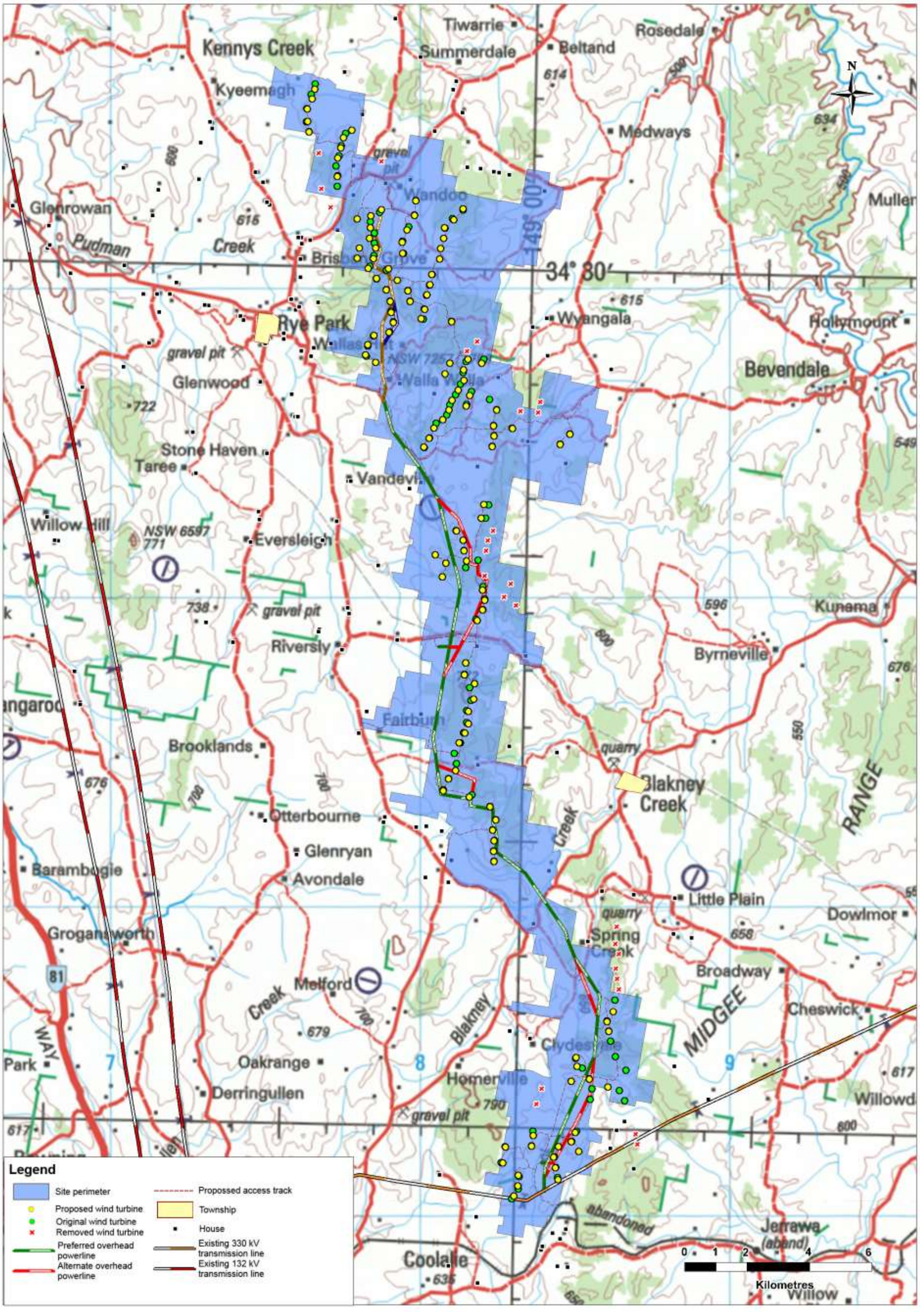


Figure 5-1 A comparison between the initial project layout and final infrastructure design

