an optimised wind turbine layout that could accommodate the turbines under consideration using a variety of specialised software packages including WaSP and Windfarmer™, as follows:

- Preparation of wind speed correlation at the 4 monitoring mast locations (comparison of measure period with long term Bureau of Meteorology wind monitoring sites) to determine likely long-term wind speed characteristics at the monitoring locations
- 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, noise limits on neighbouring residences, EMF interference, and proximity constraints)
- Calculation of likely long term average wind energy production at each turbine

The wind speed profile across the site is shown in Figure 3-8 and Figure 3-9. This demonstrates the significant variability of wind speed across the site, which would help to explain the requirement to carefully select the appropriate turbine for the site.

Turbine layout optimisation was carried out using REPower MM82 and MM92 turbines which are representative of turbines under consideration. Minor adjustments to the optimised layout were then carried out to take into consideration site constraints, access and related issues.

The turbine layout has undergone a preliminary review to determine that the layout is reasonably suitable for construction and would comply with expected consent conditions. However, minor relocation of specific turbines may be required prior to construction to take into account a number of factors including:

- Final turbine selection
- Final wind speed and energy yield analysis
- Additional site constraints identified through ongoing investigations
- Constraints identified in relation to site constructability or construction cost minimisation
- Constraints identified in relation to turbine suitability assessment of the site
- Constraints identified after the results of final geotechnical investigations at each turbine location are completed

Depending on final turbine selection, it is possible that not all turbines proposed would be installed to ensure that the project continues to meet all consent conditions (e.g. noise constraints).

In particular, there are a number of houses near the site, particularly towards the southern end of the Bannister section, which are likely to create noise constraints. Detailed noise analysis has been carried out using both MM82 and MM92 machines. In the vicinity of Kialla, this analysis demonstrated that for these turbines compliance could be achieved at the site by removing a small number of turbines. This is addressed in more detail in the Noise Assessment. Additional mitigation options include using quieter turbines, using noise control modes where available, or entering into noise agreements with affected residents.

It is likely that turbines would not need to be removed from site depending on final turbine selection however, the Proponent acknowledges the importance of meeting all criteria including noise criteria. Accordingly, the Proponent acknowledges these constraints and would remove turbines from the current layout where necessary to meet all noise criteria.

To that end, a final layout would be prepared after final turbine selection has taken place and prior to construction (refer to Statement of Commitment 8). This final layout would be adjusted to ensure all criteria (including noise criteria) are achieved.

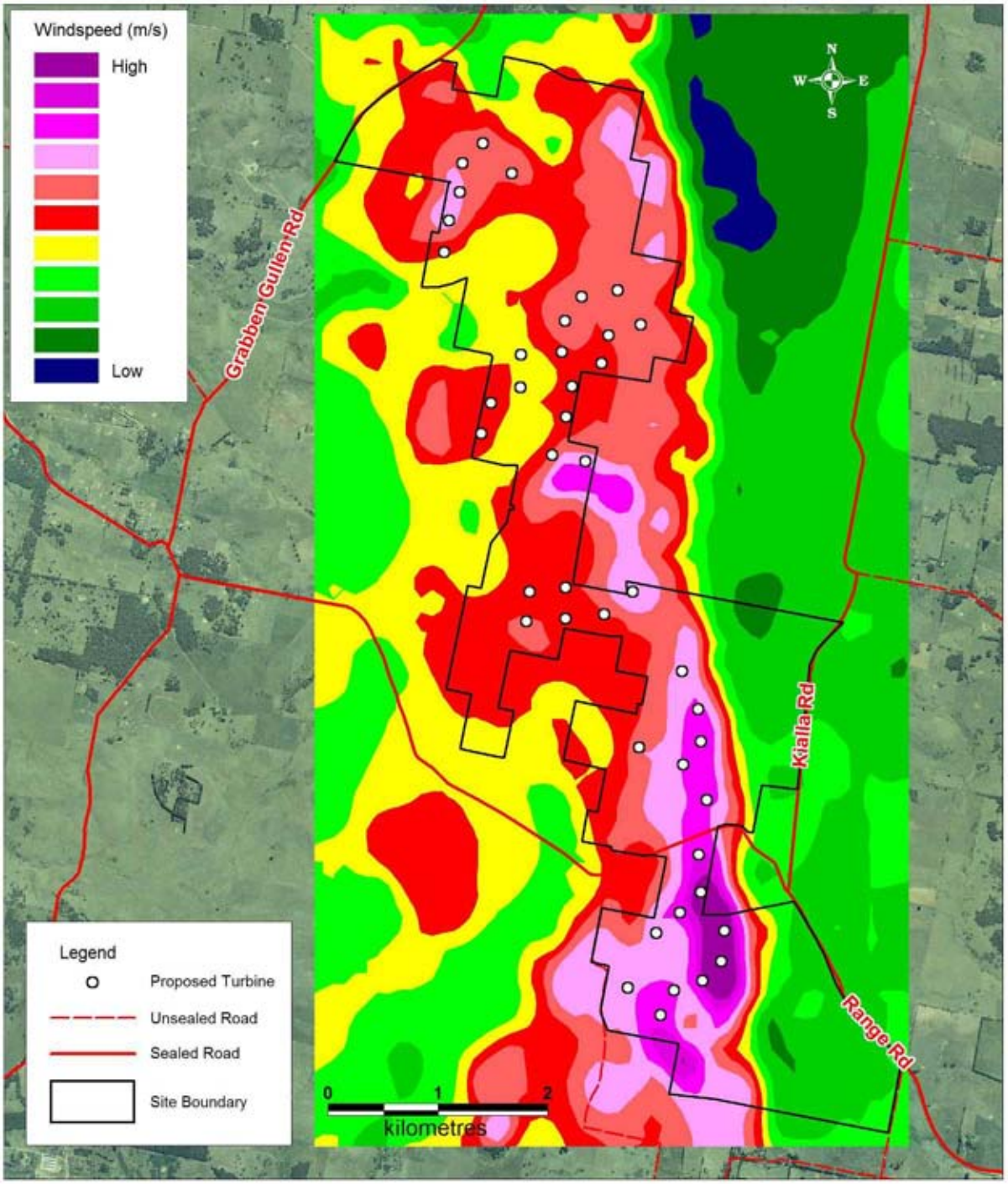


Figure 3-8 Wind speed profile across the site – northern section

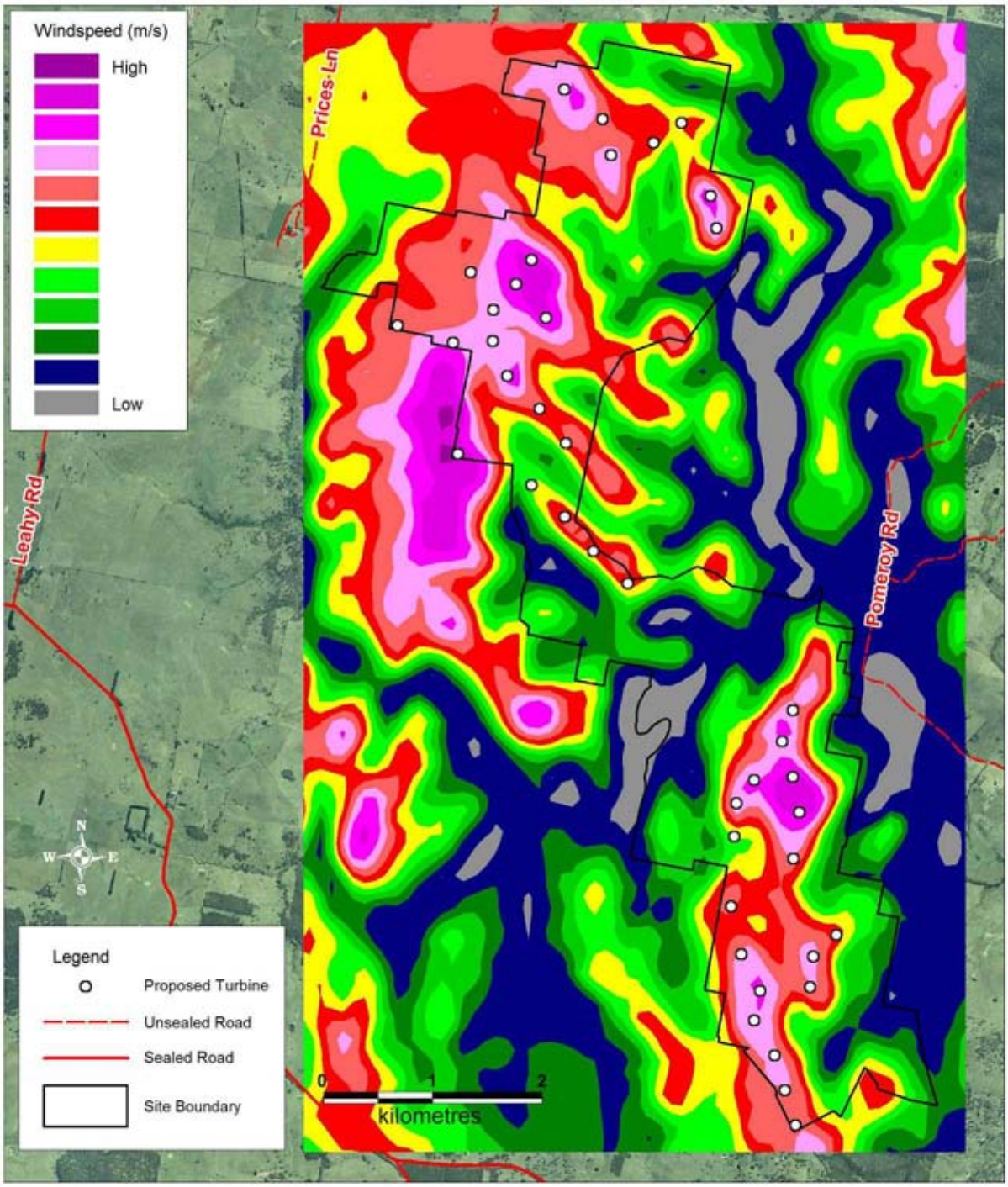


Figure 3-9 Wind speed profile across the site – southern section

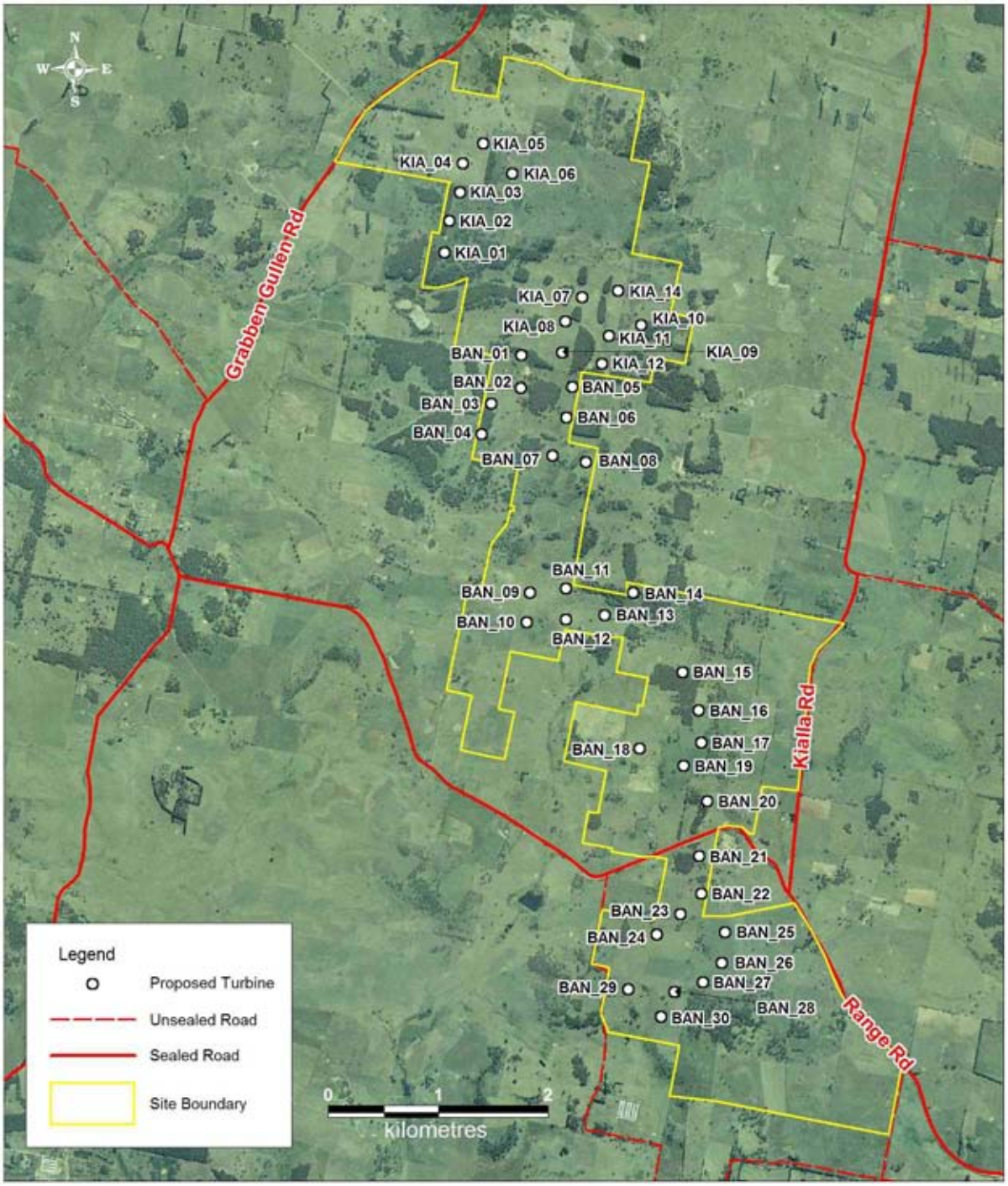


Figure 3-10 Turbine layout, northern section

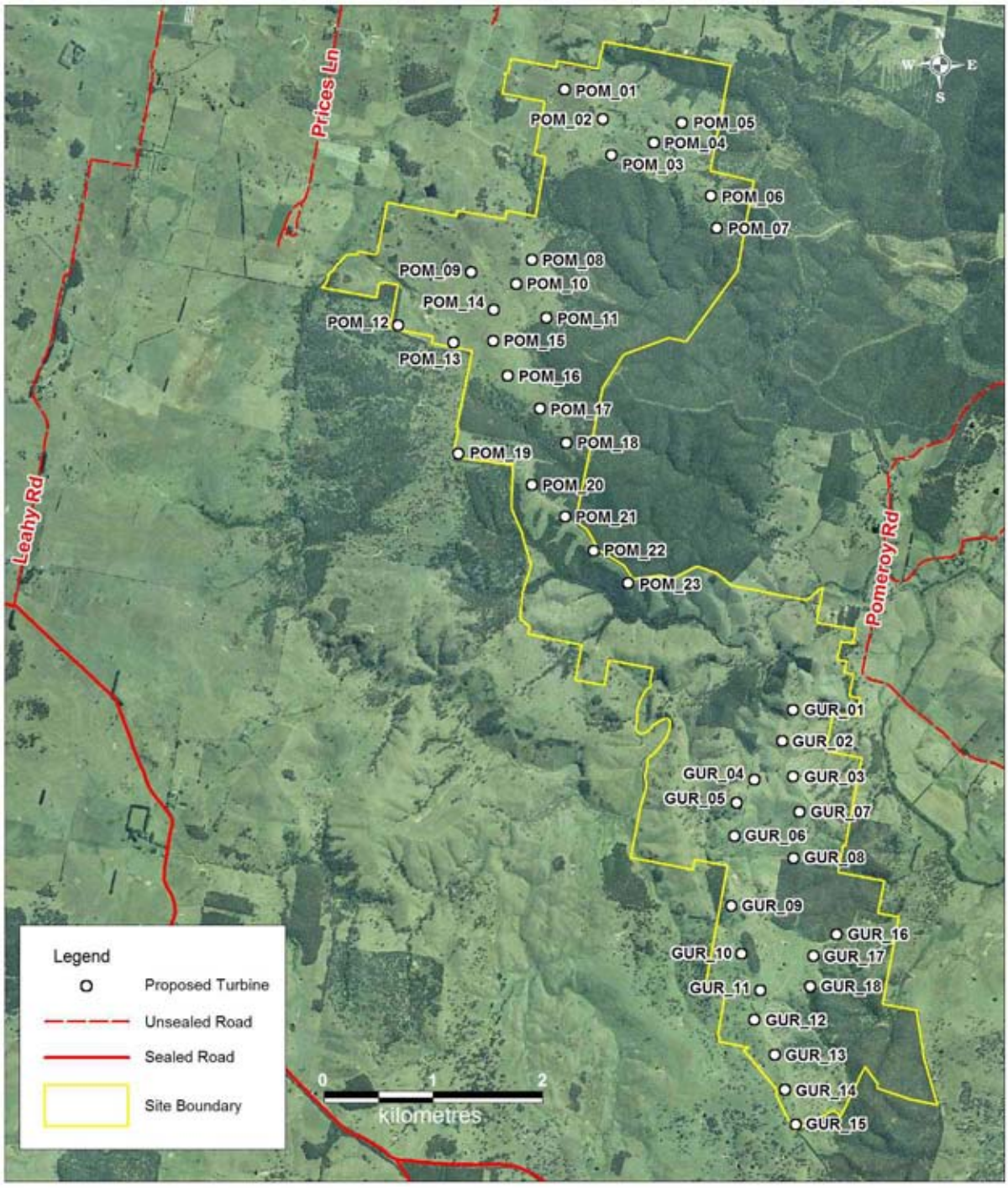


Figure 3-11 Turbine layout, southern section

3.2.4 Electrical connections and substation

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 330kV, suitable for connection to TransGrid's Yass-West Sydney 330kV transmission line which crosses the site
- Onsite power reticulation cabling (underground and overhead) at either 22,000V (22kV) or 33,000V (33kV) to connect wind turbines to the control room and site substation
- Onsite control and communications cabling
- An onsite control building housing control and communications equipment

Site substation and 330kV connection

A substation is required to convert power from on-site reticulation voltage of 22kV or 33kV to a transmission voltage of 330kV suitable to connect into TransGrid's transmission system. It would also include all necessary ancillary equipment such as control room and amenities, control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation.

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

Figure 3-12 Coffs Harbour 330/132kV substation (courtesy TransGrid)

The proposed 330kV substation would be located on-site, taking up an area of up to 200m x 150m surrounded by a security fence. This is typical for high voltage substations of this kind (e.g. the Coffs Harbour 330/132kV substation occupies an area of approx. 160m by 100m). It would be located in the Pomeroy area at the point near where the existing 330kV line crosses the site. 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; and to reduce visual impacts and ground disturbance of the site.

The potential to establish a bushfire Asset Protection Zone (APZ) that complies with the RFS *Planning for Bushfire Protection* guidelines has been evaluated based on the vegetation type and slope. The site parameters (predominantly flat land with limited continuous canopy cover) indicate that a compliant inner protection area (which can be maintained under continued grazing practices) and outer protection area would be achievable.

The substation would include up to two large power transformers. The transformers are 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. Other equipment in the substation includes circuit breakers and a 330kV busbar.

It is likely that alterations would be required to the existing transmission line to allow connection of the new cabling. This may include the construction of new power poles at the connection point to direct the conductors to the proposed substation. A separate lower voltage supply would also be required to provide backup power to the substation.