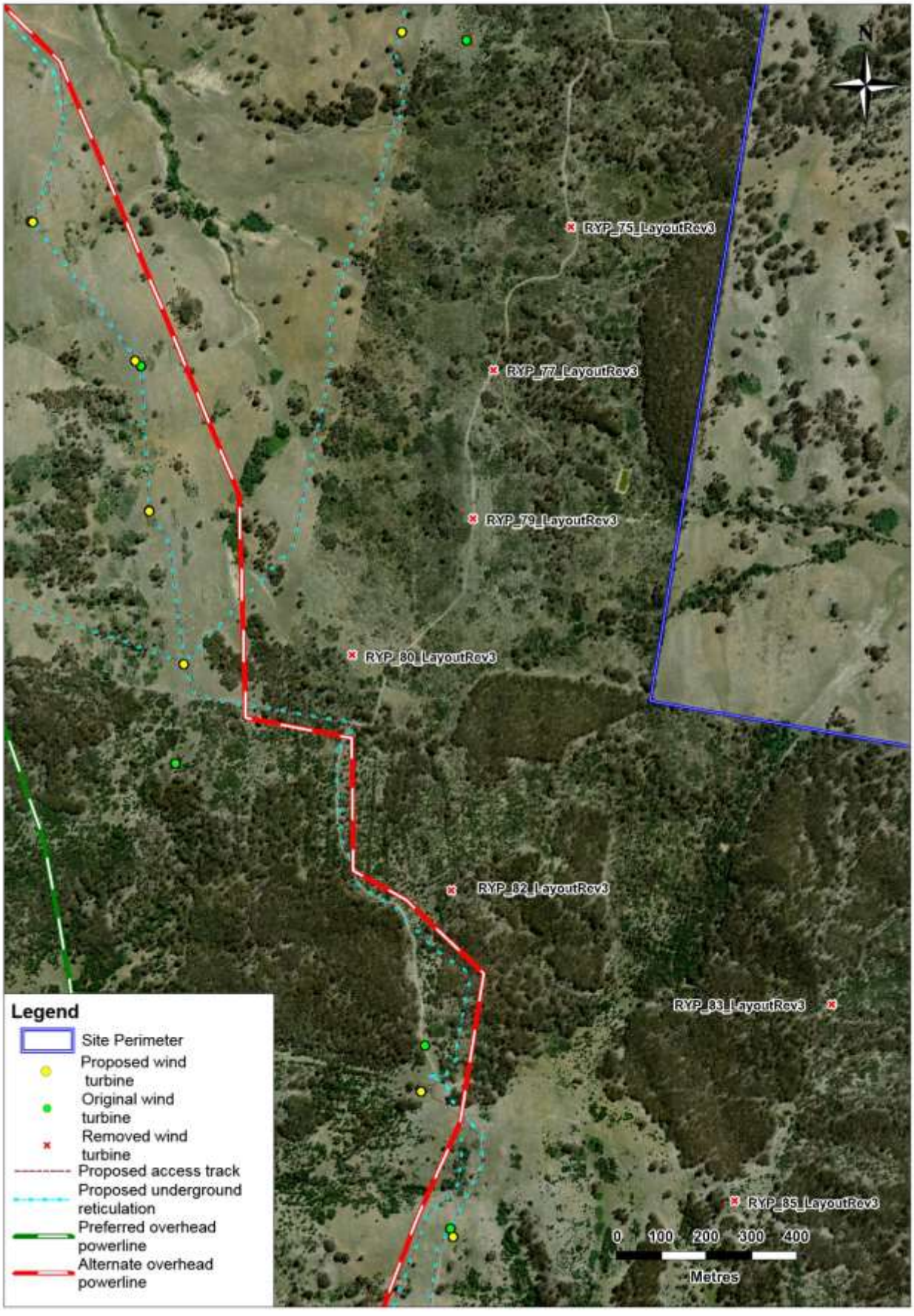


Figure 5-2 Example of revisions made to the layout

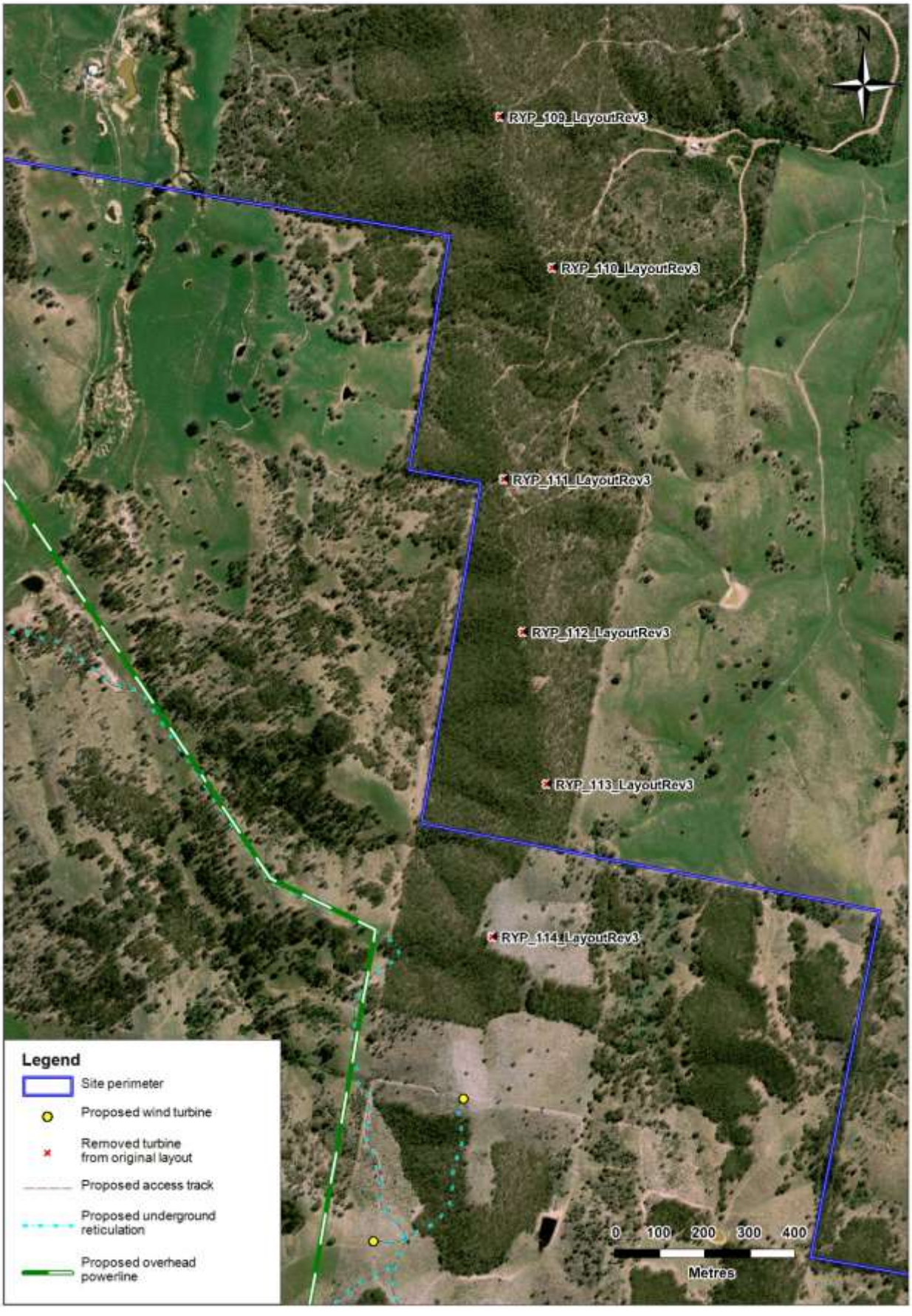


Figure 5-3 Example of changes to transmission line and turbine location

6 Planning Assessment Process

This section of the EA provides an outline of the relevant statutory provisions for the planning assessment process at the State, Local and Commonwealth levels.

6.1 State Government Legislation and Policy

6.1.1 Environmental Planning and Assessment Act 1979

Planning in NSW is governed by the *Environmental Planning and Assessment Act 1979* (*EP&A Act*).

The Director General of the Department of Planning and Infrastructure has issued the requirements for environmental assessment of the project.

Transitional Part 3A Project

Rye Park Wind Farm is a transitional Part 3A project (*EP&A Act,* Schedule 6A Transitional arrangements—repeal of Part 3A – clauses 1, 2 and 3).This is due to the fact that it has a capital investment value 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 and Infrastructure on 2 June 2010, refer to Attachment 4. Part 3A continues to apply to Rye Park Wind Farm because Director General's Requirements were issued before 1 October 2011 (on 14 February 2011), and because this EA is lodged by 30 November 2012, or as extended by DPI.

Critical Infrastructure

Given that the proposed Rye Park Wind Farm will be capable of generating more than 30MW of electricity from renewable energy resources, it is a 'critical infrastructure project' under former Part 3A (former section 75C EP&A Act; *Government Gazette* 27 November 2009 page 5841; letter from Department of Planning to Proponent dated 10 December 2010*).*

Notice Requirement