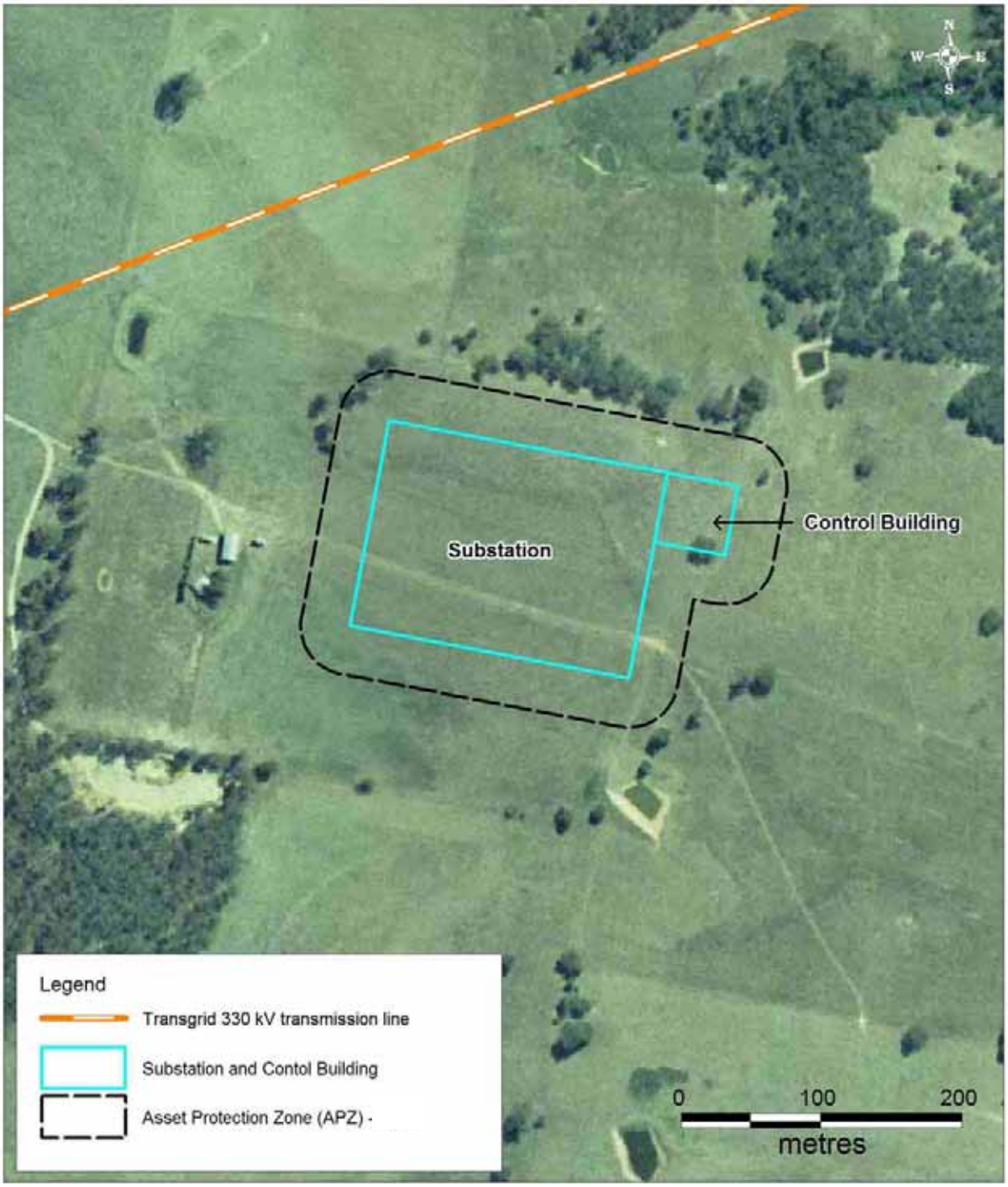


Figure 3-13 Substation and control building locations with indicative APZs

Site parameters (predominantly flat land with limited continuous canopy cover) indicate that inner and outer protection areas compliant with the RFS Planning for Bushfire Protection guidelines would be achievable.

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 22kV or 33kV for reticulation around the site. The selection between these voltages is both a technical and commercial consideration; power line easements, cable trench design, and reticulation routes are similar for both voltage levels.

Each wind turbine must be connected together at reticulation voltage, and then connected to the site substation. These connections are to be made using underground cabling. One section of overhead cabling is proposed to connect Gurrundah to the Pomeroy section of the site and there is an alternative option for connecting the Kialla turbines to the Bannister turbines that may involve an overhead cable along a section of Kialla Road. The selection of the preferred route in this area will depend on final landowner agreements for routes over freehold land.

Cable trenches would, where reasonable, be dug within or adjacent to 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.

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.

Interaction with TransGrid

The Proponent has submitted a Grid Connection Application, and seeks to finalise a Grid Connection Agreement with TransGrid on the basis of the proposed connection arrangements and in accordance with the National Electricity Code. This Grid Connection Agreement would include all technical requirements for safe connection of the wind farm to the NSW electricity grid.

Relevant stakeholders including TransGrid and NEMMCO would be consulted in preparation of the related Grid Connection Application.

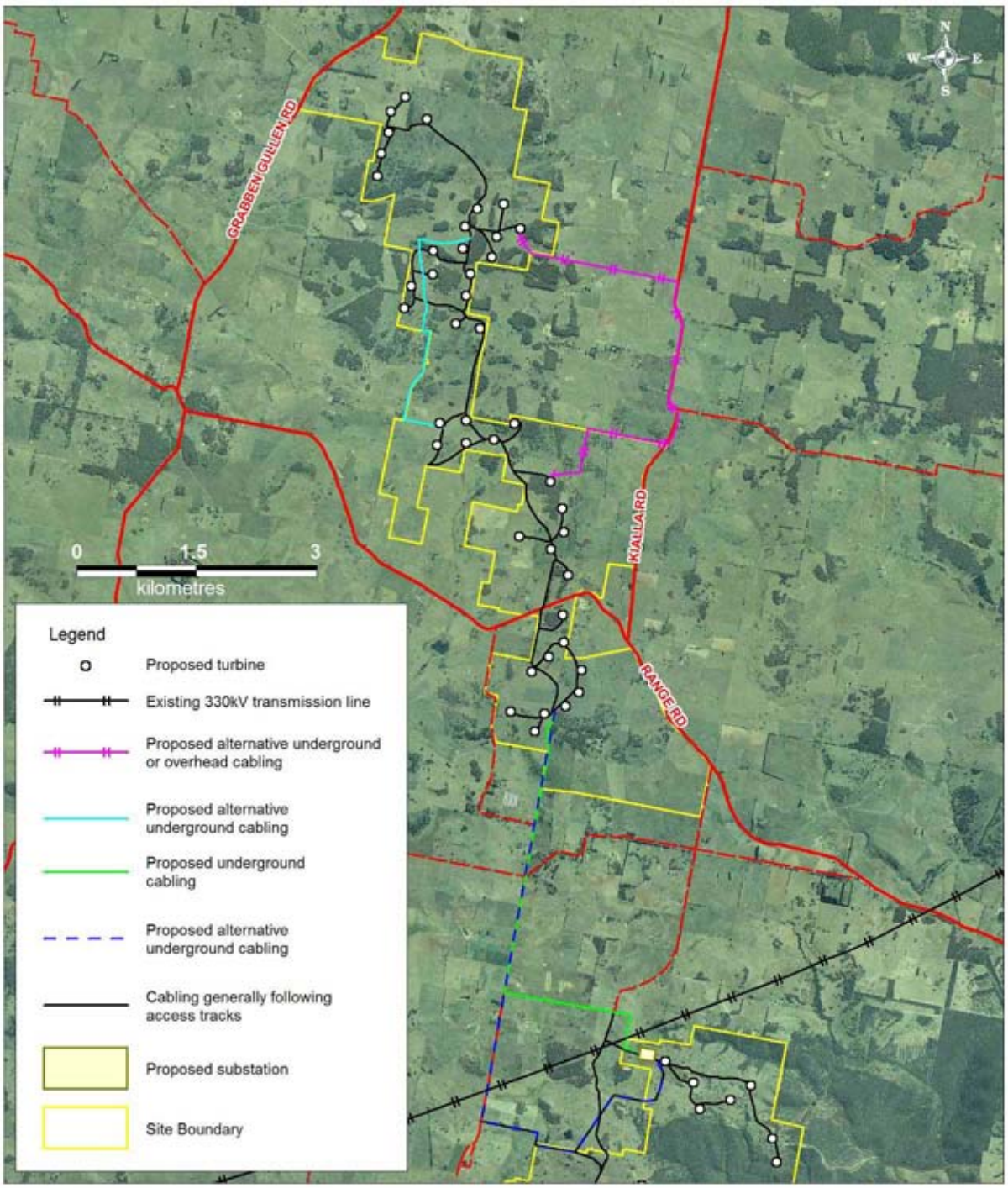


Figure 3-14 Electricity reticulation – northern end of site

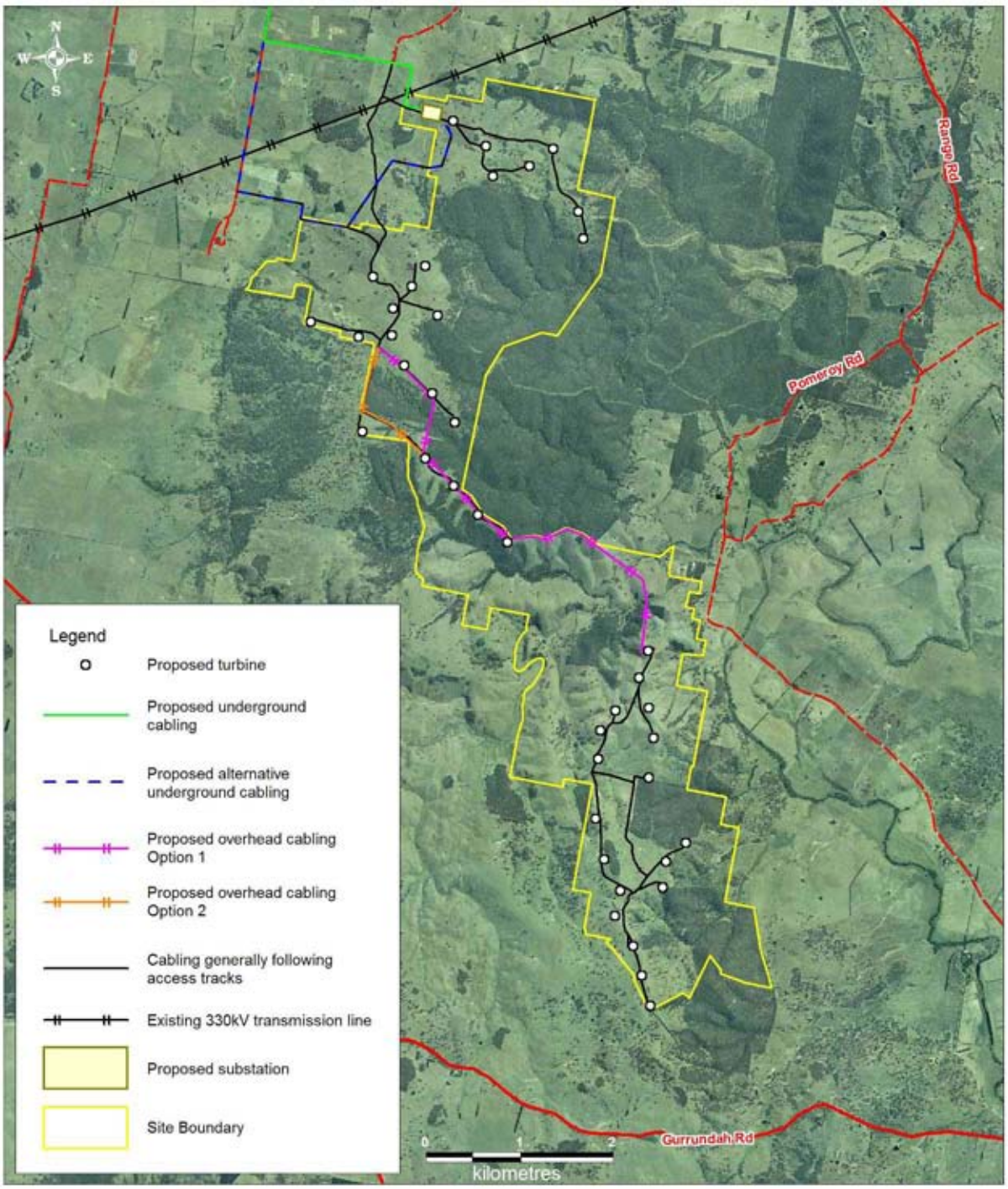


Figure 3-15 Electricity reticulation – southern end of site

3.2.5 Site civil works, roads, and access

Access route

Access to the site is complex because of the distance between the four proposed groups of wind towers along the Gullen Range. Traditional access to most of this area has been via Goulburn to Crookwell (Regional Road 54) and then to the sites via Regional Road 52 to Grabben Gullen or Kialla Road to Bannister.

Access to properties directly west of Goulburn would be provided by Range Road and Gurrundah Road which are under local council control. Kialla Road serves a similar function for access south from Crookwell. These roads carry relatively small traffic volumes as the area is sparsely populated. These roads vary significantly in their ability to safely cater for concentrated volumes of large vehicles but would provide adequate access for increased numbers of light vehicles.

However preferred access to the site would be via the State Roads (Crookwell Road and Grabben Gullen Road) to Grabben Gullen because of the higher standard of construction and potential safety on the State Roads. Access to the central section of the project from Grabben Gullen would be via Range Road and Bannister Lane. Oversized and overmass vehicles cannot use Range Rd from Goulburn and accordingly these vehicles would use a combination of Crookwell Rd, Grabben Gullen Rd and Kialla Rd.

The northern access into the Kialla site would be directly off Grabben Gullen Road. Access to the Pomeroy site off Bannister Lane would be via Storriers Lane or Prices Lane. Access between the central section and the Gurrundah site would be via Bannister Lane (western section) and Gurrundah Road.

The proximity of the proposed Gurrundah site to the Hume Highway at Breadalbane introduces another alternative route (Breadalbane to Gurrundah Road) from the south to the southern extents of the current project. This link may be preferred for the transport of some heavy and oversize loads.

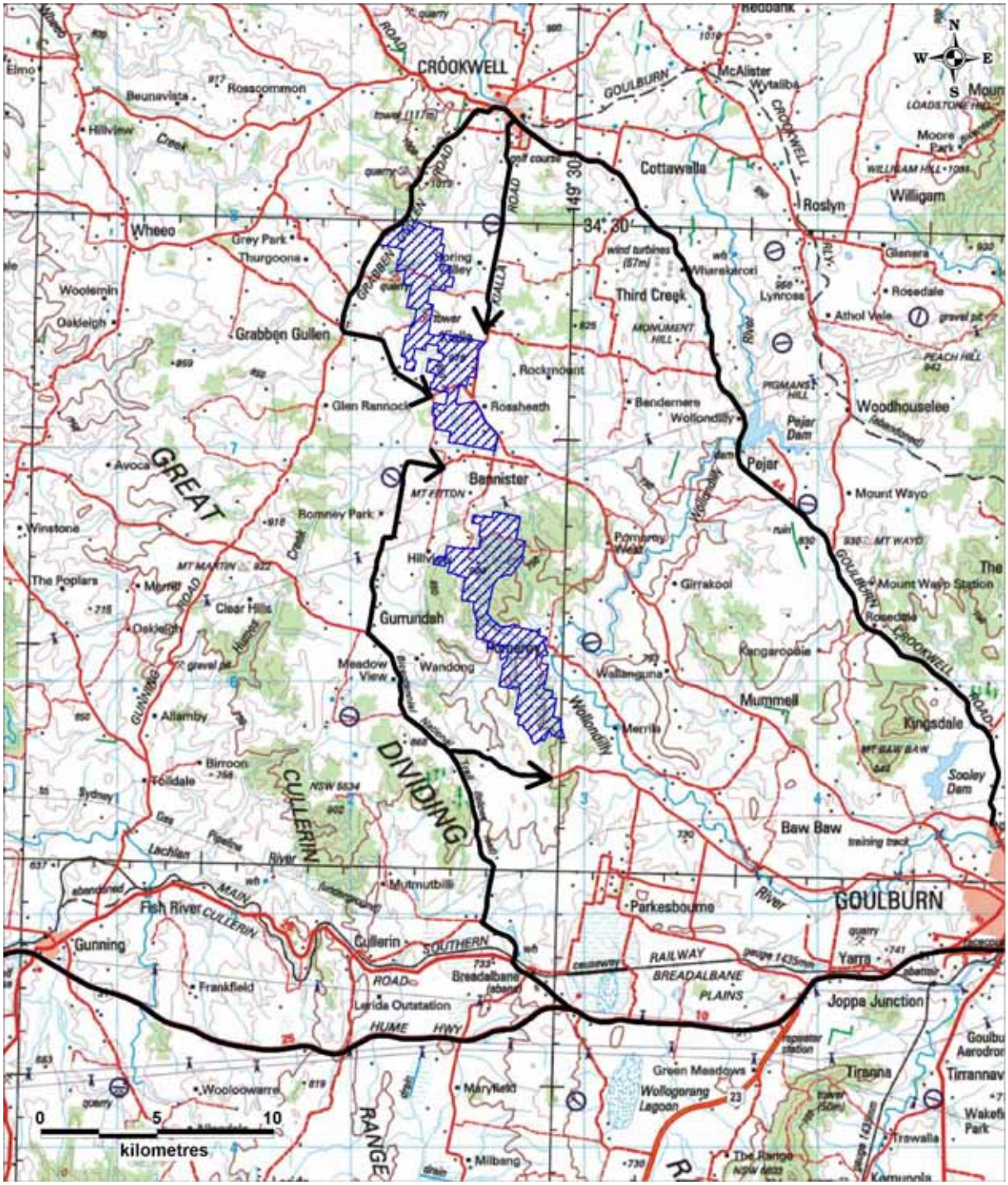


Figure 3-16 Proposed external access for over-dimensioned vehicles to the site

Proposed external access routes shown in black.

Vehicle management

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

During construction, light vehicles would generally operate within 1 hour of the normal construction hours on site. However, the delivery of turbines to the site via oversize vehicles may occur at night, outside normal construction hours, in order to ensure safe passage during low traffic conditions.

Traffic management is discussed in more detail in Section 7.10. A Traffic Management Plan (TMP) would be prepared to properly manage traffic impacts in accordance with Section 7.10. It would be developed in consultation with the RTA to ensure that the measures are adequate to address potential safety and asset degradation impacts.

Access tracks

On site access tracks for construction and operation would be unsealed formations up to 6m in width, or up to 12m in width where passing lanes are required, and are required to the base of each wind turbine location and the location of the site substation and control building.

A main access track would be located approximately as indicated in Figure 3-18. This figure shows proposed existing tracks (some requiring upgrade) in light blue, and proposed new tracks in dark blue. From this main access track, 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 (approximately 22m x 40m; 900m^2 in area). 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 in consultation with the landowners. Both hardstand and access tracks would be maintained on site to allow maintenance and repairs to the wind turbines.