The consent of the owner of land on which a critical infrastructure project is to be carried out is not required (clause 8F(1)9b) Environmental Planning and Assessment Regulation 2000). Instead, the Proponent is required to give notice of the application for the critical infrastructure project by newspaper advertisement before the start of the public consultation period (in the case of a linear infrastructure project, being development for the purpose of public utility infrastructure (clause 8F(3)(a)), or to the owner of the land before the end of a period of 14 days after the EA application is made (if the wind farm is not a linear infrastructure project (clause 8F(3)(c)). The Department's letter to the Proponent dated 10 December 2010 suggested that a project involving a grid connection would be a linear infrastructure project. However in the event that the generator component of a wind farm (in contrast to the transmission component) means that the proposal is not properly characterised as 'linear infrastructure project', the Proponent should comply with both the newspaper public notice requirement and the alternative landowner notification requirement.

Consent Authority

The Minister determines transitional Part 3A projects (former section 75J(1)). The Minister has delegated this power to the Planning Assessment Commission (Government Gazette, 28 September 2011, page 5682). If the Commission proposes a voluntary planning agreement, the instrument of delegation requires the Commission to first consult with the Minister.

Director General's Requirements

The Director General of the Department of Planning and Infrastructure has issued requirements for the Proponent to consider and address in this EA. These requirements incorporate input from the various government agencies that will provide input to the DPI in the assessment of this project.

The following table summarises the Director General's Requirements (DGRs) and indicates where they are addressed in this EA. The full DGRs are presented in Attachment 5.