In locating access tracks on site, 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 access tracks to minimise clearing of native vegetation
- Locate access tracks to minimise impact on sensitive biodiversity or heritage areas
- Construct access tracks with due regard to erosion, sediment control and drainage

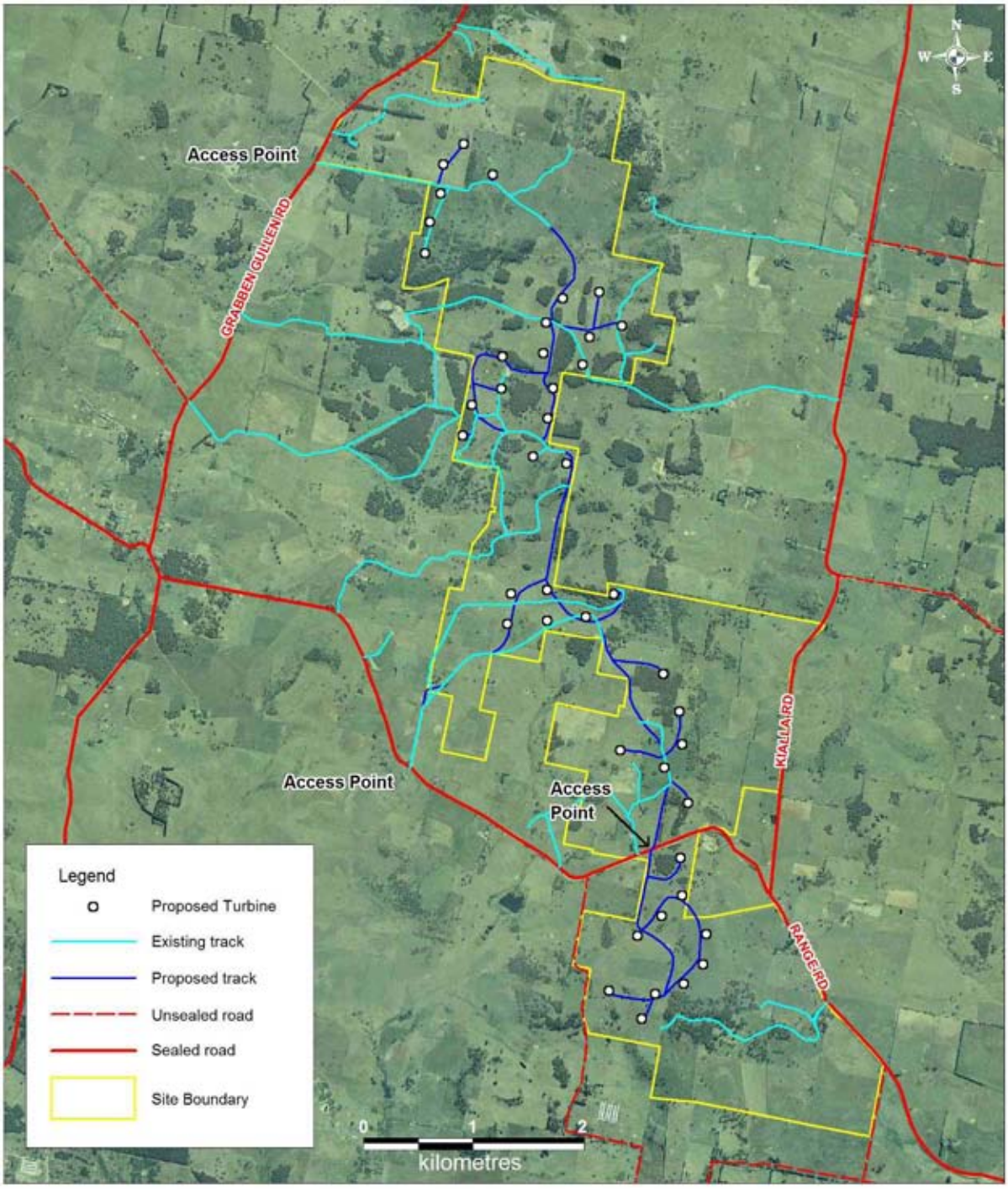


Figure 3-17 Indicative site access tracks, northern section

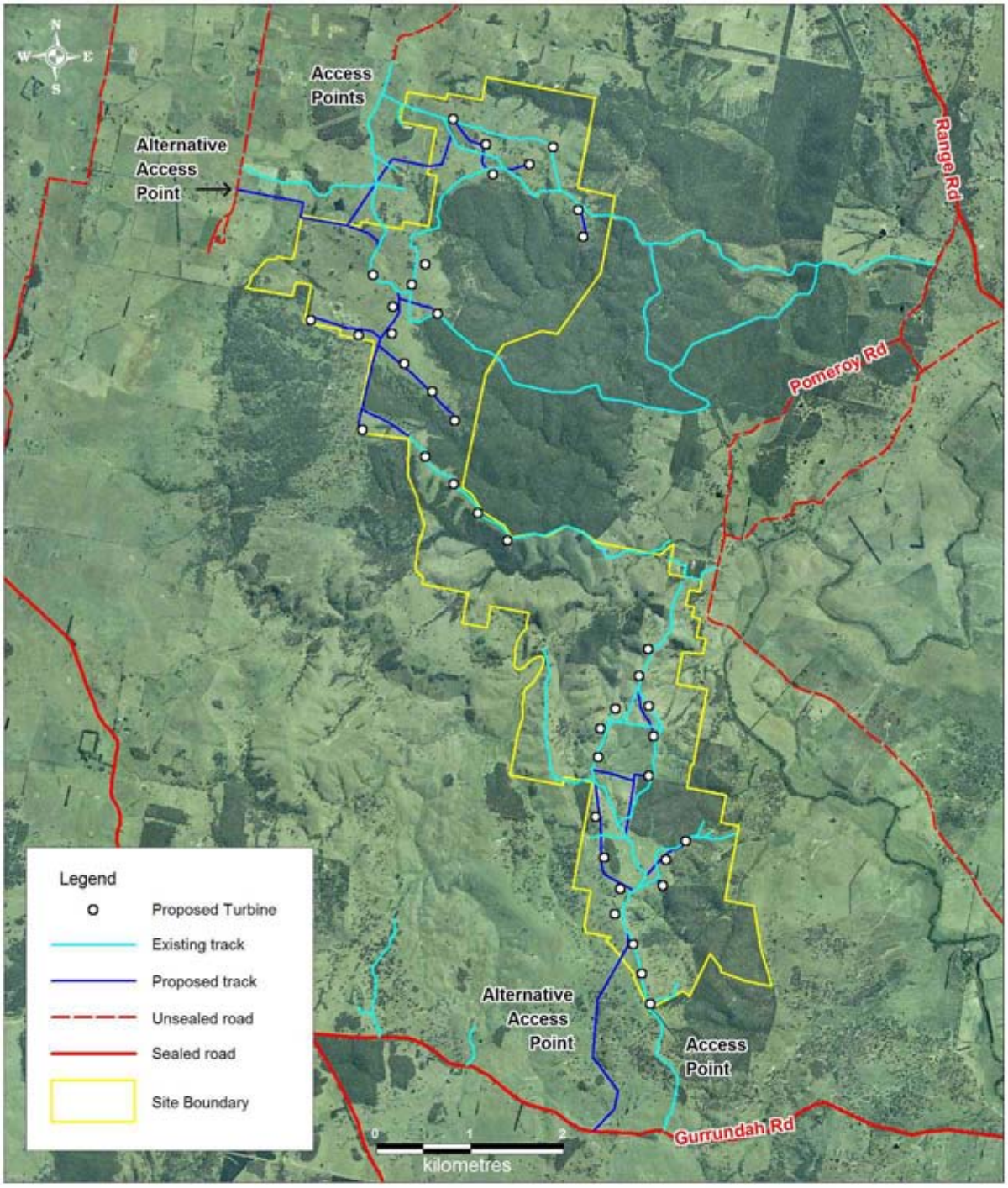


Figure 3-18 Indicative site access tracks, southern section

3.2.6 Wind monitoring equipment

The Proponent is currently maintaining a number of tall wind monitoring masts across the site to assess wind speeds at proposed turbine locations. Following construction, permanent wind monitoring masts would be required at the site to assist the control and operation of the wind farm. These would be static guyed towers with remotely operated wind monitoring equipment at multiple heights on each mast.

Pending final wind turbine placements, it may be necessary to maintain the existing wind monitoring masts, move the existing wind monitoring masts to different locations within the site, replace the wind monitoring mast with a shorter or taller wind monitoring masts, or install additional wind monitoring masts to assist with control and operation of the site. These masts would be located within the development envelope assessed in the various studies reported in this document. Accordingly, the scope of works includes all monitoring masts required for the site.

3.2.7 Control and maintenance facilities

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

The control building is expected to be of concrete slab on ground construction with steel frame, metal or brick walls, a non-reflective sheet steel (colourbond) 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 would be air-conditioned. The internal layout of the control building would be finalised after the Grid Connection Agreement has been completed with TransGrid. Parking would be provided adjacent to the building. Figure 3-19 represents an indicative control building.

Communications 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, broadband cable, microwave 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 be installed at the control building.

The control building would be located adjacent to the site substation, and is expected to be a joint facility for control of the substation as well as the wind farm (refer to Figure 3-13) and would also encompass storage of maintenance components.

Figure 3-19 Indicative control building

3.2.8 Other site services

Temporary power (11kV) would be required for the construction phase. In addition, a permanent power supply (11kV) would be required for the onsite substation to allow backup supplies to the substation in the event of an outage on the main 330kV transmission line. The 11kV lines are typically the same sized distribution lines that provide domestic power supply to houses in the area of the site. There is an existing 11kV line that extends to a location close to the proposed substation location (adjacent to an existing shearing shed).

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

3.3 Modifications to equipment locations

The equipment locations incorporated in this Proposal have undergone preliminary review to determine that the layout is reasonably suitable for construction and would comply with likely consent conditions and environmental constraints. Minor relocation of equipment may be required prior to construction however, as a result of a number of factors including:

- Final turbine selection
- Final wind speed and energy yield analysis
- Additional environmental constraints identified through any ongoing site investigations
- Constraints identified in relation to site constructability or cost minimisation
- Constraints identified in relation to turbine suitability assessment
- Constraints identified after the results of final engineering and geotechnical investigations are completed.

In a recent NSW Land and Environment Court ruling (Taralga Landscape Guardians v. Minister for Planning NSWLEC 2007) the Court found in relation to relocation of wind turbines in that circumstance:

> "… that a 250 m relocation of any of the elements is not unreasonable."

While this finding could be perceived to be site specific, it accepts the principle in relation to equipment relocation and provides some guidance as to acceptable relocation distances.

It is recognized that in accordance with the *Environmental Planning and Assessment Act 1979* any equipment relocation is required to be broadly consistent with the Proposal as outlined, otherwise an application for modification of the Development Consent would be required.

Minor relocation of wind turbines is likely in accordance with the factors outlined above, and would also require minor relocation of tracks and electrical connections as well as possibly relocation of site substations.

The Proponent considers that in relation to this Proposal:

- Relocation of wind turbines and other equipment of up to 250m would have negligible effect on visual impacts of the Proposal and is broadly consistent with the Proposal
- Relocation of wind turbines and other equipment in excess of 250m may or may not have a material effect on visual impact of the Proposal and therefore whether it is consistent with the Proposal would be considered by the Proponent on a case by case basis
- Relocation of wind turbines and other equipment is broadly consistent with the Proposal where the principle acceptability limit criteria outlined in the South Australia EPA Noise Guidelines for Wind Farms (February 2003) is achieved at neighbouring (non-involved) residences as outlined in Section 7.3
- Relocation of any equipment in a way which does not notably increase impacts to native vegetation, biodiversity, indigenous heritage or non-indigenous heritage (considered as a whole) is broadly consistent with the Proposal

3.4 Construction facilities and staging of works

The works establishment of the wind farm can be considered as occurring in four phases. These include construction, operation, refurbishment and decommissioning of the wind farm. A description of activities under these headings follows.

3.4.1 Phase 1: Wind farm construction

Before Project Approval has been received, it is not possible to define the timeline for the construction of the project. It would be expected that from the time Project Approval is received, it would take a further year to finalise the additional agreements required before construction could commence. This includes finalising the grid connection agreement and ordering long lead-time items such as transformers and turbines.

The construction phase of the wind farm would then occur over a 12-24 month period and would include such activities as:

- Transportation of people, materials and equipment to site
- Civil works for access track construction, footings and trenching for cables
- Establishment, operation and removal of up to two concrete batching plants
- Potential use of rock crushing equipment onsite, if required

- Potential use of blasting in foundation excavation, if required
- Installation of wind turbines using large mobile cranes
- Construction of substation and onsite power reticulation lines and cables
- Construction of temporary site offices and facilities
- Temporary site storage
- Restoration and revegetation of disturbed onsite areas on completion of construction works

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 approximately 2 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, 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. It is also necessary to have a delivery area for the various components adjacent to the hardstand 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 plants

It is possible that pre-mix concrete would be brought to site from local batch plants in Crookwell or Goulburn. However, up to two portable concrete batch plants may be required to supply concrete onsite and therefore two concrete batch plants forms part of this proposal.

The concrete batch plants would involve a level area of approximately 100 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. The site would 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.

One batch plant would be located on an existing clear and level area of the site, adjacent to the substation at Pomeroy. The other would be located in the central section of Gurrundah.

Each concrete batching plant would produce up to 340m^3 of concrete per day when a foundation is being poured. The maximum operational period would be 12 months and each plant would produce a maximum of 850 tonnes per day. This is equivalent to 53,550 tonnes during the project assuming that 75% of the concrete is produced from onsite batching plants. The batch plant would therefore require a license to be issued by DECC (under the *Protection of the Environment Operations Act 1997*), given the amount exceeds the license threshold of 150 tonnes per day. License conditions specified by DECC are likely to include operational protocols and monitoring.

Sands and aggregate would be sourced from excavation of footings, where possible, or from existing sand and gravel pits within the local area. 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.

Water required for onsite concrete batching would be sourced from an existing licensed onsite bore adjacent to the substation location (at Pomeroy) or would be trucked in from suitable dams or water storage areas (with agreement from relevant authorities, for example Council), such as the nearby Pejar dam. Where possible and where there is available water, water from on-site dams may be utilised. Water would not be extracted from any creek or river onsite.

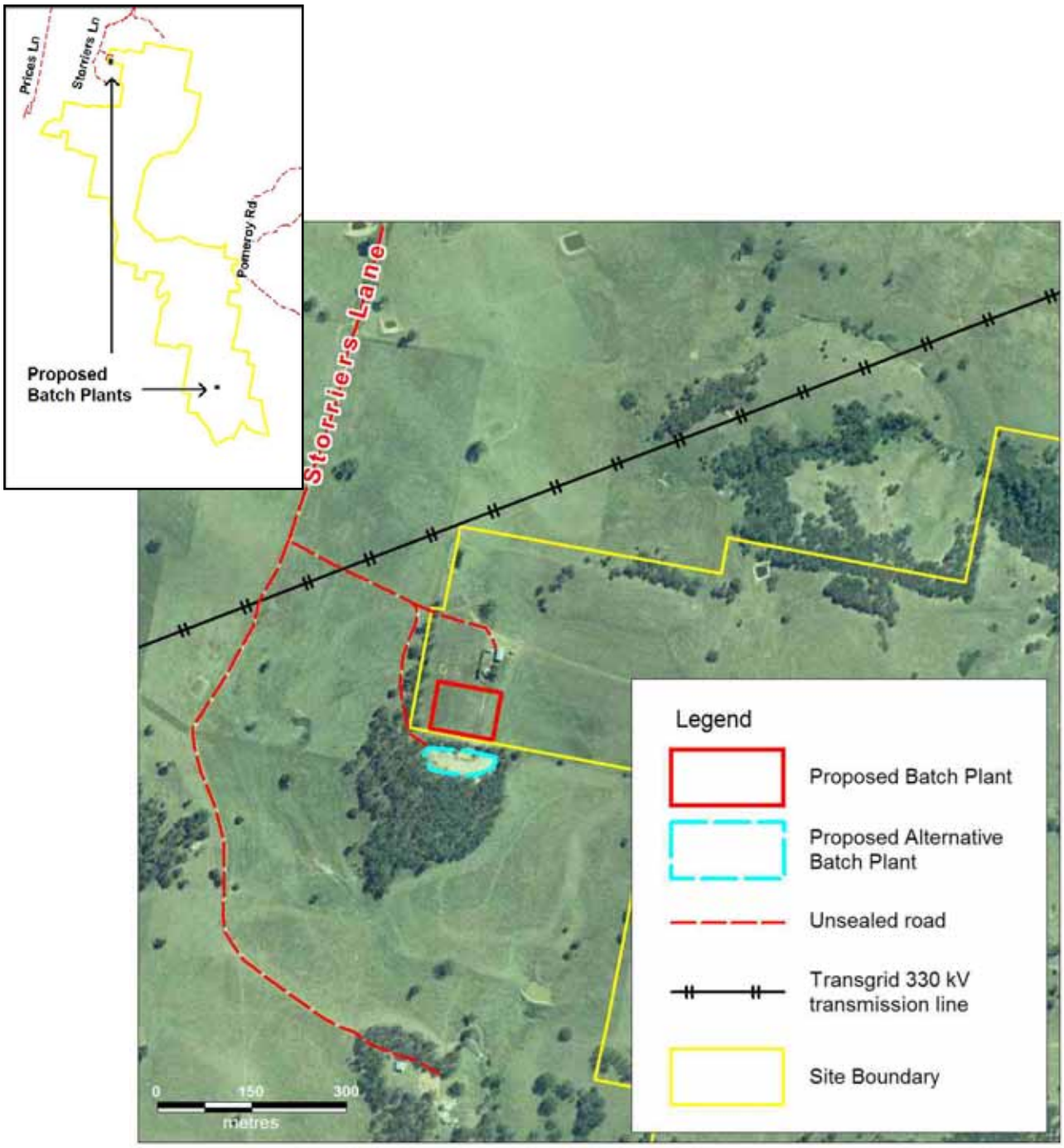


Figure 3-20 Proposed concrete batch plant locations (Pomeroy)

Proposed batch plant to be located at the north-western corner of the Pomeroy site, adjacent to the substation.

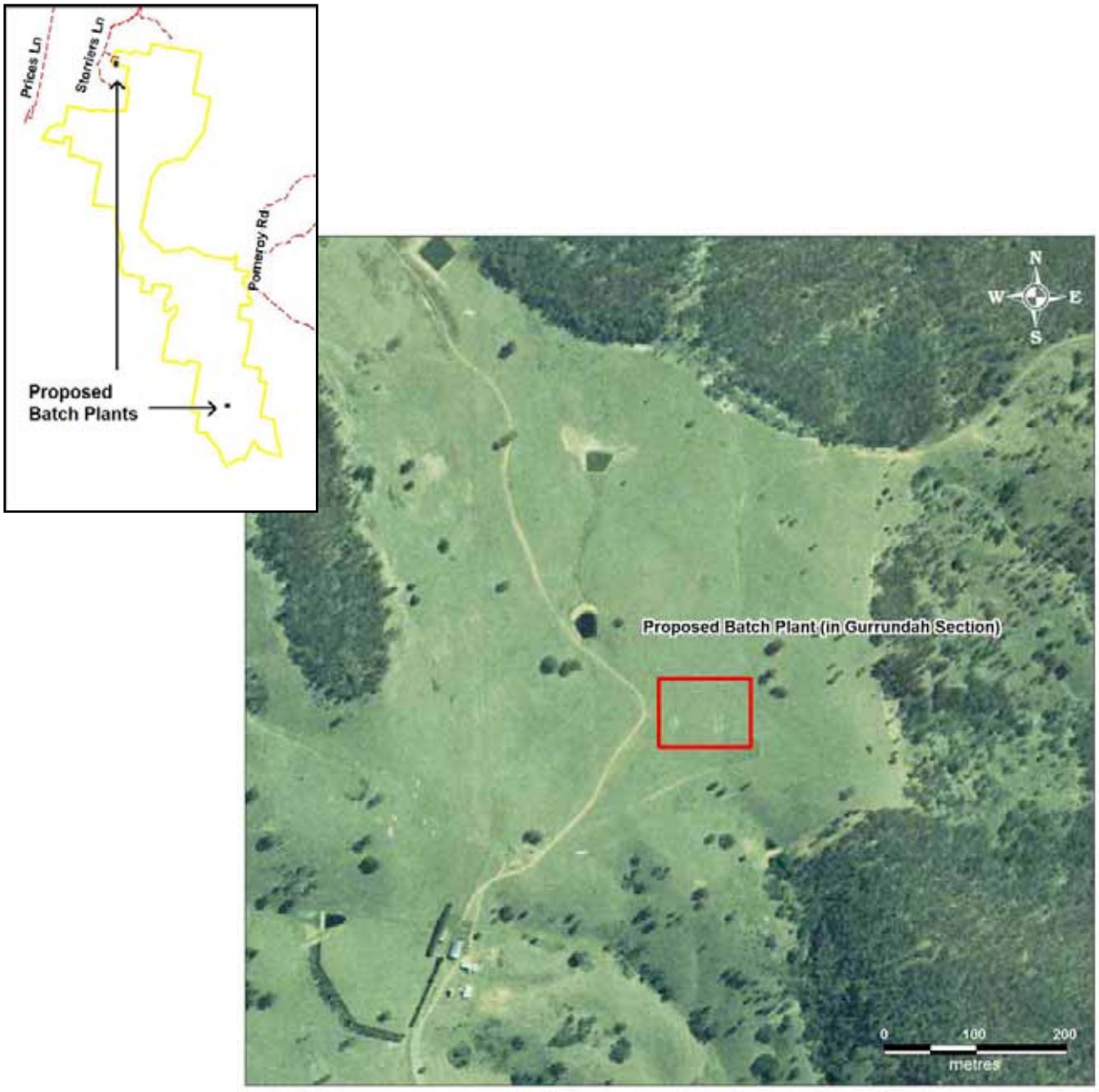


Figure 3-21 Proposed concrete batch plant location (Gurrundah)

Proposed batch plant to be located in a cleared area, north-east of the existing sheds and yards.

Phase 2: Wind farm operation

Once installed, the turbines 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. After this time the turbines may be replaced by new turbines and the wind farm would continue operation or the wind farm may be decommissioned.

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. As a guide, each turbine required about 7 days of maintenance per year. This does not require the 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.

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
- Replacement of wind turbine generators or gearboxes may 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 Gullen Range 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.

3.4.2 Phase 3: Wind turbine refurbishment

The life of a modern wind turbine is typically 20 - 30 years at which point individual wind turbines would be refurbished, replaced, overhauled or removed from the site. Individual turbines may also fail at shorter lives for various reasons.

Replacement, refurbishment and recommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the existing turbines and to install replacement turbines.

The existing substation and cabling would be largely reused. It is also possible that the existing footings and towers could also be reused, subject to the designs of turbine available at the time of replacement / recommissioning. This would allow a significant cost saving for the wind farm.

Any refurbishment or turbine replacement would comply with the requirements of the Project Approval under this application.

3.4.3 Phase 4: Wind turbine decommissioning

Should a turbine fail and it is not commercially viable to replace the turbine, the turbine would be decommissioned in accordance with the Statement of Commitments.

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. The decommissioning period is likely to be significantly shorter and with significantly less truck movements than the construction phase.

It should be noted that 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.

3.4.4 Construction hours

The majority of the construction work would be undertaken it the standard working hours proposed for the project of:

Monday – Friday	7am – 6pm
Saturday	7am – 4pm
Sunday and public holidays	No work proposed

The Saturday working hours (7am – 4pm) have been proposed to allow reasonable efficiencies of effort and thereby minimize the overall construction duration and noise impact to neighbouring residents.

However, some work (e.g. delivery or erection of turbines) may occur overnight for logistical reasons. Turbine lifts, for example, can only be carried out during periods of lower wind speeds because of operational limitations with the tall cranes and it is possible that night-time work would be required in this instance. This scenario has occurred at other wind farms (for example Cape Bridgewater, Victoria) where night crane operations have been required because of strong winds during the day.

It is proposed that any construction activities that may occur outside of the normal hours of operation would be identified in the Noise Management Plan prepared as part of the CEMP. Local residents would be informed of work outside of the standard hours in advance.

3.5 Site disturbance and impact area

The proposed wind farm requires the construction of a number of elements including turbines, turbine foundations, underground and overhead powerlines, a substation, control building and access roads on the site.

During the construction activities additional areas of the site would be impacted to provide construction compounds, concrete batching plants and storage areas. These areas can be rehabilitated and restored following the completion of the construction program.

Table 3-2 presents the calculated area of the site impacted by the project based on the proposed turbine layout. Some of these impacts would be for the duration of the wind farm operation and some are temporary impacts during the construction phase. In total approximately 2.7% of the site would suffer disturbance as a result of the project, some of these areas would be able to be rehabilitated after the construction phase.

Table 3-2 Development envelope

The development footprint is expected to create the following areas of disturbance. Some of these areas would be able to be rehabilitated after the construction phase.

	Quantity or length	Dimensions	Total area (hectares)	Description of existing land
Turbine footing	84 turbines	15 x 15m	1.89	Pasture
Access and crane stand*	84 turbines	40 x 22m	7.39	Pasture
Access and spur roads onsite #	45.0km	8m	36.00	Existing tracks and Pasture Woodland (potential EEC) 250m x 8m
External site access	4.6km	8m	3.68	Existing road / road easement, pasture
Underground powerline cabling onsite *	45.0km	2m	0.00	Predominantly located within access roads
Overhead powerline cabling / easement #	13.0km	20m	26.00	Existing tracks and pasture Woodland (potential EEC) 250m x 20m
Substation	1 substation	200 x 150m	3.00	Pasture
Control building	1 control room	25 x 15m	0.04	Pasture
Concrete batch plant#	2 concrete batch plants	100 x75m	1.50	Pasture
Construction compound, staging and storage#	4 areas	3 ha	12.00	
			91.50	**ha**
Total Site Area	**3400 ha**		**2.69**	**percent**
Development envelope	**1400 ha**		**6.54**	**percent**

* *Areas which can be rehabilitated after the infrastructure is installed (post construction phase).*

\# *Areas which can be rehabilitated after the life of the project (in excess of 25 years).*

These totals include the total lengths of alternative power line and access tracks.
Access tracks onsite are largely existing farm tracks that would require upgrades.

4 PROJECT JUSTIFICATION

This section provides details of the local, regional and global benefits of the project. It also outlines the justification for the use of wind energy to provide additional electricity generation in NSW, wind energy penetration in global markets, Government policy objectives and targets for greenhouse gas reductions.

4.1 The viability of wind power

4.1.1 International wind power development

Wind power technology has evolved rapidly through a research and development stage in the 1980's, rapid expansion and consolidation in the industry in the 1990's and is now a mature, advanced mainstream 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.

Wind farms are an increasingly important source of electricity generation worldwide. Internationally, by the end of 2007, the total capacity of wind energy was more than 94,000 megawatts which amounts to over four times the total capacity of power generation in New South Wales. Approximately 67% of this has been installed in the last 5 years (GWEC 2008) and the global wind industry has been growing at the staggering rate of nearly 30% per year for the last 10 years (GWEC 2008).

On global terms, the installed capacity of wind energy is predicted to reach 149.5GW by 2010 which is roughly twice the installed capacity at the end of 2006 of 74.2GW (GWEC 2007). The annual cumulative growth will be 19.1% during the period 2006 – 2010.

According to a statement released 1 February 2007 by the European Wind Energy Association (EWEA), the EU cumulative wind power capacity increased by 7,588MW or 19% to 48,545 MW in 2006 representing a wind turbine manufacturing turnover of some €9 billion. China has the potential to be world's biggest wind energy market by 2020, recently doubling its current wind energy target for 2020 to 20,000MW (Hydro Tasmania 2006). In the USA, 2,400MW of new capacity was installed in 2006, and another 5,244MW in 2007, representing a percentage growth of 26.8 and 45.3 per year respectively.

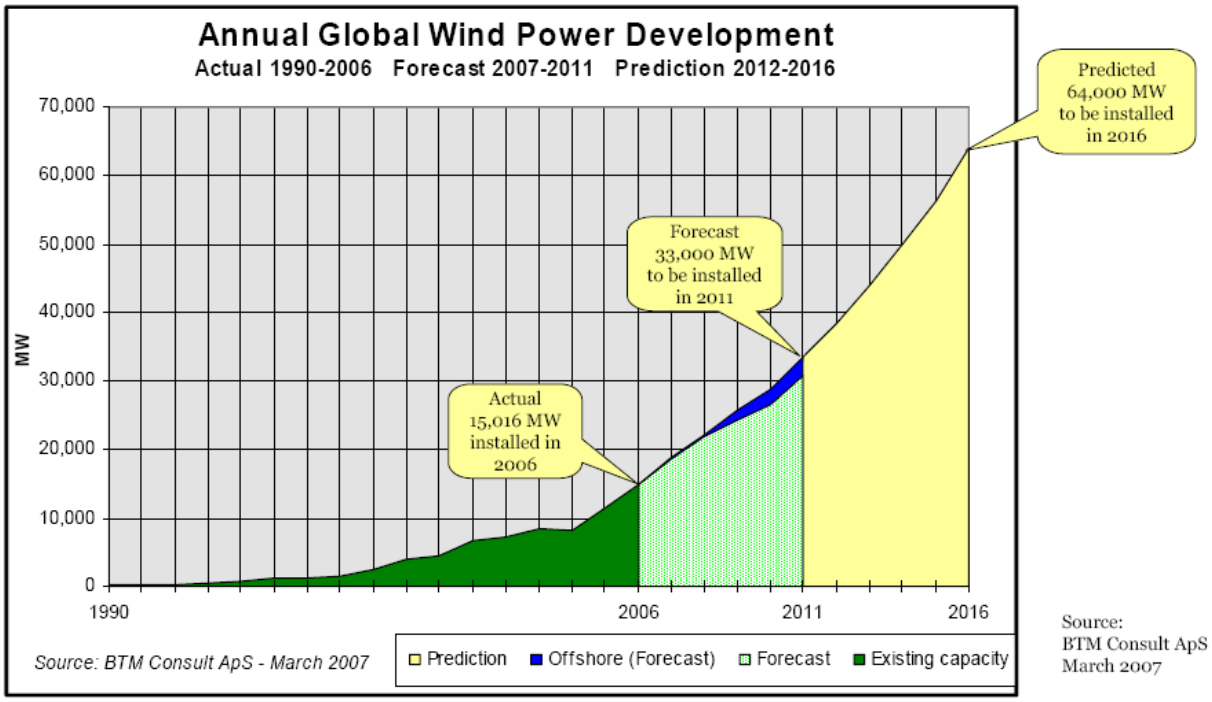


Figure 4-1 Annual global wind power development (BTM Consult ApS, 2007)

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 referring to the United Kingdom, 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)

The Global Wind Energy Report 2006 reviews the recent and substantial forecast growth in the wind industry around the world.

"Wind Energy is becoming an established, mainstream power source in a rapidly growing number of countries, and that growth will, and must, continue, as we seek to stave off the effect of global climate change and create true energy security." (GWEC, 2007)

Table 4-1 Installed wind power capacity at end 2007 (GWEC 2007) and 2006 (WWEA 2006)

Region	Installed Capacity 2007 (MW)	Installed Capacity 2007 in %	Installed Capacity 2006 (MW)	Installed Capacity 2006 in %
Europe	57,136	60.7	48,563	65.4
Americas	19,199	20.4	13,542	18,3
Asia	16,091	17.1	10,659	14,4
Australia/Pacific	1,158	1.2	1,000	1,3
Africa	528	0.6	369	0,6
World	**94,112**	**100,0**	**74,133**	**100,0**

Top 20 Countries by Installed Capacity:

Country/region	Additional Capacity Installed in 2007 (MW)	Percentage increase in capacity in 2007 (%)	Total Capacity Installed at end 2007 (MW)
1. Germany	1,667	8.1	22,247
2. USA	5,244	45.3	16,818
3. Spain	3,522	30.3	15,145
4. India	1,730	27.6	8,000
5. China	3,449	132.4	6,050
6. Denmark	3	0.1	3,125
7. Italy	603	28.4	2,726
8. France	888	56.6	2,454
9. United Kingdom	427	21.7	2,389
10. Portugal	434	25.3	2,150
11. Canada	386	26.4	1,846
12. The Netherlands	210	13.5	1,746
13. Japan	139	10.0	1,538
14. Austria	20	2.1	982
15. Greece	125	16.8	871
16. Australia	**7**	**0.9**	**824**
17. Ireland	59	7.9	805
18. Sweden	217	38.0	788
19. Norway	8	2.5	333
20. New Zealand	151	88.3	322

Source: Global Wind Energy Council press release 6 February 2008

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. In the past, wind farms have been viable because of the Federal Government's Mandatory Renewable Energy Target (MRET). MRET required electricity retail companies to purchase a percentage of their power from renewable energy sources.

While the existing MRET program is approaching full subscription, following recent elections, the new Federal Government has announced a new renewable target of 20% by 2020. This

would require in the order of 10,000 megawatts of new renewable energy generators to be built across Australia by 2020.

In mid 2007 NSW State Government introduced new legislation to parliament called the Renewable Energy (NSW) Bill as part of the Governments Greenhouse Policy to encourage additional generation of renewable energy. The NSW renewable target is also referred to as NRET and requires 10% of electricity to be sourced from renewable energy by 2010 and 15% by 2020.

This proposed wind farm could provide renewable energy which is eligible for Renewable Energy Certificates under the NSW Government scheme. NRET is a market based mechanism designed to encourage investment in renewable technologies that would provide the lowest cost generation of renewable electricity in the National Electricity Market. Projects like this would encourage renewable investment in NSW and would reduce the costs of production by reducing transmission losses to the NSW load centres.

There appears to be some indication that the NSW Government may prefer the introduction of the proposed Federal target as a national scheme, and therefore may not legislate NRET. At the time of writing this has not been determined. Nevertheless, it is clear that both NSW and Federal governments support new renewable energy projects.

The proposed Gullen Range wind farm would provide renewable energy which is eligible for Renewable Energy Certificates under the appropriate State or Federal Government's scheme. The full costs of these schemes have already been taken into account by electricity retail companies in power prices set by them. Therefore, the wind farm would not increase prices for NSW residents or businesses. In fact, it would 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 or NRET are unwarranted. Renewable energy targets were 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, these renewable targets (and wind farms) would provide a base for cheaper and cleaner power into the future.

4.1.3 Viability of this project

The Gullen Range 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 consistently high wind speeds measured on the site and the availability of TransGrid 330kV transmission line on the site that provides a cost effective grid connection solution.

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 Community support for wind farms

4.2.1 Government policy objectives

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 Department of Water and Energy (DWE), Department of the Environment and Climate Change (DECC), the NSW Greenhouse Gas Abatement Scheme and the NSW Greenhouse Office
- Increased consumer demand for electricity generated from renewable sources is apparent in the increasing customer numbers 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.

4.2.2 National Telephone Survey 2003

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:

- Ninety-four percent 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. Less than 3% considered the current target to be too high or much too high
- Eighty percent of respondents 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. Eighty-eight percent 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
- Ninety-one percent 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. Fifty-nine percent 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 than avoiding building wind farms in rural Australia (4%).

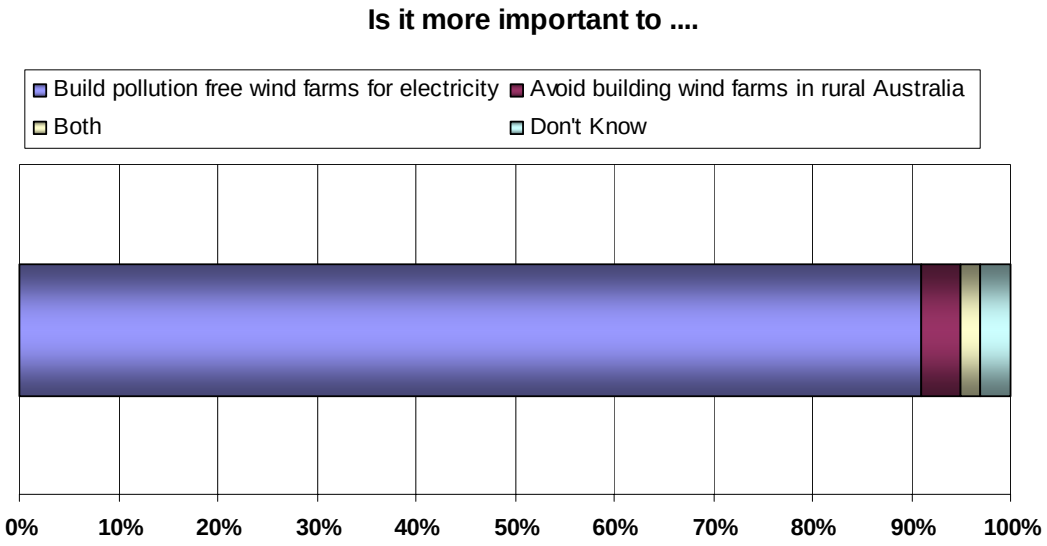


Figure 4-2 Community support for building wind farms

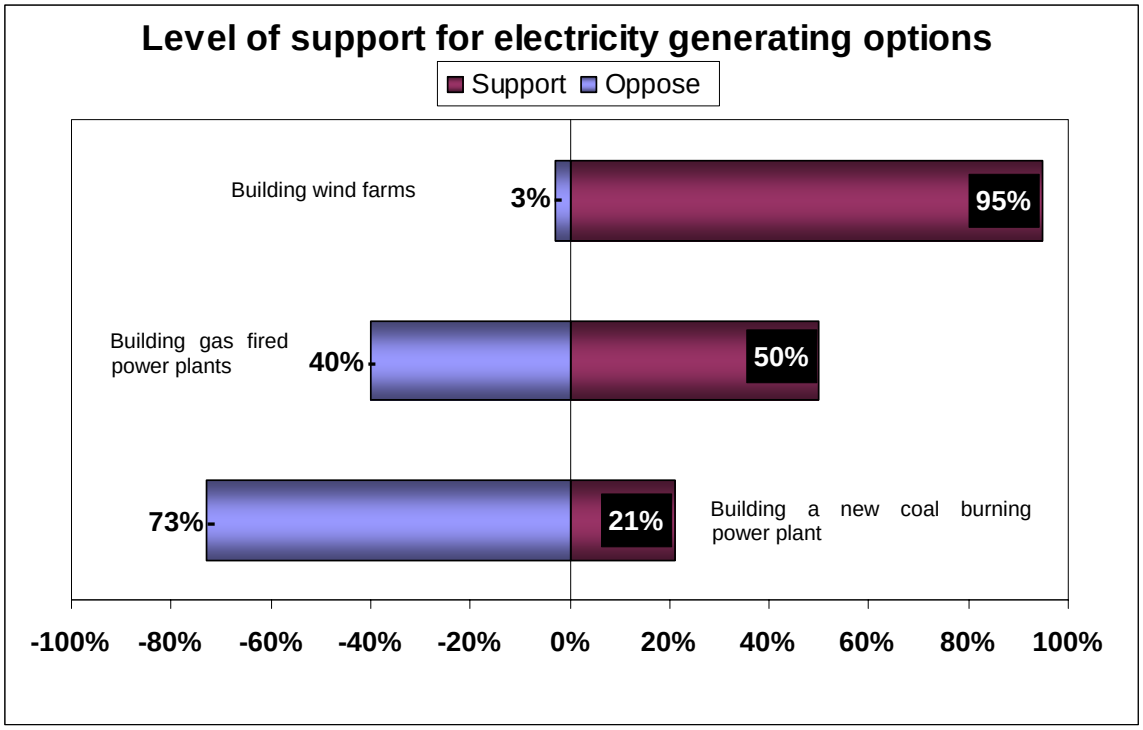


Figure 4-3 Community support for electricity generating options

4.2.3 NSW Southern Tablelands Survey 2007

A more recent random phone survey of 300 residents of the Goulburn - Crookwell – Yass region was undertaken by REARK Research (on behalf of Epuron) in July 2007 to determine the community perception of wind farm developments in the Southern Tablelands.

The survey matched the demographic profile of the area based on the census records and had a sampling precision of 5.7% at the 95% confidence level. The Gullen Range wind farm is located within the area surveyed.