Table 6-1 Summary of the Director-General's Requirements

Director-General Requirement's	*Addressed in:*
General Requirements	
The Environmental Assessment (EA) must include:	
➢ an executive summary;	Section 1
➢ a detailed description of the project (both the wind farm and associated infrastructure) including:	
○ construction, operation and decommissioning details;	Section 3.9 and Appendix G
○ the location and dimensions of all project components including the wind turbines (including map coordinates and AHD heights), underground/ overhead cabling between turbines, electrical substation and transmission line linking the wind farm to the grid, temporary concrete batching plant(s), construction compounds, access roads/road upgrades (including internal access tracks) and obstacle lighting;	Sections 3.3, 3.4, 3.5, 3.6, 3.7 and Attachment 3
○ a timeline identifying the proposed construction and operation of the project components including staging, their envisaged lifespan and arrangements for decommissioning;	Section 3.9
○ supporting maps/plans clearly identifying existing environmental features (e.g. watercourses, vegetation), infrastructure and land use (including nearby residences and approved residential developments or subdivisions, if any) and the location/ siting of the project including associated infrastructure in the context of this existing environment; and	See Figures index
○ resourcing requirements (including, but not limited to, water supply and gravel).	Section 16.5
➢ consideration of any relevant statutory provisions including the consistency of the project with the objects of the Environmental Planning and Assessment Act 1979 (i.e. Clause 5 of the Act) and any relevant development control plans;	Sections 6.1 and 6.2
➢ an assessment of the key issues outlined below, during construction, operation and decommissioning (as relevant). The Environmental Assessment must assess the worst case as well as representative impact for all key issues;	See 'Key Assessment Requirements' addressed below
➢ a draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project;	Section 17
➢ a conclusion justifying the project taking into consideration the environmental, social and economic impacts of the project; the suitability of the site; and the public interest; and	Section 18
➢ certification by the author of the EA that the information contained in the assessment is neither false nor misleading.	Section 20
Key Assessment Requirements	
The EA must include assessment of the following key issues for both the wind farm and transmission line:	
➢ Strategic Justification – the EA must:	
○ include a strategic assessment of the need, scale, scope and location for the project in relation to predicted electricity demand, predicted transmission constraints and the strategic direction of the region and the State in relation to electricity supply, demand and electricity generation technologies, and its role within the Commonwealth's Renewable Energy Target Scheme. The EA must clearly demonstrate that the existing transmission infrastructure has sufficient capacity to accommodate the project;	Sections 4.1, 4.2, 4.3, 4.4 and 3.4
○ include a clear demonstration of quantified and substantiated greenhouse gas benefits, taking into consideration sources of electricity that could realistically be replaced and the extent of their replacement, with reference to the Department of Environment, Climate Change and Water NSW wind farm greenhouse gas savings tool	Section 4.2

(http://www.environment.nsw.gov.au/climatechange/greenhousegassavingstool.htm);	
○ include an analysis of the suitability of the project with respect to potential land use conflicts with existing and future surrounding land uses (including rural residential development, building entitlements and subdivision potential, land of significant scenic or visual value, land of high agricultural value, mineral reserves, forestry, conservation areas and Crown land), taking into account local and strategic land use objectives and the potential for social and economic impacts on the local community. The analysis of site suitability shall consider the Environmentally Sensitive Area Mapping held by Boorowa, Yass Valley and the Upper Lachlan Shire Councils; and	Section 6.1
○ describe the alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits on a local and strategic scale and how it achieves stated objectives and any measures to offset residual impacts (for example community enhancement programmes).	Sections 5.2 and 4.5.4
➢ Visual Impacts – the EA must:	
○ provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project, including an assessment of the significance of landscape values and character in a local and regional context. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation;	Sections 9.1 – 9.4 and Appendix A
○ assess the impact of shadow "flicker", blade "glint" and night lighting from the wind farm;	Sections 9.1, 14.1, 14.4 and Appendix A.1
○ identify the zone of visual influence of the wind farm including consideration to night lighting (no less than 10 kilometres) and assess the visual impact of all project components on this landscape;	Section 9.1
○ include an assessment of any cumulative visual impacts from transmission line infrastructure;	Section 9.3
○ include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for both the wind farm and the transmission line. The photomontages must include representative views of turbine night lighting if proposed; and	Section 9.1 an Appendix A.10
○ provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.	Section 9.4 and Appendix A.15
➢ Noise Impacts – the EA must:	
○ include a comprehensive noise assessment of all phases and components of the project including: turbine operation, the operation of the electrical substation, corona and / or aeolian noise from the transmission line, construction noise (focusing on high noise generating construction scenarios and works outside of standard construction hours), traffic noise during construction and operation, and vibration generating activities (including blasting) during construction and/ or operation. The assessment must identify noise/ vibration sensitive locations (including approved but not yet developed dwellings), baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness, low frequency etc.) generated by noise sources, noise/ vibration criteria, modelling assumptions and worst case and representative noise/ vibration impacts;	Section 10 and Appendix B
○ in relation to wind turbine operation, determine the noise impacts under operating meteorological conditions (i.e. wind speeds from cut in to rated power), including impacts under meteorological conditions that exacerbate impacts (including varying atmospheric stability classes and the van den Berg effect for wind turbines). The probability of such occurrences must be quantified;	Sections 10.2 – 10.6 and Appendix B.7.1, B.7.2 and B.7.4