The outcomes from this study show:

- 80% of respondents are concerned, right now, with the threat of global warming and its impact on the environment; 16% said they were unconcerned
- 9 in 10 respondents had seen a wind turbine, and more than 8 in 10 had seen the Crookwell wind farm. Awareness of wind turbines was very high
- 90% of respondents were aware of announcements of wind farms to be built in the Southern Tablelands
- 89% of respondents were in favour of wind farm projects being developed in the Southern Tablelands, 5% were opposed
- 83% of respondents stated "*I would be happy to see a wind farm built on farm land near where I live*"

- When respondents were asked regarding the acceptability of a wind farm near where they lived, 87% supported a wind farm within 25 kilometres, and 71% of respondents favoured a wind farm within one kilometre of their home
- In considering multiple wind farms in their local rural area, 3 out of 4 respondents accepted two 'typical' wind farms (15 to 80 turbines), and 2 out of 3 respondents accepted three typical wind farms in their local area

This study shows the adult residents in the survey area are concerned about global warming and are aware of the alternatives available. The study also shows respondents know and understand what a wind turbine is and how wind farms appear in the landscape; respondents are generally supportive of wind farms.

Moreover when it comes to locating wind farms, respondents are supportive (rather than averse) to having wind farms in their immediate locality, and a majority still approving of a wind farm within one kilometre of their home.

It is suggested that respondents feel the creation of wind farms is positive and this study shows that many are prepared to embrace them in their local area.

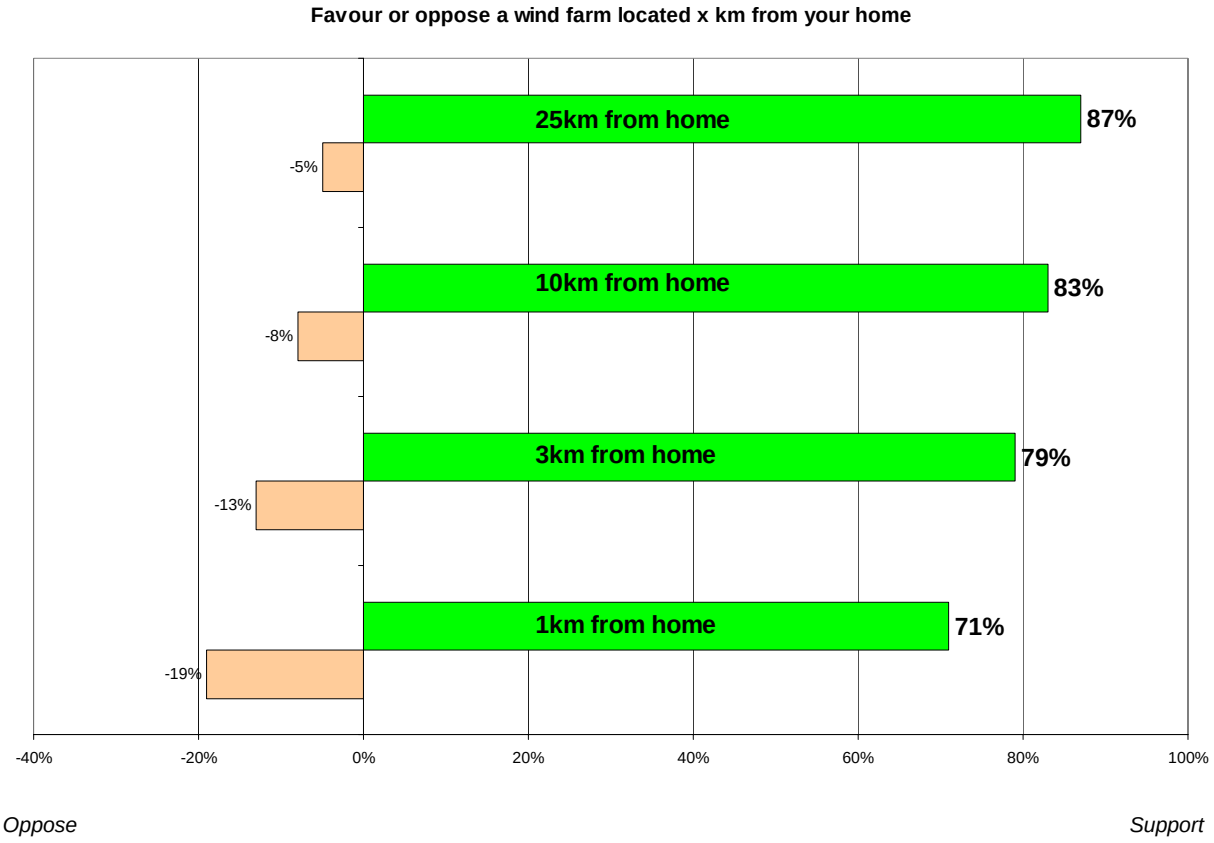


Figure 4-4 Community support for wind farms located near their home

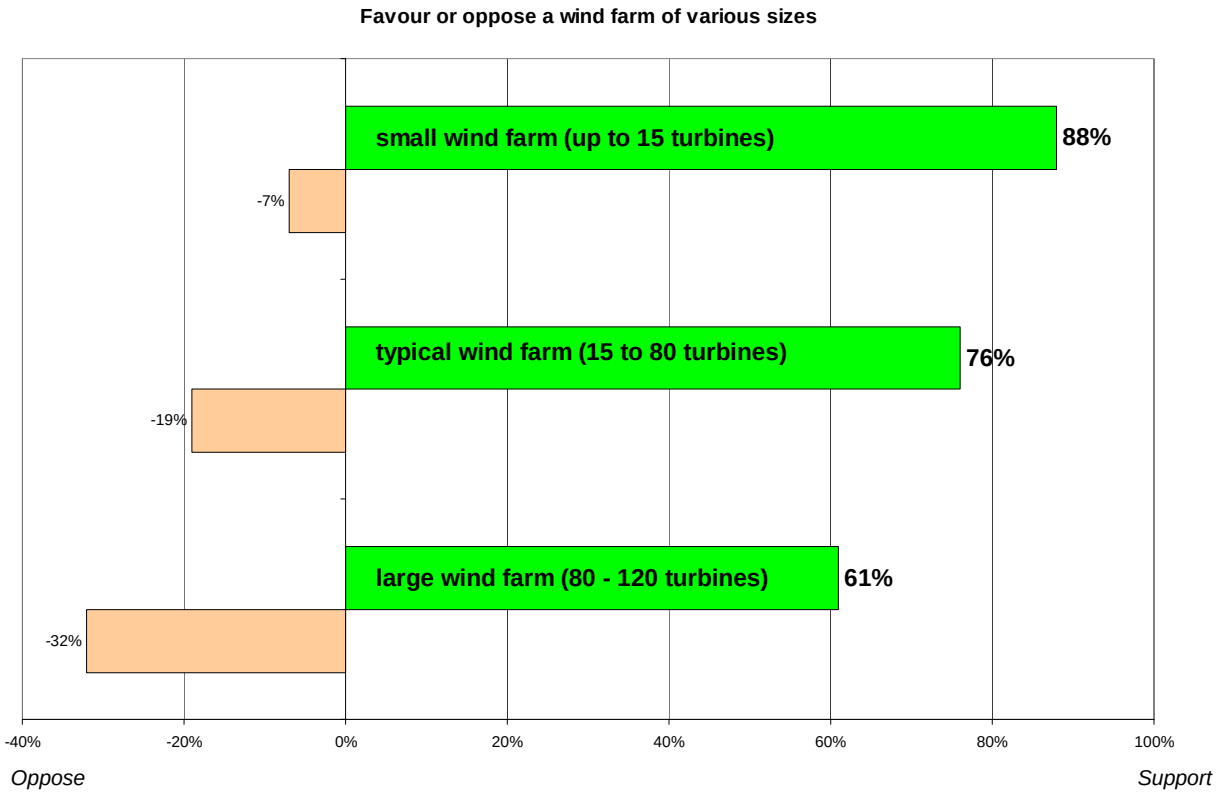


Figure 4-5 Community support for wind farms of various sizes

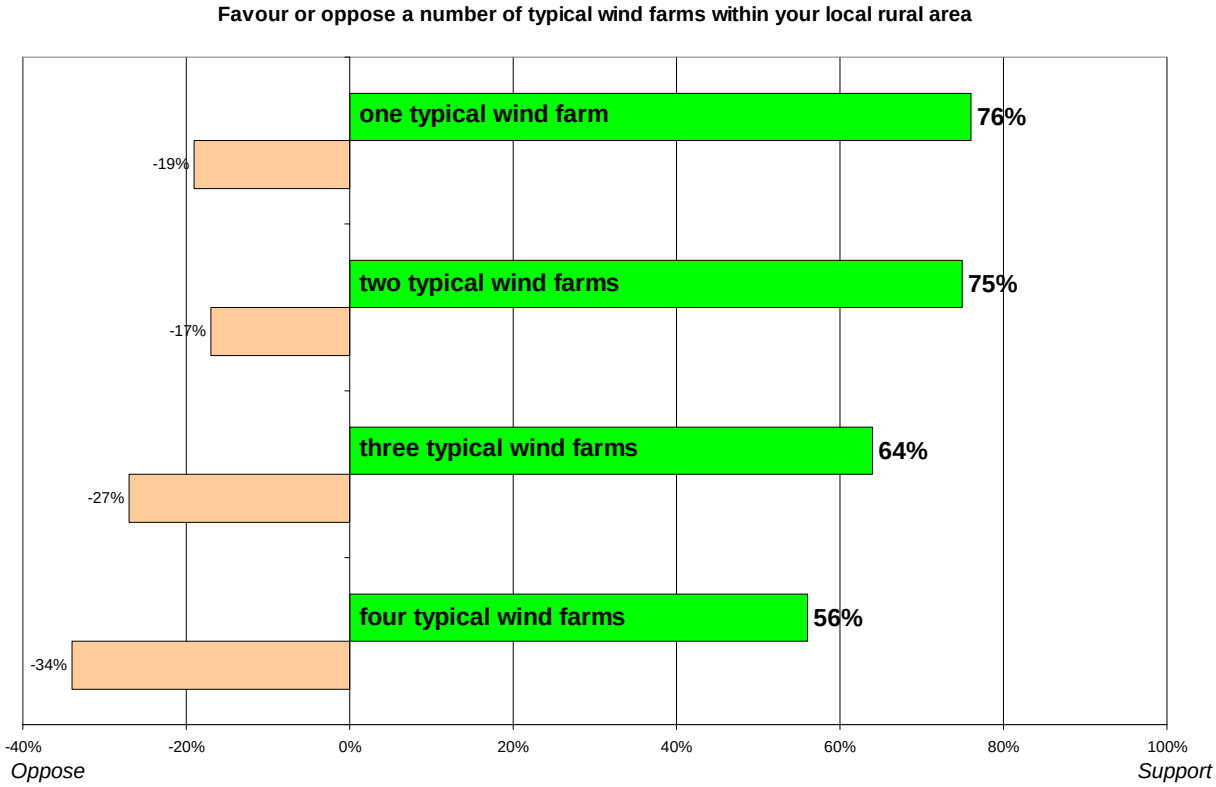


Figure 4-6 Community support for multiple wind farms within their local area

4.3 Regional and global benefits

4.3.1 Public electricity generation from renewable resources

Energy production of Gullen Range wind farm

The Proponent requested wind engineering consultants Garrad Hassan to prepare a wind energy assessment and electricity generation calculation based on a draft turbine layout 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.

Additional investigations were carried out by the Proponent on a wider range of turbines using the wind turbine analysis tool Windographer™. This analysis produced consistent results with the analysis prepared by Garrad Hassan, and provided a broader range of energy yield estimates based on the range of turbines indicated in Table 3-1.

On the basis of these studies energy production estimates (on a sent – out basis) for the Gullen Range wind farm are in the range of 5.5 to 8.5 GWh per turbine per annum depending on final turbine selection and turbine layout. This calculation is based on a predicted typical year, with variations around this average of in the order of 10-20% likely for any single year.

Predictions used in this report are therefore presented on the basis of an average figure of 7.0 gigawatt-hours (GWh) per turbine per annum. On this basis the wind farm is expected to produce in the order of 588 GWh per annum. Further figures in this report are based on this production estimate.

Domestic electricity consumption in NSW was 7,399 kWh on average in 1999, growing from 6,983 kWh on average in 1990 (DEUS 2000). We have used a figure of approximately 8,000 kWh on average for 2007 based on ABS figures.

On this basis, production of electricity from the Gullen Range wind farm of 588,000 MWh per annum would equate (on an annual average basis) to the annual electricity use of approximately 73,500 average NSW homes.

Life cycle assessment and embodied energy

Wind power is a clean form of energy, which during operation produces no carbon dioxide (CO2) emissions. While some emissions of these gases would 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 they leave no legacy of pollution for future generation (AWEA 2006).

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).

Vestas have prepared a report on the Lifecycle Assessment of the V90 (3.0MW) turbine (Vestas, 2006) calculating the energy balance for an onshore V90 (3.0MW) is 6.6 months. The energy balance (or payback) is the duration the turbine is required to operate until the energy required to manufacture, operate, transport, dismantle and dispose the turbine is paid back.

Need for new power generation in NSW

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 and gas-fired power generators supply around 90% of New South Wales electricity consumption and this percentage is increasing.

The Gullen Range wind farm would not cause one of NSW's existing coal fired power stations to be permanently closed down. However, every megawatt-hour of electricity produced from the proposed wind farm would 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.

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. As the electricity will feed into the Sydney West – Yass transmission network (including a new substation at Marulan), electricity produced onsite would be able to be consumed in the region, depending on instantaneous load requirements across the NEM.

Growth in electricity demand will soon exceed electricity supply during peak times. According to TransGrid's Annual Planning Statement 2007; scheduled demand projections show that additional generation would be required to manage peak periods by summer 2008/9. Accordingly, New South Wales requires additional electricity generators to be built to meet this demand, and to avoid power outages and blackouts.

Interaction with the electricity network

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 10-20% of the 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 4-7 shows NSW Regional Reference Price (RRP) and electricity demand over a 24 hour period in February 2008.

Figure 4-8 shows NSW electricity demand over a 12 month period. These figures show a daily variation of approximately 6,000 MW, or more than 20 times the maximum possible output available from the proposed wind farm.

TransGrid and NEMMCO require modelling of the existing network (in accordance NEM rules) to demonstrate that the wind farm will not adversely affect the performance of the network under normal or fault conditions. Preliminary assessment suggests that the point at which the wind farm would be connected to the 330kV network is strong and stable under most fault conditions and able to handle fluctuations in power. It is considered that the existing NSW transmission system in is more than strong enough to cope with output fluctuations attributable to the Gullen Range wind farm.

The existing electricity system in NSW is more than strong enough to cope with output fluctuations of the wind farm.

Transmission benefits

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.

Well located wind farms also provide a better utilization of existing power line infrastructure, including substations, providing better use of assets and in some cases reducing or removing the need to build new powerlines to supply customers.

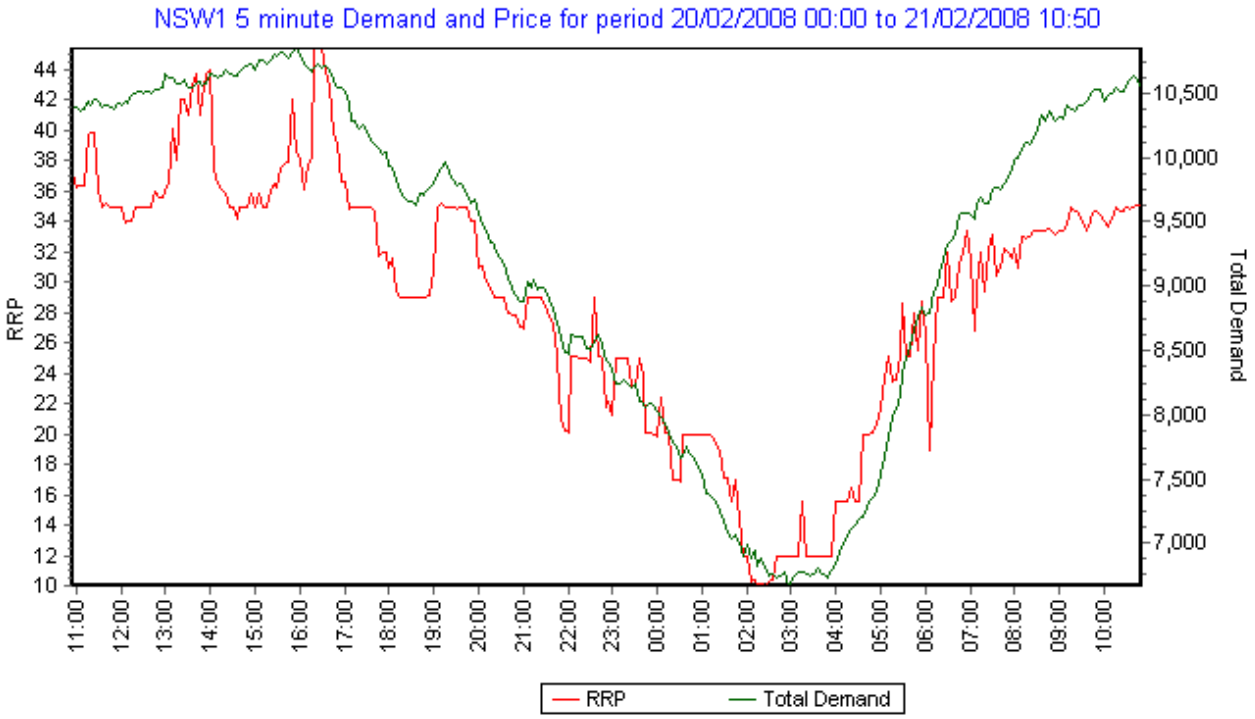


Figure 4-7 Daily variation in NSW electricity demand (20th February 2008)

(Note: RRP = Regional Reference Price for NSW)

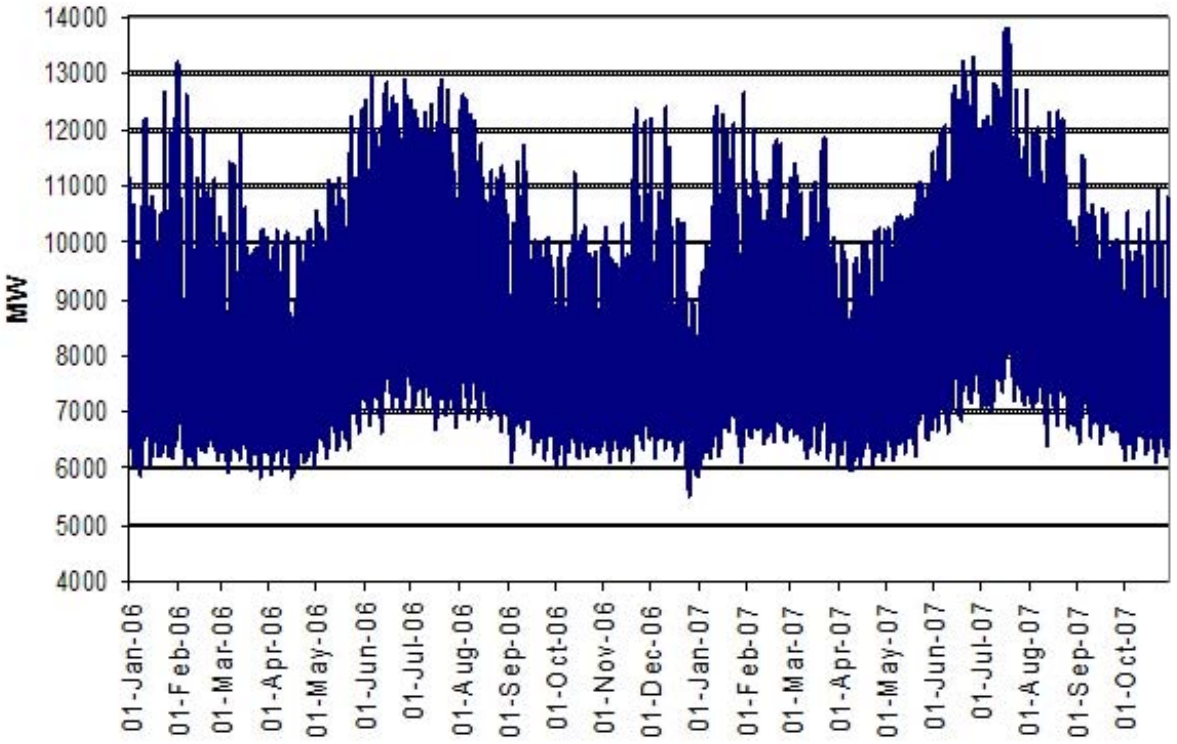


Figure 4-8 Annual variation in NSW electricity demand (2006/07)

4.3.2 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.

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 year (AGO 2005). Therefore in Australia, 33% 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).

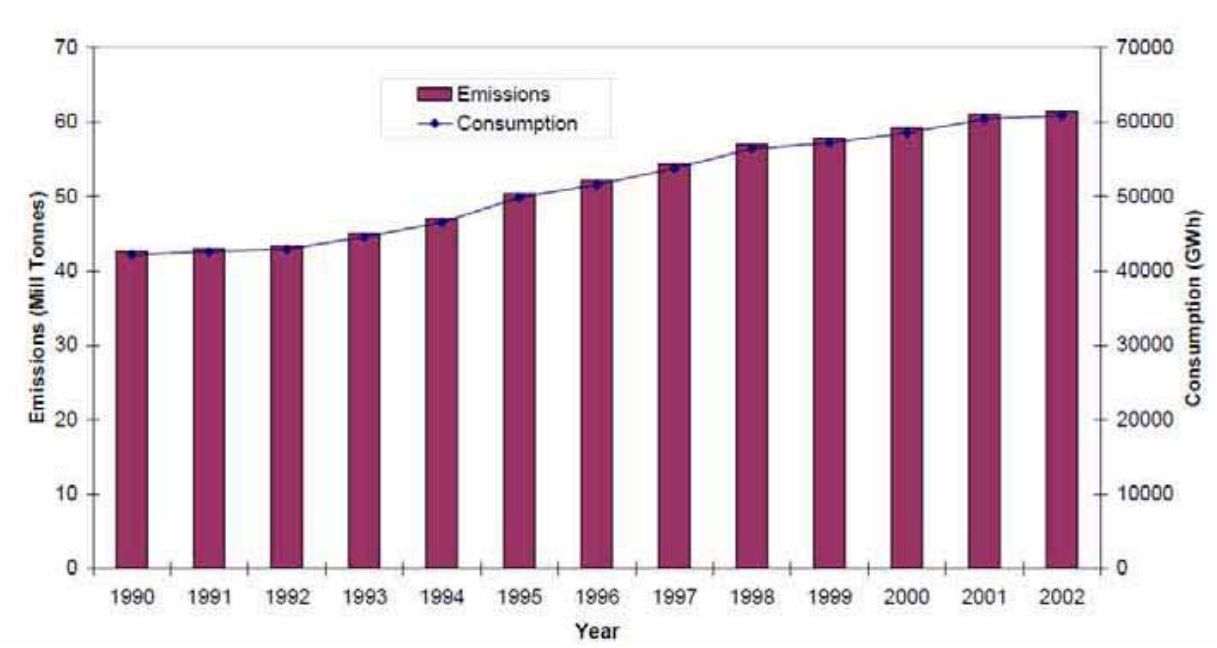


Figure 4-9 Greenhouse gas emissions from NSW power stations (NSW Govt 2004)

The nature of the NSW power system and the dominance of coal as the fuel source means 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 Gullen Range wind farm) would 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 2006 of 0.969 Tonne CO2e/MWh (NSW Greenhouse Office 2005). This figure shows NSW greenhouse gas emissions have been growing rapidly in recent years as shown in Figure 4-9.

Table 4-2 NSW electricity system greenhouse gas coefficients

Year	Total NSW Population	Total NSW emissions (tCO2-e)	Total NSW Sent Out Generation (MWh)	Annual Pool Value tCO2- e/MWh
2003	6,678,400	63,431,793	66,800,866	0.950
2004	6,752,100	65,979,036	67,276,401	0.981
2005	6,812,300	65,896,606	69,341,455	0.950
2006	6,869,400	70,010,515	72,222,646	0.969

(Source: NSW Greenhouse Office 2005, GGAS newsletter, Dec 2006 and Dec 2007)

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 would 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. 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 4.3.1 outlines the energy production of the Gullen Range wind farm, which is expected to be approximately 588,000 MWh per annum in a typical year.

The wind farm would reduce greenhouse gas emissions by up to 588,000 Tonnes of CO2e per annum, or a cumulative effect of 11.7 Million Tonnes of CO2e over the first 20 years of the wind farm operations.

This is the equivalent reduction in greenhouse gas emissions of taking 117,600 typical cars off our roads for the life of the wind farm.

Reduced impacts of climate change

Section 4.3.1 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 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
- 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 the 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).

4.3.3 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$100/barrel in November 2007. The prices for fossil fuel energy used for power generation, in particular gas, are 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 13 new power stations in NSW, with operational dates up to 2013, and a total capacity of 6,064MW. Eleven out of the 13 of these projects are gas-fired power stations, with the remaining power stations coal fired and making up 32% of new capacity (ABARE 2006). The supplemental use of wind power,

with its free fuel cost, helps to decouple electricity prices from international oil and gas markets.

Corin Millais as CEO of the European Wind Energy Association summarised the situation:

> *"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 a given level of demand

This wind farm would help to reduce climate change, and would provide a distributed power station to serve the regional community; it would provide a positive effect on energy security.

4.3.4 Regional 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 would lead to a reduced demand on Australia's finite sources of potable water. This in turn would free up water for more productive uses, and is also likely to have longer term benefits to river quality and thereby water quality.

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

Table 4-3 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.

Accordingly, the Gullen Range wind farm is likely to reduce water consumption in NSW by 774 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:

> *"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." (Gipe 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 4-4 which highlights that the industry is a major emitter of heavy metal compounds, carbon monoxide, oxides of nitrogen, and sulfur dioxide.

Table 4-4 National Pollutant Inventory 2005-06, electricity supply sector (NPI 2008)

Substance	Total Emissions (kg/year)	Emissions to Air (kg/year)	Emissions to Land (kg/year)	Emissions to Water (kg/year)
Acetaldehyde	14,000	14,000		
Ammonia (total)	95,000	47,000		48,000
Antimony & compounds	1.4	1.4		
Arsenic & compounds	190	190		
Benzene	130	130		
Beryllium & compounds	53	53		
Boron & compounds	430,000	430,000		
Cadmium & compounds	79	79		
Carbon monoxide	9,000,000	9,000,000		
Chromium (III) compounds	880	870		10
Chromium (VI) compounds	46	46		
Cobalt & compounds	87	87		
Copper & compounds	510	510		
Cumene (1-methylethylbenzene)	240	240		
Cyanide (inorganic) compounds	7,000	7,000		
Cyclohexane	180	180		
Ethylbenzene	250	250		
Fluoride compounds	1,300,000	1,300,000		
Formaldehyde (methyl aldehyde)	120,000	120,000		
n-Hexane	180	180		

Substance	Total Emissions (kg/year)	Emissions to Air (kg/year)	Emissions to Land (kg/year)	Emissions to Water (kg/year)
Hydrochloric acid	8,600,000	8,600,000		
Lead & compounds	830	830		
Manganese & compounds	1,500	1,500		
Mercury & compounds	340	340		
Nickel & compounds	950	950		
Oxides of Nitrogen	140,000,000	140,000,000		
Particulate Matter 10.0 um	4,700,000	4,700,000		
Polychlorinated dioxins and furans	0.0074	0.0074		
Polycyclic aromatic hydrocarbons	370	370		
Selenium & compounds	9,600	9,600		
Sulfur dioxide	250,000,000	250,000,000		
Sulfuric acid	2,500,000	2,500,000		
Toluene (methylbenzene)	2,300	2,300		
Total Volatile Organic Compounds	1,100,000	1,100,000		
Xylenes (individual or mixed isomers)	400	400		
Zinc and compounds	630	630		

These figures are total emissions over all power stations in NSW. Ref (http://www.npi.gov.au)

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. Any reduction in fossil fuel use would also reduce the level of pollutants released each year into the environment.

Table 4-5 Power station emissions per unit, Macquarie Generation

	Bayswater Power Station	Liddell Power Station
Coal consumed	7,029,587 tonnes	5,436,503 tonnes
Non-coal fuel consumption		
Biomass co-firing		21,468 tonnes
Coal replaced by biomass		18,774 tonnes
Coal replaced since August 1999		289,879 tonnes
Electricity from biomass since August 1999		565,595 MWh
Annual average production from biomass		70,699 MWh
Oil firing		
Boiler start-up	4,405 tonnes	8,588 tonnes
Liddell Supplementary Fuels Program		15,136 tonnes
Air Emissions		
Sulfur dioxide	5.36 kg/MWh	4.56 kg/MWh
Oxides of nitrogen (expressed as NO2)	2.1kg/MWh	2.39 kg/MWh
Particulate matter	0.033 kg/MWh	0.15 kg/MWh
Carbon dioxide	931 kg/MWh	953 kg/MWh
Water Diverted (Hunter River)	48,641 ML	

Source: Macquarie Generation 2007.

By way of an example, in the financial year 2006-07 Macquarie Generation's Bayswater coal-fired power station consumed over 7 Million tones of coal and 4,000 tonnes of fuel oil to produce 14,310 GWh of electricity. The per-MWh emissions of sulfur dioxide, oxides of nitrogen, carbon dioxide and particulate matter are shown in Table 4-5.

Based on these figures, the proposal would prevent the atmospheric emission of:

- 2,680,000 to 3,150,000 kilograms of sulfur dioxide;

- 1,235,000 to 1,405,000 kilograms of nitrogen oxides;

- 19,400 to 88,200 kilograms of particulates.

4.4 Local environmental, economic and social benefits

4.4.1 General benefits to community

The local community would gain a marginal benefit from those global and regional benefits contained in Section 4.3, in particular:

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

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.

A number of specific benefits are also available to the local community.

4.4.2 Community Enhancement Program

As part of this proposal, the Proponent has committed to establish a Community Enhancement Program to broaden the benefits of the wind farm within the local community.

The Community Enhancement Program would include two components:

1. A Clean Energy Program, specific to supporting the installation of residential clean energy improvements
2. A Community Fund, to provide funds to undertake initiatives which provide direct benefit to the local community

The Proponent would fund this program through a total annual allocation of $75,000 per annum from project revenues, from the commencement of operation of the project until final decommissioning. This annual allocation will be escalated with CPI from the date of commencement of the wind farm operation.

This is a voluntary commitment which the Proponent requests become a binding condition of consent if the project receives approval.

This commitment of $75,000 per annum would be the largest recurring voluntary community contribution from a wind farm in Australia, and is significantly larger than contributions made from much larger wind farms as shown in Table 4-6. It is three times larger than the annual contribution proposed by the Cullerin wind farm, however it is noted that other projects (such as the Capital wind farm) have made large one-off community contributions for capital items such as roads and fire fighting equipment.

Table 4-6 Annual community contributions from wind farms

Project	Contribution in 1st year of operation	No. of turbines	Contribution $/turbine
Cullerin, NSW	$25,000	15	$1,666/an
Portland, Vic	$50,000	100	$500/an
Waubra, Vic	$64,000	128	$500/an
Gullen Range, NSW	**$75,000**	**84**	**$890/an**

Clean Energy Program

The Proponent would establish a Clean Energy Program which offers discounted solar water heaters, solar photovoltaic systems, and energy efficiency packages for residences surrounding the site.

The Clean Energy Program would commence at start of construction of the wind farm and be completed within 2 years of completion of construction. Under the program, the Proponent would offer residents:

1. An Energy Efficiency package for all houses within 10km of the wind farm;
2. Solar water heaters for all houses within 5km of the wind farm;
3. A 1 kilowatt solar photovoltaic system for all houses within 5km of the wind farm.

Under the program these products would be required to be installed on the principle place of residence within the relevant distance from the wind farm. The systems would therefore be offered at a discounted rate to the resident, with the remaining funds paid for by the Proponent under the Community Enhancement Program.

These programs are being offered on the basis of existing Government support levels of $8,000 per kilowatt (for a 1kW photovoltaic system) and up to $1800/system (for a solar water heater). Therefore, the offer is made on the basis that the residence complies with the requirements of these programs. Additional terms and conditions would apply.

<u>Energy Efficiency Package</u>

This package would include energy efficient lights, 3 star (AAA) shower roses, tap aerators and flow restrictors as well as detailed information on efficient use of the energy in the home and Green Power. This would be offered at no cost to the homeowner (conditions apply).

<u>Solar Water Heating</u>

A range of solar water heaters would be offered providing options for the homeowner to reflect varying numbers of residents at each house. The homeowner would select the appropriate system for their residence from a list of products available.

The Proponent would source the product and secure a 3rd party contractor to install the systems at a one off installation fee to the homeowner of $500. This small cost represents the typical annual savings of a solar water heating system, and reduces the overall cost to the program. After installation, the homeowner would benefit from significantly lower energy bills for the life of the product, as well as a significant environmental benefit. Overall, this cost represents a discount to the resident of around 90% on the full cost of a typical solar water heater. Note, the fee would be adjusted to take into account any changes in Government rebates available, additional terms and conditions would apply.

Solar Photovoltaics

A 1 kilowatt (peak) solar photovoltaic (PV) system would be offered to residents which have committed to reduce their energy requirements by installing the Energy Efficiency package and Solar Water Heating package.

Solar photovoltaic systems have very high one-off costs and low to negligible operating costs. The Proponent would source photovoltaic systems at competitive prices and secure a 3rd party contractor to install the systems at a one off installation fee to the homeowner. This fee to the landowner reduces the cost of the overall program.

This fee would initially be set at $2,000 based on current rebate level available, providing the landowner a simple payback of approximately 7 years. Overall, this cost represents a discount to the resident of around 85% on the full cost of a solar PV system. Note, the fee would be adjusted to take into account any changes in Government rebates available, additional terms and conditions would apply.

Community Enhancement Program

To support the direct benefits to residents of the Clean Energy Program, a Community Fund would be established to provide for local environmental benefits and local community facilities to the benefit of the local community. The intent of the Proponent is that these funds are spent on facilities within the local area (i.e. within 10 kilometres of the wind farm). Potential projects could include:

- Road upgrades (e.g. Sealing of Range Road west of Bannister)
- Weed and pest management
- Landcare
- Local sporting facilities
- Local public services (e.g. libraries)
- Community parklands
- Academic scholarships
- Rural fire service support
- Event sponsorship
- Local heritage management

The structure of the fund and its management is to be determined. There appears to be significant merit in a structure which has Council involvement but where the decision making is driven by local community representatives. The Proponent would seek local input into the structure of the fund.

The Community Fund would receive all funds under the proposed Community Enhancement Program which are not used for the Clean Energy Program.

4.4.3 Jobs, investment and economic benefit

Over the life of the wind farm, the project would inject in excess of $200 Million into the Australian economy and approximately $60 - $90 Million into the local economy from the wind farm construction and operations (Passey 2003; MacGill *et al.* 2002). This economic injection would 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 600 direct jobs locally in Australia. Depending on the local community this could translate to as many as 180 jobs created during the construction period and 15 ongoing jobs during the operational phase of the wind farm.

Of particular interest in the Goulburn region is the potential to construct the large steel turbine towers required for this project. A consortium involving Ainsworth Engineering, Vale Engineering, Rigby Jones, Edwards Construction and Southern Steel Group, supported by Bluescope Steel, are currently finalizing plans to commence tower manufacture in Goulburn. This could provide a large number of jobs and additional economic benefits to the wider Goulburn region.

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

The general benefits to the community would also have direct and substantial economic implications, due to the heavy reliance within the area on agricultural pursuits.

4.4.4 Regional infrastructure benefits

The infrastructure required for development of the wind farm would also provide a significant local benefit to the community. In particular, we note the following:

Communications upgrade

Upgrade the existing wooden pole with a new steel communications tower at Mount Martin and upgrade the RFS communications link to Goulburn (equipment and poles). This would provide RFS and other emergency services with a new and more secure steel tower at Mount Martin. The RFS would also have a higher capacity and upgraded radio link to Goulburn, resulting in overall improved communication services into this area. This would benefit the local community by strengthening the emergency communications network providing a better and more secure network for communications during emergency events such as bush fires.

Road upgrades

Road upgrades required for this project would also provide the community additional benefits. The assessment has identified that both Storriers Lane (upgrade) and Bannister Lane (realignment) would require upgrade. These are more fully described in Section 7.10. These road upgrades would provide the local community safer and improved roads while allowing the Council budget for road upgrades to be used for other road projects in the local area. These upgrades also provide ease of access to properties and reduced vehicle maintenance costs.

Road maintenance

The Proponent would cover the cost of the maintenance of the upgraded Storriers Lane for duration of the wind farm. This would provide improved road infrastructure to the local residents without any additional maintenance costs being carried by the rate payers, and allow Council budget for road maintenance to be used for other roads in the local area.

New electricity connection point

The construction of the substation and cabling associated with the wind farm also may provide the opportunity to provide a backup or supplementary supply of electricity to the Crookwell region. This region is currently supplied by a single 66kV powerline which is limiting load growth at Crookwell. The Proponent would provide access to its system for Country Energy to supplement this existing connection as required by the load conditions within Crookwell. This would help increase local electricity supply capacity; reduce blackouts from the existing powerline; and allow more regular maintenance of the existing powerline.

4.5 Consideration of alternatives

4.5.1 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 operational life of a wind farm, it would 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 Organization (ILO) show that miners account for 1 per cent of the global work force yet at the same time contribute to seven per cent of global work fatalities (Westwick-Farrow Pty. Ltd. 2006).

4.5.2 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
- Native vegetation cover is sparse or is able to be avoided
- Housing in the immediate vicinity is relatively sparse
- High voltage transmission lines are available on or near site
- Reasonable road access is available to site
- Relevant landowners are interested in allowing wind turbines on their land

While many believe that coastal winds 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.

The Proponent has investigated various regions around NSW for their wind farm potential and has one of the most extensive wind data sets available in NSW through its combination of wind monitoring towers and wind modelling studies. In relation to this specific project, the Proponent has six on-site monitoring masts and two off-site monitoring masts within the immediate vicinity.

The Gullen Range site

In 2002, Marubeni Corporation installed wind monitoring towers on the ridgeline at Kialla, Bannister and Gurrundah. In mid 2006, the Proponent purchased the monitoring towers and data primarily to help assess wind speeds at the Cullerin wind farm to the south. The wind data recorded on the site also showed there are high and consistent wind speeds sufficient to support a viable wind farm.

In November 2006, the NSW Government announced a new target to increase the amount of renewable energy supplied in NSW from 10% to 15% of consumption. This new target would require a major increase in wind energy use and has led to the Proponent assessing the potential of the area to host a new wind farm.

Initial assessment of the Gullen Range indicated that the site has:

- High and consistent wind speeds
- Sparse and non-sensitive native vegetation cover in areas that would be affected
- Low population density (one person per 88.59 hectares in the Upper Lachlan Shire area)
- Existing electricity transmission line on site (330kV Yass - Sydney West)
- Interested property owners for the relevant properties

4.5.3 Scale of the proposed wind farm

Wind farms are comprised of multiple wind turbine generators. Generally, the more wind turbines located in a wind farm, the higher its energy production and the lower its capital cost per unit of energy generated.

Most wind farms currently proposed in New South Wales are greater than 50 megawatts, with more than 25 wind turbines each. As demands for renewable energy are increasing, newer proposals are increasing in size. For example, the Silverton wind farm under development could see in excess of 500 wind turbines in a single location west of Broken Hill.

The proposal would see four 'clustered' turbine locations, thus minimising the visual impact of a single large development. This approach also provides certainty; while the four clusters could be developed separately, by combining into one project there is greater certainty as to the level of development in an area. Accordingly it is also easier to determine and minimise cumulative impacts as all four clusters are developed together and with reference to each other.