○ include monitoring to ensure that there is adequate wind speed/profile data and ambient background noise data that is representative for all sensitive receptors;	Section 10.2 and Appendix B.6
○ provide justification for the nominated average background noise level used in the assessment process, considering any significant difference between daytime and night time background noise levels at background noise levels higher than 30 dB(A);	Section 10.2 and Appendix B.6
○ identify any risks with respect to tonal, low frequency or infra-noise;	Sections 10.3, 10.4, 10.5 and Appendix B.7.6 and B.9.2
○ clearly outline the noise mitigation, monitoring and management measures that would be applied to the project. This must include an assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been incorporated;	Section 10.2, Appendix B.7, B.7.5 and SoC 8 – 14
○ if any noise agreements with residents are proposed for areas where noise criteria cannot be met, provide sufficient information to enable a clear understanding of what has been agreed and what criteria have been used to frame any such agreements; and	n/a
○ include a contingency strategy that provides for additional noise attenuation should higher noise levels than those predicted result following commissioning and/or noise agreements with landowners not eventuate.	Section 10.1.10, 10.1.14, Appendix B.7.5 and SoC 15 and 16
The assessment must be undertaken consistent with the following guidelines:	
○ Wind Turbines - the South Australian Environment Protection Authority's Wind Farms- Environmental Noise Guidelines (2003);	Section 10 and Appendix B
○ Substation- NSW Industrial Noise Policy (EPA, 2000);	Section 10.8 and Appendix B.7.7
○ Site Establishment and Construction - Interim Construction Noise Guidelines (DECC, 2009);	Section 10.11 – 10.14 and Appendix B.10
○ Traffic Noise - Environmental Criteria for Road Traffic Noise (NSW EPA, 1999); and	Section 10.12 and Appendix B.10.10
○ Vibration - Assessing Vibration: A Technical Guideline (DECC, 2006).	Sections 10.5, 10.2 and Appendix B.10.8 and B.10.9
➢ Ecological Impacts – the EA must include an ecological assessment considering terrestrial and aquatic ecosystems (as relevant), including groundwater dependent ecosystems, consistent with Guidelines for Threatened Species Assessment (DEC, 2005); The EA must:	
○ identify threatened species, populations and communities listed under both State and Commonwealth legislation that have the potential to occur on site. In particular, the following must be addressed: box woodland, table basalt forest and natural temperature grassland communities, and crimson spider orchid, silky swainson-pea, Yass daisy, hoary sunray, small woodland birds, superb, turquoise & swift parrots, barking owl & powerful owl, raptors, squirrel glider, koala, spotted tailed quail, bats and golden sun moth;	Sections 11.2 – 11.4 and Appendix C
○ map existing vegetation by vegetation/ community type and include details on existing site conditions, including whether the vegetation comprises a highly modified or over-cleared landscape and the types and quality of habitat resources available. Vegetation mapping should consider any Environmentally Sensitive Area Mapping held by Boorowa Council, Yass Valley and the Upper Lachlan Shire Council;	Appendix C
○ provide details of the survey methodology employed including survey effort and representativeness for each species targeted and clear justification for species that were discounted from requiring field surveys or further assessment;	Sections 11.1 and 11.2
○ demonstrate a design philosophy of impact avoidance on ecological values, and in particular, ecological values of high significance;	Sections 11.8 and 5.2
○ provide a worst case estimate of vegetation to be cleared (in hectares), including quantifying impacts (in hectares) by vegetation type and threatened species	Sections 11.6, 11.7 and 11.9

habitat (as relevant);	
○ assess the significance of impacts to native vegetation, listed threatened species, populations and communities and their habitats with consideration to local and region-based ecological implications, including habitat connectivity and distribution of species. The assessment must consider impacts to in-stream and riparian ecology from works close to waterways and/ or waterway crossings. In addition, impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting from the turbines must be assessed, including demonstration of how the project has been sited to avoid and/ or minimise such impacts;	Sections 11.5 – 11.7
○ include details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation/ regeneration measures and maintenance protocols;	Section 11.8
○ demonstrate how the project (with the incorporation of all proposed measures to avoid, mitigate and/ or offset impacts) achieves a biodiversity outcome consistent with "maintain or improve" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project and to secure these measures in perpetuity; and	Section 11.8 and SoC 38 and 39
○ address the risk of weed spread and identify mitigation measures.	SoC 28
➢ Heritage - the EA must include an assessment of the potential impact of the project components on Aboriginal heritage values (archaeological and cultural). The EA must demonstrate effective consultation with Aboriginal stakeholders during the assessment and in developing mitigation options (including the final recommended measures) consistent with Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (DEC, July 2005). The EA must also consider impacts to historic (European) heritage values, as relevant.	Section 12 and Appendix D
➢ Traffic and Transport - the EA must assess the construction and operational traffic impacts of the project including:	
○ details of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation;	Section 13.1.1 and Appendix E
○ assess the potential traffic impacts of the project on road network function (including intersection level of service) and safety;	Section 13.1.2 and Appendix E
○ assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over dimensional traffic) during construction and operation, including full details of any required upgrades to roads, bridges, site access provisions (for safe access to the public road network) or other road features;	Appendix E
○ details of measures to mitigate and/or manage potential impacts, including construction traffic control, road dilapidation surveys and measures to control soil erosion and dust generated by traffic volumes;	Section 13.3 and Appendix E
○ details of access roads within the site including how these would connect to the existing public road network (i.e. site access) and ongoing operational maintenance requirements for on-site roads; and	Section 13 and Appendix E
○ consideration of relevant Council traffic/road policies.	Section 13.1 and Appendix E
➢ Hazard/Risks- the EA must include an assessment of the potential impacts on aviation safety, including the need for aviation hazard lighting, considering nearby aerodromes and aircraft landing areas, defined air traffic routes, aircraft operating heights, approach/departure procedures, radar interference, communication systems, and navigation aids. Aerodromes within 30km of the turbines should be identified and impacts on obstacle limitation surfaces addressed. Attention is drawn to Airservices Australia's specific requirements (attached). In addition, the EA must assess the impact of the turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the turbines and transmission line. Possible effects on telecommunications systems must be identified. Potential hazards and risks associated with electric and magnetic fields and bushfires/use of bushfire prone land must also be assessed.	Section 14