Table 4-7 NSW wind farms, proposed and operational

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	Substation on site
Blaney Wind Farm, near Bathurst	Eraring Energy (Operational)	9.9MW Built 2000	15	Substation on site
Kooragang, near Newcastle	Energy Australia (Operational)	0.6MW Built 1997	1	Substation on site
Hampton Park, near Hampton	Hampton Park Wind Company (Operational)	1.32MW Built 2001	2	Substation on site
Cullerin WF, near Goulburn	Origin Energy (Under construction)	30MW	15	Substation on site
Capital WF, Bungendore	Renewable Power Ventures (Under Construction)	126MW	63	330kV Substation on site
Snowy Plains WF, near Berridale	Epuron (DA approved)	30MW	15	Substation on site
Conroy's Gap WF, near Yass	Epuron (DA approved)	30MW	15	<4km aerial
Woodlawn WF, near Tarago	Wind Energy JV (DA approved)	50MW	25	Not specified
Taralga WF, near Taralga	RES Southern Cross (DA approved)	186MW	62	Not specified, >30km high voltage
Gunning WF, near Gunning	Delta Electricity (DA approved)	64MW	32	14km, 132kV, aerial
Crookwell 2 WF, near Crookwell	TME (DA approved)	92MW	46	330kV substation, on site
Liverpool Ranges WF, Near Murrurundai	Macquarie Generation (DA Approved)	8MW	4	Substation on site
Box Hill WF, near Guyra	Allco (DA approved)	Up to 21MW	10	No details available

Project, Project Location	Proponent (Status)	Project Capacity	No. of Turbines	New Powerlines to connect to grid
Black Springs WF, near Oberon	Wind Corporation (Aust) Pty Ltd (Proposed)	18.9MW	9	Substation on site
Silverton WF, near Broken Hill	Silverton Wind Farm Developments Pty Ltd (proposed)	~1000MW	~500	Substation on site with staged development of power lines to grid
Kyoto Energy Park, near Scone	Pamada Pty Ltd (Proposed)	85 – 120MW	Up to 47	Substation and overhead lines
Ben Lomond, near Guyra	Ben Lomond Wind Farm Pty Ltd (Proposed)	Up to 205MW	98	Onsite 132kV substation
Glen Innes WF, near Glen Innes	Glen Innes Wind Power Pty Ltd (Proposed)	44 – 66MW	22	substation on site
Gullen Range WF, near Gunning	Gullen Range Wind Farm Pty. Ltd. (proposed)	Up to 278MW	84	330kV substation, on site

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

4.5.4 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 which can supply up to two thousand houses each. These large turbines can have blade diameters and hub heights of well over 120 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:

- Increased clean energy generation from a site
- Reduced overall visual impact (see discussion in the *Visual Assessment*)
- Reduced environmental impacts of construction through less footings, hardstands, road areas etc
- Reduced cost of wind power per unit of output

The Proponent proposes to use mid-sized wind turbines, with each wind turbine having a hub height of approximately 78-85 metres, with the blade tip at its apex up to 135 metres above ground level. This mid-size turbine provides an appropriate balance in considering this trade-off between size and environmental impacts.

4.5.5 Electricity transmission connection options

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

The original proposal in relation to this site was to install approximately 25 - 35km of new overhead 132kV power line to the south of the site to connect into the Country Energy 132kV line to the south at Breadalbane. This would have had increased visual impact and was therefore not preferred.

The connection to the 330kV line that crossed the site was considered in detail. Such a connection would involve construction of a major 330kV substation at significant cost. However on balance it was considered that this solution was a better outcome for the project as a whole and the local community and was therefore preferred.

A feasibility study into the grid connection options for the Gullen Range wind farm concluded that the connection to the 330kV Sydney West – Yass 39 line is technically feasible and that this line is thermally capable of accommodating up to 400MVA and would therefore have the capacity to take the output of the wind farm.

4.6 Modifications to the Gullen Range wind farm proposal

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

The location of equipment has also been guided by community feedback through the extensive public consultation program undertaken. 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 following feedback at the Community Information Day in November 2007:

- Medium voltage reticulation around the site has been reviewed in detail. The original proposal involved overhead powerline connections between various sections of the site, where practical this has been changed to underground cabling. The key areas where cabling is to be located underground is between the Bannister and Pomeroy sections of the site along Prices Lane, this minimises impacts to properties and property development in the area and reduces the need to remove existing trees
- Turbines and access tracks have been moved to avoid areas of potential threatened reptile habitat at the Kialla, Bannister and Gurrundah sites
- Adjustment of turbine locations following the noise assessment at nearby residences to ensure the proposed layout achieves relevant noise limits
- Storriers Lane is now the preferred access route to the Pomeroy section of the site to reduce impacts on residents along Prices Lane which was previously preferred
- Access to Kialla and Bannister areas of the site have now been relocated via Grabben Gullen Road to minimise traffic movements along Kialla Road
- Relocation of turbines from high points along the ridge in the section between Kialla and Bannister to minimise visual impacts to local residents
- The concept of a Community Fund has now been incorporated into this proposal to broaden the benefit of this proposal within the local community. In particular, the inclusion of the Clean Energy Program would provide direct benefits to surrounding residents
- A commitment to offer visual screening to affected landowners in the vicinity of the wind farm has been incorporated into the final proposal

4.7 Reversibility of the proposal

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 proposal would not substantially alter the vegetation, soil or water quality on the site. In the short-term, mitigation measures would 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 and an adaptive management program.

Impacts on the visual landscape would be ongoing during the operational phase of the wind farm. However, visual and noise impacts would disappear on decommissioning of the project.

At the time of decommissioning of the project or individual turbines 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 then be returned to its pre-existing state.

As there is no significant tree clearing or substantial cut and fill operations involved in the project, on decommissioning the site could be substantially returned to its current state.

4.8 Project benefit summary

The Proponent is committed to developing the Gullen Range wind farm in a way which minimises adverse local impacts and maximises the benefits of the project to the local community and broader population. Based upon an 84 turbine layout, the project offers the following broad benefits:

- Production of approximately 588,000 MWh of renewable electricity per annum, sufficient for the average consumption of up to 73,500 homes
- Reduction in greenhouse gas emissions of approximately 588,000 tonnes of carbon dioxide (equivalent) per annum, the equivalent of taking 117,600 cars off our roads
- Savings in water consumption of approximately 774 Million litres per annum of potable water (this is the amount of water required to produce the same amount of electricity from coal fired power stations)
- Annual savings in pollution from coal fired power stations of up to 3,150,000 kilograms of sulfur dioxide, 1,405,000 kilograms of nitrogen oxides, and 88,200 kilograms of particulates
- Provision of a community fund of $75,000 per annum for local community and environmental projects
- Provision of local jobs and injection of up to $200 Million into the Australian economy and approximately $60 - $90 Million into the local economy
- Improved security of electricity supply through diversification

5 PLANNING CONTEXT

5.1 State government legislation and policy

5.1.1 Critical infrastructure

On the 26th of February 2008, the NSW Premier Morris Iemma announced that proposals to build new power stations with capacity greater than 250MW would be declared 'critical infrastructure'. The formal declaration was gazetted on the same day under section 75C of the Environmental Planning and Assessment Act 1979 by the Minister for Planning. The declaration is intended to secure the energy future of the state, to allow for sustainable economic development. Proposals will be subject to a transparent and public assessment process to ensure protection of the environment and the health and amenity of local communities.

While this proposal is to be assessed as a Part 3A Major Project, under the NSW *Environmental Planning and Assessment Act 1979,* it is also considered Critical Infrastructure under this Act as it is a power generator with capacity to generate in excess of 250 megawatts and is the subject of an application lodged under section 75E of the Act.

5.1.2 Part 3A approval process

The proposal is a Major Project which would be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (*EP&A Act*). The project has a capital investment of more than $30 million and was confirmed to be a project to which Part 3A of the EP&A Act applies by the Director-General of the Department of Planning on 13 June 2007. The approval process applying to Major Projects under Part 3A and the Major Projects State Environmental Planning Policy is described in Section 2.2.

Part 3A 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. 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)

5.1.3 Director General's Requirements

Under the *EP&A Act*, Determining Authorities are to consider 'to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. The Director General's Requirements that outline the form and content of the Environmental Assessment are attached to this document (Attachment 1.1). The following table summarises the requirements and where they are addressed in this report.

Table 5-1 Director General's Requirements

This table outlines the DGRs, issued by the DoP on September 21, 2007 and where each item is addressed in this EA. The full DGRs are provided in Attachment 1.1.

Director-General Requirement's:	Addressed:
General requirements	
• Executive summary	Section 1
• Glossary	Section 11
• Detailed description of proposal including grid coordinates of turbines	Section 3 and Attachment 4 (grid co-ordinates)
• Timeline indicating staging (including decommissioning)	Section 3
• Consideration of relevant statutory provisions (including DoP draft NSW Wind Energy Environmental Impact Assessment Guidelines 2002, Auswinds's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia 2006)	Section 5
• Assessment of key issues (outlined below) with mitigation measures required to reduce impacts to acceptable levels	Section 4 and 7
• Draft *Statement of Commitments*	Section 9.2
• Certification by the authors of the EA	Section 12
Key issues	
• Strategic justification	Section 4
• Visual amenity impacts	Section 7.2
• Noise impacts	Section 7.3
• Flora and fauna (biodiversity)	Section 7.4
• Aboriginal heritage	Section 7.5
• Aviation / communications / EMFs	Section 7.6, 7.7, 7.8
• Land value impacts	Section 7.9
• Traffic and transport	Section 7.10
• Bushfire risk	Section 7.11
• Water quality	Section 7.12
• Mineral resource	Section 7.13
• General environmental risk analysis	Section 8, Table 8-1

Director-General Requirement's:	Addressed:
Consultation requirements	
• Appropriate and justified level of consultation with agencies and community	Section 6

Resources considered in this EA include:
• DoP Draft NSW Wind Energy Environmental Impact Assessment Guidelines 2002
• Auswinds's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia 2006
• Auswea and National Heritage Trust wind Farms and Landscape Values March 2005
• South Australian EPA Wind Farms – Environmental Noise Guidelines 2003
• EPA – Environmental Noise Control Manual 2004
• Section 5A *Environmental Planning and Assessment Act 1979*: Impact on critical habitats, threatened species, populations and ecological communities
• DEC and DPI Draft Guidelines for Threatened Species Assessment 2005
• DEH Cumulative Risk for Threatened and Migratory Species, 2006
• Auswind's Wind Farms and Birds: Interim Standards for Risk Assessment 2005
• Auswea's Assessing the Impacts on Birds – Protocols and Data Set Standards
• DEC's Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005
• CASA Advisory Circular AC 139-18(0) Obstacle marking and Lighting of Wind Farms 2005
• ARPANSA Guidelines on Radiation Protection Standard for Exposure Limits to EMFs
• RFS Planning for Bushfire Protection

5.1.4 Protection of the Environment Operations Act 1997

This Act is administered by the Department of Environment and Climate Change (DECC), Environmental Protection Authority (EPA). Projects approved under Part 3A of the *EP&A Act* do not generally require authorisations under this Act however, DECC has asked to have sufficient project information to ensure matters relevant to this Act are taken into consideration.

Activities listed in Schedule 1 of this Act (which include electricity generating works that supply or are capable of supplying more than 30MW of electrical power) require a licence. The EPA issue licences which are designed to control the air, noise, water and waste impacts of an activity. Licences are on-going but subject to review at least once every 5 years and can be varied, suspended or revoked.

The wind farm would exceed 30MW and therefore, if approved, would seek a license from the EPA if required under the consent conditions. Impacts and mitigation measures related to air and water quality as well as noise amenity are described in this EA, Sections 8.1, 7.3 and 7.12.

Concrete batch plants exceeding production of 150 tonnes per day or 30,000 tonnes per year also require a license under this Act. It is anticipated that up to two temporary concrete batch

plants would exceed this amount and would therefore also require a license to be issued by DECC.

5.1.5 DoP draft NSW Wind Energy Environmental Impact Assessment Guidelines 2002

This guideline identifies some important factors to be considered when undertaking environmental assessment of wind farm projects. Key recommendations relate to consultation, site selection, project justification as well as specific impact areas such as noise, visual amenity and aerial fauna.

The DoP guideline has been considered in the preparation of this EA.

5.1.6 Auswinds's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia 2006

The guidelines were developed to establish the process for identifying, developing and implementing wind energy projects, recognising that each project would require assessment on its individual merits. They are focused primarily on technical and planning issues.

These guidelines have been considered in the preparation of this EA, particularly with respect to the chronological flow of the project phases.

5.1.7 DEH Supplementary Significant Impact Guidelines 2.1.1: Wind Farm Industry Sector 2005

The purpose of these guidelines is to assist operators in the wind farm industry to decide whether or not actions which they propose to take require assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*).

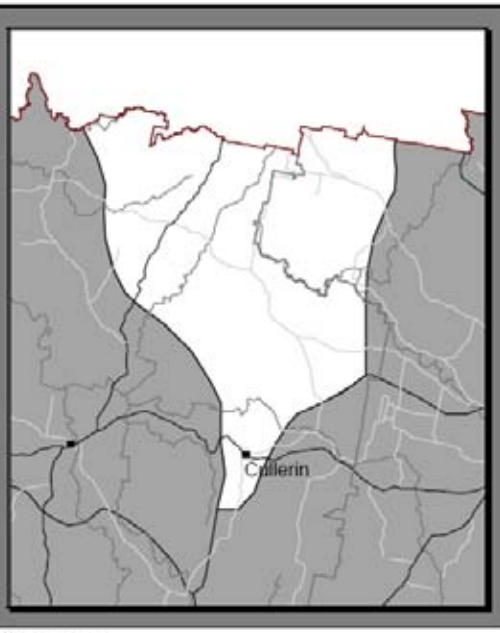
These guidelines have been considered in the preparation of this EA, particularly with reference to Section 7.4, biodiversity impacts.

5.1.8 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.

While most of the site is beyond the scope of this planning document, a small proportion of the site would fall within the Cullerin landscape unit. Key features of this unit are shown in Table 5-2. These features, most pertaining to biodiversity attributes, have been considered in Section 7.4 of this EA.

Table 5-2 Cullerin landscape unit



15. Cullerin Landscape Unit

Planning and management guidelines

These guidelines summarise important biodiversity information for land within this landscape unit.

The information can be used to assist in:

- Deciding where and how to develop land
- Assessing development proposals
- Guiding management of land

Note: Information for each unit will be updated over time

Description	Land uses
An extension of the Lake George Range to the south, this unit contains a low range with Dry Forests and Box-Gum Woodlands, with small areas of Grassland formerly occupying the low valleys and basalt plateau. Also formerly contained small areas of Wet forests.	Grazing, a major and a minor transport corridor, a small village.
Vegetation status	**Endemic features**
The Wet Forests have been largely cleared. Dry Forests and Box-Gum Woodlands are partly cleared and Grasslands are largely cleared or modified. There are: • A number of samples of Box-Gum Woodland of considerable diversity, including McCabes and Hearley's TSRs.	This unit contains: • The region's only other basalt landscape (see Taralga)
Known threatened and important species and endangered ecological communities	**Planning and management issues**
Plants: Golden Moths Orchid **Mammals:** Koala **Birds:** Superb Parrot, Hooded Robin, Speckled Warbler, Diamond Firetail **Vegetation communities:** Natural Temperate Grassland, White Box - Yellow Box - Blakely's Red Gum Woodland	Planning and management issues have not been identified for this unit, due to limitations relating to lack of survey data. Consists primarily of planning settings D and B (See Part 5 of report).

Source: Fallding 2002.

5.1.9 Ecologically Sustainable Development (ESD)

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.

For the purposes of the *EP&A Act* and other NSW legislation, the Intergovernmental 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: 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

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

(b) Inter-generational equity: 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: that conservation of biological diversity and ecological integrity should be a fundamental consideration

(d) Improved valuation, pricing and incentive mechanisms: 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

The precautionary principle has been adopted in the assessment of impact; all potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been suggested to address the uncertainty.

The majority of potential impacts of the proposal are likely to be localized and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Parameters such as the site's soil, hydrology and native vegetation have been valued in terms of their broader contribution to the catchment and catchment processes. The reversibility of the proposal has been specifically addressed in Section 4.7 and is considered to be an advantage of this type of development.

The impacts of the proposal on biodiversity been assessed in detail in the attached Biodiversity Assessment (summarised in Section 7.4). Due to the uncertainty related to bird and bat strike, monitoring has been incorporated into the *Statement of Commitments*.

The aims, structure and content of this EA have incorporated these ESD principles. The Draft *Statement of Commitments* in Section 9.2 provides an auditable environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the proposal at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of the above ESD definitions.

5.2 Commonwealth legislation

5.2.1 Environment Protection and Biodiversity Conservation Act 1999

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

i) Actions that have a significant impact on 'matters of national environmental significance'

ii) Actions that (indirectly or directly) have a significant environmental impact on Commonwealth land

iii) 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

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 which are endangered, vulnerable or presumed extinct. Schedule 3 outlines key threatening processes.

A search for Matters of National Environmental Significance based on the study area and a 50 kilometre buffer was undertaken using the Commonwealth Government's Protected Matters Search Tool, 20th June 2007. 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 report generated by the Matters Commonwealth Government's Protected Matters Search Tool is provided in full in Attachment 3.5 and discussed within the Biodiversity Assessment, provided in Attachment 3.3.

On 4 February 2008, the Federal Minister for the Environment determined that the development of a wind farm at Gullen Range of approximately 80 turbines would not constitute a controlled action pursuant to Section 75 of the *EPBC Act 1999* and therefore, that significant impact on matters of national significance is not expected as a consequence of the proposal.

5.2.2 Bilateral agreements

In accordance with subsection 45(4) of the *EPBC Act* and Division 16.1 of the EPBC Regulations 2000, the Commonwealth of Australia entered into a bilateral agreement with New South Wales. One of the aims of the agreement is to minimise duplication of environmental impact assessment processes, ensuring a co-ordinated approach for actions requiring approval from both the Commonwealth and the state. Should the proposal be considered a 'controlled action' under the *EPBC Act* the referral would be assessed by the NSW DoP, funded by the federal agency.

While it is not considered that the proposal represents a 'controlled action', as defined by the *EPBC Act 1999*, an EPBC referral was completed for the proposal as a precautionary measure as detailed in Section 5.2.1, above. No other matters pertaining to this proposal are relevant to the bilateral agreement.

5.3 Local government instruments and policies

5.3.1 Local Environmental Plans (LEPs)

The proposed site for the Gullen Range wind farm is located in the Upper Lachlan Local Government Area on land that is subject to three Local Environmental Plans (LEPs):

- Gunning LEP 1997
- Mulwaree LEP 1995
- Crookwell LEP 1994

These LEPs establish the framework for development within the local government area. It contains a planning scheme establishing specific land use zones which guide Council planning. Each zone carries specific planning objectives.

All works proposed for the Gullen Range wind farm would occur within land zoned 1 (a) Rural Zone. The objectives of this zone differ under each LEP. Wind farms are not prohibited under any of these LEPs.

Gunning LEP 1997

Zone 1 (a) objectives:

(a) to maintain the rural character of the area of Gunning,
(b) to encourage the use of rural land for agriculture and other forms of development which are associated with rural activity or which require an isolated or rural location,
(c) to ensure that the location, type and intensity of development is appropriate, having regard to the characteristics of the land, the rural environment and the need to protect significant natural resources, including prime crop and pasture land,
(d) to minimise the cost to the community of:
(i) fragmented and isolated development of rural land, and
(ii) providing, extending and maintaining public amenities and services,
(e) to ensure that the soils within this zone are protected and maintained in good condition, and that the water quality is maintained above a minimum standard determined by the Council.