➢ Water Supply, Water Quality and Hydrology - The EA must identify water demands, and determine whether an adequate and secure water supply is available for the project, including the statutory (licensing) context of the water supply sources, and assess potential environmental impacts associated with use of identified sources including impacts on groundwater and implications for existing licensed users/basic landholder rights. The potential to intercept groundwater should be assessed. Where the project involves crossing or works close to waterways, the EA must identify likely impacts to the waterways and measures to minimise hydrological, water quality, aquatic and riparian impacts. The EA must identify how works within steep gradient land or highly erosive soil types will be managed during construction and operation.	Section 15
➢ General Environmental Risk Analysis - notwithstanding the above key assessment requirements, the EA must include an environmental risk analysis to identify potential environmental impacts associated with the project, proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures·. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impact(s) must be included in the EA.	Section 16
Consultation Requirements	
The Proponent must undertake a consultation programme as part of the environmental assessment process, including consultation with, but not necessarily limited to, the following parties:	Section 7
➢ Boorowa Council	Section 7.3
➢ Yass Valley Council	Section 7.3
➢ Upper Lachlan Shire Council	Section 7.3
➢ Department of Environment, Climate Change and Water;	Section 7.3
➢ NSW Office of Water;	Section 7.3
➢ Industry and Investment NSW;	Section 7.3
➢ NSW Roads and Traffic Authority;	Section 7.3
➢ NSW Rural Fire Service;	Section 7.3
➢ Land and Property Management Authority;	Section 7.3
➢ Lachlan Catchment Management Authority;	Section 7.3
➢ Commonwealth Department of Defence;	Section 7.3
➢ Civil Aviation Safety Authority;	Section 7.3
➢ Airservices Australia;	Section 7.3
➢ Aerial Agricultural Society of Australia;	Section 7.3
➢ relevant service providers;	Section 7.3
➢ relevant minerals stakeholders (including exploration and mining title holders); and	Section 7.3
➢ the local community and landowners (including "associated" and "non-associated" properties).	Section 7.3
The consultation process shall include measures for disseminating information to increase awareness of the project as well as methods for actively engaging stakeholders on issues that would be of interest/concern to them. The EA must:	
➢ demonstrate effective consultation with stakeholders, and that the level of consultation with each stakeholder is commensurate with their degree of interest/concern or likely impact;	Section 7.2
➢ clearly describe the consultation process undertaken for each stakeholder/group including details of the dates of consultation and copies of any information disseminated as part of the consultation process (subject to confidentiality); and	Section 7.2 and Attachment 7
➢ describe the issues raised during consultation and how and where these have been	Section 7.2 and 5.2

addressed in the EA.	

Supplementary Director-General's Requirements

The Director-General of the Department of Planning and Infrastructure issued supplementary DGRs on 16 August 2011. These supplementary DGRs related to the requirement:

"…that the community must be consulted during the preparation of the Environmental Assessment and relevant issues must be addressed in the document."

Table 6-2 summarises the supplementary DGRs and highlights the sections in which the appropriate responses have been made. The full supplementary DGRs are presented in Attachment 5.

Table 6-2 Summary of the Supplementary Director-General's Requirements

Supplementary Director-General's Requirements	***Addressed In:***
A comprehensive, detailed and genuine community consultation and engagement process must be undertaken. This process must ensure that the community is both informed of the proposal and actively engaged in issues of concern to them, and is given ample opportunity to provide its views on the proposal. Sufficient information must be provided to the community so that it has a good understanding of what is being proposed and of the impacts. There should be a particular focus on those non wind farm associated community members who live in proximity to the site;	Section 7 and Attachment 6 and 7
The EA must clearly document and provide details and evidence of the consultation process and who was consulted with;	Sections 7.2 and Attachment 6 and 7
All issues raised during the consultation process must be clearly identified and tabulated in the EA; and	Sections 7.2 and 5.2
The EA must state how the identified issues have been addressed, and how they have informed the proposal as presented in the EA. In particular, the EA must state how the community's issues have been responded to.	Section 7

6.1.2 Draft NSW Wind Farm Planning Guidelines

The Draft NSW Wind Farms Planning Guidelines have been prepared to ensure effective consultation with local communities and to deliver improved consistency, transparency and rigour in the planning assessment process. These guidelines were exhibited from 23 December 2011 to 14 March 2012 and public comments on the draft guidelines were sought.