Crookwell LEP 1994

Zone 1 (a) objectives:

(a) To protect, enhance and conserve the area's:

(i) agricultural land (particularly prime crop and pasture land) to sustain its efficient and effective agricultural production potential,

(ii) forests of existing and potential commercial value for timber production,

(iii) valuable deposits of minerals, coal, petroleum and extractive minerals while allowing their efficient extraction,

(iv) trees and other vegetation in environmentally sensitive areas where they are significant to scenic amenity or natural wildlife habitat or are likely to control land degradation,

(v) water resources for use in the public interest,

(vi) places of significance for nature conservation, and

(vii) places and buildings of archaeological or heritage significance (including the protection of Aboriginal relics and places).

(b) To discourage further subdivision and encourage consolidation of existing agricultural landholdings.

(c) To control development that could:

(i) have an adverse impact on the rural character of the land in the zone,

(ii) create unreasonable or uneconomic demands for the provision or extension of public amenities and services, or

(iii) be subjected to physical limitations such as erosion hazard, bush fire risk and flooding.

(d) To provide land for future urban development, for rural residential development and for development for other non-agricultural purposes, depending on the need for such development.

Mulwaree LEP 1995

Zone 1 (a) objectives are to promote the proper management and utilisation of resources by:

(a) promoting, enhancing and conserving:
(i) agricultural land, particularly prime crop and pasture land, in a manner which sustains its efficient and effective agricultural production potential,
(ii) soil stability by controlling and locating development in accordance with soil capability, as identified by the Department of Conservation and Land Management,
(iii) forests of existing and potential commercial value for timber production,
(iv) valuable deposits of minerals, coal, petroleum, and extractive materials by controlling the location of development for other purposes in order to ensure the efficient extraction of those deposits,
(v) trees and other vegetation in sensitive areas and in any place where the conservation of the vegetation is significant to the protection of scenic amenity or natural wildlife habitat or is likely to control or contribute to the control of land degradation,
(vi) water resources and water catchment areas for use in the public interest,
(vii) localities of significance for nature conservation, including localities with rare plants, wetlands, permanent watercourses and significant wildlife habitat, and
(viii) places and buildings of archaeological or heritage significance, including aboriginal relics and places,
(b) minimising the costs to the community of:
(i) fragmented and isolated development of rural land, and
(ii) providing, extending and maintaining public amenities and services, and
(c) providing land for future urban development, for rural residential development and for development for other non-agricultural purposes, in accordance with the need for that development, and subject to the capability of the land and its importance in terms of the other objectives of this zone.

5.3.2 Wind Power Generation Development Control Plan

The Upper Lachlan Shire Council Wind Power Generation Development Control Plan (DCP) was adopted on 22nd September 2005 and amended in July 2007. Although the scale of the development (in excess of $30 million capital investment) has determined that the proposal would be assessed by the NSW Minister for Planning, during the consultation process Upper Lachlan Shire Council expressed interest in the Proponents referencing the Shire's DCP.

The Upper Lachlan Shire DCP is intended to give the community and developers guidelines in relation to planning wind farms in the local government area. It is not an environmental planning instrument but a guide to the Council's expectations and accordingly has been considered by the Proponent.

A summary of the DCP criteria is outlined below and the means by which the development would address these are provided in the right hand column.

Table 5-3 Items indicated in the Upper Lachlan Shire's DCP for Wind Power Generation

Item	Addressed in:
The EIS, as a minimum, should contain:	
1:25,000 maps showing proposed development, property boundaries, transmission lines, gradient, service roads, significant features (housing, heritage items, aircraft facilities).	All development proposal maps are located in Section 3. See Note 1, below
The location of wind turbine and associated infrastructure, native vegetation, access points.	All development proposal maps are located in Section 3. Vegetation maps are included in the biodiversity assessment, Attachment 3.3. Grid co-ordinates are located in Attachment 4
Description of wind turbines.	Section 3
Land use description of adjoining land including future use.	Landuse has been discussed in Sections 5.3, 7.2, 8.5
Noise impact assessment and compliance to NSW DEC licences, reference to SA EPA wind farm environmental noise guidelines, monitoring to validate predicted noise levels.	Section 7.3
Visual assessment, including shadow flicker.	Sections 7.2, 7.10, 8.6.2
Electromagnetic radiation and interference from the proposed infrastructure (health as well as TV reception issues).	Sections 7.7, 7.8
Construction program environmental management plan incorporating the staging of works, erosion and sedimentation controls, heavy vehicle movements, site access, weed controls, farm impacts and all other works.	Outlined in Section 9
Evaluation of flora and fauna impacts.	Section 7.4 and Attachment 3.3
Decommissioning and site restoration plan.	Decommissioning impacts are evaluated where relevant within this EA. The Proponent commits to a Site Restoration Plan as part of the Project EMP, refer to Section 9
Relevant issues in the NSW EIA Guidelines and NSW Wind Energy Handbook.	These publications have guided the preparation of this EA

Item	Addressed in:
Demonstration that all relevant agencies' issue have been addressed.	Section 5, 6
Heritage significance of the site and surrounds (making reference to the LEP, Heritage Council, DEC, National Trust of Australia, Australian Heritage Council and draft Heritage Council of NSW wind farm policy.	Section 8.7 and Attachment 3.9
Assessment of the development regarding relevant legislation and policies.	Section 5
The development application should consider the following guidelines in design criteria and assessment of the wind farm:	
Sited and carried out to minimise impacts on normal grazing, farming, forestry.	Section 8.5. This objective has been achieved
Carried out to minimise adverse impact on land degradation, drainage patterns, pollution of ground water, spread of noxious plants and animals and bushfire hazard.	Sections 7.4, 7.11, 7.12. This objective has been achieved
Assess and consult with council and community on the visual impacts.	Section 7.2, 6.2. This objective has been achieved
Assess the cumulative impact of the development in regard to existing and proposed wind farms (avoid large expanses of ridges covered with turbines).	Section 8.10. This objective has been addressed
Comply with SA EPA noise criteria guidelines.	Section 7.3. This objective has been achieved
Locate the development more than 15 times the blade tip height *(2.025km for the largest turbines in this proposal)* or 2km (whichever is greater) from any lot that has been created for the purpose of a dwelling (or greater where the turbines will be significantly higher than such properties and will dominate the view).	See Note 2, below
Locate the development more than 2 times the height of the turbine *(270m for the largest turbines in this proposal)* from a formed public road (greater if required by the road authority).	See Note 3, below
Locate the development more than 2 times the height of the turbine *(270m for the largest turbines in this proposal)* from a non-related property boundary.	See Note 4, below
Turbine locations shall be sensitive to non-related dwellings surrounding the development. Existing and proposed screenings could be used to minimise visual impacts to existing and potential building lots.	Section 7.2. The proposal aims to achieve this objective
Turbine locations should not surround a non-related property.	Sections 3, 7.2. This objective has been achieved
Communications study should assess current conditions and potential impacts. If necessary the developer may be required to install additional services to maintain such services.	Section 7.7. The proposal meets this objective
The construction phase shall only occur on approved routes/roads which will be identified in the development application.	Section 7.10. The proposal meets this objective
Substantial investigations into the roads chosen should be undertaken (ARRB and gypsy camera).	Section 7.10. See Note 5, below

Item	Addressed in:
Bonds required for any potential damage to roads during the construction phase, road works required for the development will be at the developers cost.	Section 7.10. See Note 5, below
Internal roads shall be the responsibility of the developer, with proof supplied to council that they have been adequately designed.	Access tracks onsite would be the responsibility of the developer Design details can be forwarded to council, when completed, upon request
All infrastructure required for the wind farm should be included in the development application and located in low visual impact locations.	Section 3 and 7.2. The proposal meets this objective
Reference to relevant council and state acts, assessment guidelines and policies should be made (including the SA EPA noise guidelines)	Section 5 and throughout document. The assessment addresses and meets these objectives
Council prefers to have a viewing area where safe vehicle and pedestrian movements can view the wind farm in a safe manner; the developer should liaise with council and RTA.	See Note 6, below
Within six months of the wind turbine generators becoming redundant, any rights of carriageways that were constructed for maintenance should be extinguished by the developer, unless otherwise agreed to by the landowner.	This objective is not relevant, no rights of carriageways are required
Within six months of the wind turbine generators becoming redundant, they are to be fully dismantled and removed from the site by the developer.	See Note 7, below
Community Enhancement Program prepared in consultation with the community and funded at the rate of $850/MW generating capacity per annum, indexed to the consumer price index for Sydney, commencing at September 2006 quarter.	Section 4.5.2. See Note 8, below

The proposal would generally be compliant with the Council's DCP however, seven items are not considered to be fully compliant. These include:

Note 1 1:25,000 scale plans can be made available to the Council upon request.

Note 2 The proposal does not comply with this set-back distance, however it achieves compliance with the SA noise criteria. Furthermore, the layout has been assessed for visual impact. The noise and visual studies are based on an assessment of amenity and consider site specific factors relating to the project design and minimisation of overall impacts. Accordingly and considering that there is no sound basis for the setback distances described in the DCP, the proposal achieves the desired objectives of the DCP and complies with the other requirements, particularly the noise criteria. Noise monitoring and landscape screening will ensure that adverse impacts are addressed into the operational phase of the wind farm.

Note 3 While only two turbines are within this distance from Range Road, the visual impacts and safety considerations have been assessed within the Traffic Impact Assessment Section 7.10 and are considered acceptable.

Note 4 As per Note 2.

Note 5 A preliminary traffic investigation has been completed (Section 7.10). Additional investigations would occur as required by RTA and DoP, in consultation with the Upper Lachlan and Goulburn-Mulwaree Councils.

Note 6 A viewing area does not form part of this proposal.

Note 7 Within 12 months of wind turbines becoming redundant, they would be removed and the site restored, see Section 7.11. For the scale of the project, this is a more achievable time frame than 6 months.

Note 8 The amount proposed for the Community Enhancement Program would be $75,000 for the wind farm every year, assuming a 278MW wind farm is developed. For further information refer to Section 4.4.2.

6 CONSULTATION

6.1 Government consultation

6.1.1 Initial meetings

The Proponent met with the consent authority, the Department of Planning, formally on 2nd of August, 2007, introducing the Gullen Range proposal and seeking advice on the assessment process. The department participated in the onsite Planning Focus Meeting with other agencies, described below.

6.1.2 Planning Focus Meeting (PFM)

The Planning Focus Meeting (PFM) was held on the 15th August, 2007. Participants met in Goulburn and proceeded to each of the four sites in turn; Gurrundah, Pomeroy, Bannister and Kialla. Simon Davey and Andrew Durran of Gullen Range Wind Farm Pty. Ltd. gave an overview of likely infrastructure placement. Nick Graham-Higgs of **ngh**environmental described the Part 3A assessment process, under the *Environmental Planning and Assessment Act 1979*, and the purpose of the Planning Focus Meeting. Questions and key concerns were then voiced informally by agency representatives, to kick off the agency consultation process.

Agency participants included:

- Neville Osborne and Ricardo Prieto-Curiel, Department of Planning
- Robert Mowle, John Bell, Brian McCormack, Gary Cosgrove and Bill Martin, Upper Lachlan Shire Council
- Dianne James, Goulburn-Mulwaree Shire Council
- Mathew Rizzuto and Craig Jones, Department of Environment and Climate Change
- Col Hackney, Country Energy
- Iain Paterson, Department of Primary Industries (Minerals)
- Ian Kenerley, Rural Fire Service Crookwell
- John Daunt, Department of Lands
- Rob Adam, Hawkesbury Nepean Catchment Management Authority (also representing the Lachlan CMA in this instance)

The minutes of the PFM are included in Attachment 1.2.

Additionally, agencies unable to attend the PFM but expressing interest in the proposal and further consultation included:

- Roads and Traffic Authority
- Civil Aviation Safety Authority
- Department of Primary Industries (Agriculture)
- Department of Defence
- TransGrid
- Department of Water and Energy

6.1.3 Further correspondence

Included with the DGRs, the DoP forwarded agency and stakeholder submissions to be considered in the preparation of the EA. Agencies and stakeholders who provided submissions included:

- Department of Environment and Climate Change
- Sydney Catchment Authority
- Hawkesbury-Nepean CMA
- Upper Lachlan Shire Council
- Goulburn-Mulwaree Shire Council
- CASA
- Airservices Australia
- Department of Defence
- Department of Water and Energy

6.2 Community consultation

Wind farm developments and approvals in Australia have elicited polarised responses from the community, highlighting the need to appropriately identify and consult with community stakeholders early in the development process. The Proponent has informed and consulted with the local community during the planning and development of the Gullen Range wind farm proposal, as discussed below.

6.2.1 Community Consultation Plan

A Community Consultation Plan was prepared by **ngh**environmental with input from Twyford Consulting for the Gullen Range wind farm (Attachment 2.1). It began by developing a 'community decision statement'; that is, the decision around which the community would be engaged:

> *How to assist the Proponent with the identification and mitigation of impacts important to the community, within the context of the wind farm development (i.e. amid technical and other constraints).*

This statement requires the identification of community impacts, prioritisation of these impacts, provision of context and suggestions for mitigation. It also relies on the community understanding the process of wind farm development. These were the challenges of the consultation process. Effective community engagement can address the concerns of the community while making the proposal more acceptable to the local community. This was the aim of the consultation process.

The format of this plan included:

1. Decision statement – what decision will the community be engaged around?
2. Issue management – what specific issues need consideration?
3. Project based activities – what means will be utilised to engage the community?

Methods of consultation included release of media statements, newspaper advertisements and in-person meetings (including onsite meetings, teleconferences and open house sessions). Consultation followed the stages of the development to ensure that transparency was maximised and that activities were appropriate to the stage of the proposal (i.e. *inform* motive: one way transfer of information, promote awareness and educate, or *consult* motive: two way transfer of information, seek input and feed-back).

The Community Consultation Plan prepared for this project is appended, Attachment 2.1.

6.2.2 Two-way flow of information

While the majority of the consultation process focussed on *informing* the community about issues relating to the proposal, activities to engage the community in *two-way dialogue* were also undertaken for the purpose of incorporating community concerns, local knowledge and thereby maximising the suitability of the proposal to the site and the community's acceptance of the proposal.

Face to face meetings

During the early stages of the project and continuing through to the submission of the proposal to the Department of Planning, the Proponent carried out extensive face to face meetings with land owners interested in hosting wind farm infrastructure on their properties and neighbours. These meetings had the aim of explaining the scope of the project, addressing concerns raised and in the case of involved landowners, finalising lease agreements. Between June and December 2007, it is estimated that the project team spoke to 50 land owners in the area surrounding the proposal.

Open house

The open house forum allowed the opportunity for members of the community to speak individually or in small groups to the Proponents and to persons undertaking parts of the environmental assessment. An open house format can be helpful in avoiding the stress and heat of a public meeting for contentious issues, allowing a flow of stakeholder dialogue throughout the event rather than a more constrained discussion that can be hijacked by the most vocal individuals. It allows for a larger proportion of stakeholders to voice their individual concerns with the relevant representatives in a less confrontational situation. It also allows the presentation of issues and information to be tailored to individual queries.

The open house session was held on 21 November 2007 at the Grabben Gullen Hall, Grabben Gullen. A community newsletter preceded the event which was also advertised in the local media (newspaper and radio). The event ran from 2-7pm. Representatives from the Proponent (four representatives), nghenvironmental (two representatives), Marshall Day (two representatives) and ERM (one representative) were present to discuss the proposal specifics (including general questions about wind farms and wind farm development), the environmental planning process, biodiversity, noise and visual impacts. A summary of the work completed to date was distributed as well as a feed back form. Photomontages and noise modelling of the latest turbine layout were posted on the walls of the hall.

Seventy-five people registered their attendance on the day. It is estimated that in total, around 85 people attended. Notable observations made on the day included:

- A community organised meeting to discuss the proposal had been held prior to the open house to discuss the implications of the proposal.
- Several people commented that they would like to see additional photomontages produced. Kialla Road and a property near Grabben Gullen were suggested.
- Several people were interested in the flora and fauna work, particularly the level of clearing that would be required and the process for determining species at risk and monitoring collision impacts
- Several people wanted to know if the proposal had already been approved or was a 'done deal'. The submission timeline and opportunities for input were of interest.

In conversations with the community throughout the day, it became apparent that the amount of local knowledge about wind farm developments and wind farm impacts was greater than previously encountered in the Goulburn area in similar open house forums conducted by **ngh**environmental on behalf of Epuron over the last three years. Also apparent was a larger

degree of misinformation about various environmental impacts, gained from word of mouth and anecdotal information obtained from the internet. Both factors assisted the effectiveness of the consultation by facilitating discussion.

Feedback forms

Feedback forms were handed out at the open house to encourage the community to list their concerns and provide feedback on the proposal (sample provided in Attachment 2). Twenty-two feed back forms had been returned by December 17, 2007. Respondents were asked to tick or list items of concern. The results are tallied below (note, participants were encouraged to list all issues that concerned them, hence totals may not equal 22). Visual, noise and community impacts were of most concern. The issues raised by the community were able to be used to guide the preparation of this Environment Assessment report.

What do you value most about the local area?	**Tally**
Views	14
Community / family ties	11
Historic values	7
Other	4
Work opportunities	3
Recreation opportunities	2
What is you interest in the local area?	
Live nearby	16
Industry	8
Recreation	2
Work nearby	2
Other	1
Which statements best describe you?	
See from house	17
Resident in the area	13
See from property or work	10
See from place of recreation	1
Involved landowner	0
What do you like about wind farms	
See them as an alternative energy option for Australia	12
Nothing	8
What do you dislike about wind farms	
Visual impact	10
Inefficient/dubious	8
Noise pollution	6
They create divisions in the community	5
Nothing	2

If you have concerns about this proposal, please state them under any headings that are relevant below:

a) Environmental concerns	
Bird kill	7
Soil erosion	2
Uncertain environmental value	1
b) Visual concerns	
Destroy scenic rural landscape	12
Unattractive	3
Too close	1
c) Aboriginal / heritage concerns	
Historic properties will lose value	3
Artefacts found on neighbouring property	1
d) Noise issues	
Sound levels	9
As a health issue	7
e) Recreational issues	
Deter tourists	1
Effect on TV	2
Noise and visual impact during personal recreation on property	3
f) Health issues	
Stress	6
Repetitive noise and shadow flicker	4
Vibration	1
g) Community concerns	
Divides community	12
Affect real estate growth	2
Poor integration plan	1
Don't agree the area is sparsely populated	1
h) Other	
Land values will decrease	5
Feel community views will be ignored	3
Wind power is becoming obsolete	3
TV interference	2
Rural people's lives disregarded to support city lifestyles	1
Airfield access	1
Lacks safety guidelines	1
Live close by and have not been consulted	1

6.2.3 Keeping the community informed

Early in the proposal, risks that could hinder effective community consultation were identified. These included the requirement for confidentiality surrounding land owner lease agreements and that the proposal would be assessed by the Minister for Planning rather than a local authority. Both of these features can generate suspicion and ill-feeling difficult to overcome at later stages of the development.

To address this, regular updates were disseminated to the community, even before specific proposal details such as turbine number were known. In person contact was established for the closest landowners, generally those within 2km of selected sites. Media releases, newsletters and editorials were also distributed to the broader community.

Newsletters

The first newsletter introduced the proposal; outlining an indicative time frame for submission to the consent authority and advising of opportunities for receipt of community input. It was distributed to all residents within 5km of the site; 294 landowners in Upper Lachlan Shire, 64 landowners in the Goulburn-Mulwaree Shire and 10 local community groups (posted 20th and 23rd of July 2007). Newsletters were also made available on the counter of the Upper Lachlan Shire Council, Crookwell office.

The second newsletter provided updated proposal information (regarding the number of turbines) and invited the community to attend the open house session to be held locally. It was distributed to all residents within 5km of the site; 294 landowners in Upper Lachlan Shire, 64 landowners in the Goulburn-Mulwaree Shire and 10 local community groups (posted 7 November 2007).

A third newsletter will accompany the submission of the EA, to advise where the reports can be viewed by the public and to thank the community for their participation to date.

Copies of all community consultation material (Community Consultation Plan, local community questionnaire, broader perceptions survey, community newsletters, media releases and letters received from key stakeholders are included as attachments (Attachment 2).