Correspondence was received from the Director-General on 18 April 2012 in regards to the changes that the guidelines would introduce. A list of key aspects that must be considered has been provided for projects that have received their DGRs but where the project has not yet been exhibited.

The Draft Guidelines provided a table of key aspects relevant to applications. See Table 6-3.

Table 6-3 Key issues of the Draft NSW Planning Guidelines for Wind Farms

Potential Issues for Consideration	***Addressed In:***
Consultation	
Form a Community Consultation Committee	Section 7.2
Document the consultation process undertaken, including the stakeholders consulted. Identify and tabulate the issues raised by the stakeholders during consultation. Describe how the issues raised have been addressed.	Section 7
Consult with all neighbours with dwellings within 2km of a proposed wind turbine.	Section 7.2
Consider seeking an agreement with neighbours with dwellings within 2km of a proposed turbine.	Section 7.2.2.3
Landscape and Visual Amenity	
Provide photomontages from all non-host dwellings within 2km of a proposed wind turbine.	Section 9 and Appendix A

Potential Issues for Consideration	*Addressed In:*
Identify the zone of visual influence of the wind farm (no less than 10km) and likely impacts on community and stakeholder values. Consider cumulative impacts on landscapes and views.	Section 9
Outline mitigation measures to avoid or manage impacts.	Section 9.4
Noise	
Undertake assessment based on separate daytime (7am to 10pm) and night time (10pm to 7am).	Section 10 and Appendix B
Predict noise levels at all dwellings within 2km of a proposed turbine.	Section 10
Consider special audible characteristics, including tonality, amplitude modulation, and low frequency noise (apply penalties where relevant)	Section 10
Outline measures to avoid, minimise, manage and monitor impacts.	Section 10
Health	
Consider and document health issues, focusing on neighbours with dwellings within 2km of a proposed wind turbine.	Sections 8.1 and 14.7
Ecological Issues	
Consider the impact on birds and bats, particularly migratory species and outline the proposed monitoring and mitigation strategy.	Section 11 and Appendix C
Aviation Safety	
Outline current agricultural aerial uses on neighbouring properties.	Section 14.1
Consider the potential for the proposed wind farm to impact on aviation safety associated with agricultural aerial uses consistent with the draft guidelines.	Section 14.1
Bushfire Hazard	
Consider bushfire issues consistent with the draft guidelines, including the risks that a wind farm will cause bushfire and any potential impacts on the aerial fighting of bushfires.	Section 14.5
Blade Throw	
Assess blade throw risks consistent with the draft guidelines.	Section 14.6
Outline measures to avoid, minimise, manage and monitor impacts.	Section 14.6
Economic Issues	
Consider whether the wind farm is consistent with the relevant local or regional land use planning strategies	Section 6.1.10
Consider the potential impact upon mining/petroleum leases and exploration licenses.	Section 16.3
Consider any potential impacts upon property values consistent with the draft guidelines, including properties within 2km.	Sections 16.6 and 8.1
Decommissioning	
Include a Decommissioning and Rehabilitation Plan in the EA, including proposed funding arrangements.	Section 3.9.4 and Appendix G
Confirm that the proponent not the landowner is responsible for decommissioning.	Section 3.9.4 and Appendix G
Monitoring and Compliance Program	
Outline program to monitor the environmental performance to ensure compliance including mechanisms for reporting outcomes and procedures to rectifying non-compliance – including any provisions for independent reviews.	Statement of Commitments
Council Planning Controls	
Outline whether the proposal is consistent with any relevant provisions of the relevant council's Development Control Plan and list any variations	Section 6.1.10

6.1.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) only apply to the carrying out of a critical infrastructure project 'to the extent that the provisions of such a policy expressly provide that they apply to and in respect of the particular project' (former section 75R(2)(b) EPA&A). No SEPPs expressly provide that they apply to and in respect of the Rye Park Wind Farm project, with the result that SEPPS do not apply to this application. However 'In deciding whether or not to approve the carrying out of a project, the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved' (former section 75J(3)). Accordingly, the Minister may wish to take into account *State Environmental Planning Policy No 44 – Koala Habitat Protection ('Koala SEPP').*

The *Koala SEPP* applies to the Boorowa and Yass local government areas (Schedule 1, *Koala SEPP*). While Upper Lachlan local government area is not listed in Schedule 1 as an area to which the *Koala SEPP* applies, the former local government areas of Gunning and Mulwaree, which were amalgamated to form Upper Lachlan Shire Council after the date of last amendment of the *Koala SEPP,* are listed in Schedule 1. Accordingly, the Minister may wish to take into account the provisions of the *Koala SEPP* in considering the Rye Park Wind Farm application.

The Minister may also wish to take into account *SEPP (Infrastructure) 2007*. Electricity generating works, such as the Rye Park Wind Farm, may be carried out with consent in certain prescribed zones (clause 34). These zones, defined in clause 33, are consistent with the rural zonings in the Rye Park Wind Farm local government areas, as further discussed in 'Local Government Instruments and Policies' in this EA.

6.1.4 Protection of the Environment Operations Act 1997

The proposed development of the Rye Park Wind Farm does not require an environment protection licence under the Protection of the Environment Operations Act 1997 (POEO Act) because wind power generation is excluded from the definition 'general electricity works' that must be licensed (POEO Act, section 48 and Schedule 1, clause 17(1)).

However, at the time of writing this EA, we understand the Environmental Protection Authority is proposing an amendment to the POEO Act requiring wind farms to be licensed. In the event this amendment comes into force during the assessment of this EA the granting of a license is required.

6.1.5 Roads Act

The Roads Act 1993 provides certain rights with respect to public roads and the regulation of activities relating to public roads. The project would require minor upgrade works to various public roads as outlined in Section 13, Traffic and transport, enabling access to wind farm access roads for construction vehicles. Under Section 138 of the Roads Act 1993, approval is sought under this EA from the appropriate road authority for proposed upgrade works on public roads.

6.1.6 Crown Lands Act

Under the Crown Lands Act 1989 proposed access via an existing Crown road to a proposed development must obtain the approval of the Land and Property Management Authority. The proposed road works must be approved by the Land and Property Management Authority under sections 71 or 138 of the Roads Act 1993 on behalf of the Minister for Lands as the designated Roads Authority. As sections of some wind farm access roads are proposed over existing Crown roads, this approval is sought under the EA.

6.1.7 Ecologically Sustainable Development

Ecologically sustainable development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*. In NSW, the concept has been incorporated in legislation such as the *EP&A Act* and Regulation.

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:

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:
    - Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
    - An assessment of the risk-weighted consequences of various options.
- 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;
- Conservation of biological diversity and ecological integrity: that conservation of biological diversity and ecological integrity should be a fundamental consideration;
- Improved valuation, pricing and incentive mechanisms: that environmental factors should be included in the valuation of assets and services, such as:
    - Polluter pays: that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;
    - 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; and
    - Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which 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 impacts of the project on ecology, including EPBC listed species, have been assessed in detail in the attached Ecology Assessment (summarised in Section 11).

The aims, structure and content of this EA have incorporated these ESD principles. The Draft *Statement of Commitments* in Section 17 provides an auditable environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the project 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 principles.

6.1.8 Catchment Action Plans

Catchment Action Plans (CAPs) are strategic, statutory plans under the *Catchment Management Authorities Act 2003* that provide a framework for natural resource management in a catchment. CAPs include general principles for biodiversity, land and water management.

Each catchment management authority is required to prepare a catchment action plan in partnership with regional community and government agencies. Catchment action plans guide natural resource management investment in the 13 catchment regions across NSW. They bring together government priorities, best available science and the values of catchment communities into a strategic plan for making improvements in NSW's natural resources (ABS, 2010).

The proposed Rye Park Wind Farm falls across the border of the Lachlan and Murrumbidgee Catchment Management Authorities.

Overall, the Rye Park Wind Farm will only have a small effect on the key principles of:

- water management;
- regional vegetation management;

- floodplain management;
- regional action plans;
- property management;
- local environment plans.

While vegetation clearing would be required on site, the amount required would be relatively small in size. The impact to native vegetation has been assessed as part of the proposal and was concluded to be manageable with effective implementation of the Construction Environmental Management Plan.

Of these other principles which the development may affect, prevention and mitigation measures identified to reduce potential impacts have been developed using best practice and will be implemented into both the Construction and Operational Environmental Management Plans.

6.1.9 Renewable Energy Precincts

In February 2009 the NSW Government created six renewable energy precincts in areas where significant future renewable energy development is expected, especially wind farms. The precincts were each assigned a coordinator with the purpose of enabling local communities to have a voice and a stake in renewable energy development

The proposed wind farm is located within the NSW/ACT Border East and ACT/NSW Border West Precincts.

6.1.10 Local Government Instruments and Policies

Local Environment Plans

As stated above (in relation to SEPPs) 'In deciding whether or not to approve the carrying out of a project, the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved' (EP&A Act, former section 75J(3)). Local Environmental Plans are environmental planning instruments (EPA&A section 4). Accordingly the Minister may (but is not required to) take into account the applicable Local Environmental Plans (LEPs), namely:

- Yass LEP 1987;
- Upper Lachlan LEP 2010; and
- Boorowa LEP 2012

Yass LEP 1987

Yass Valley Council was created by council amalgamation in 2004, and as a result three LEPs (Gunning, Yarrowlumla and Yass) currently apply in different parts of the local government area. The project passes through land subject to Yass LEP 1987 only.

The part of the project site under Yass LEP is zoned No 1(a) Rural Agriculture. Wind farms are permissible with consent in Zone 1(a) Rural Agriculture.

The objective of Zone No 1 (a) (Rural Agriculture Zone) is 'to set aside certain land for agricultural purposes and purposes incidental thereto'.

The project is 'generating works' or 'public utility undertaking' (being one for the supply of electricity in pursuance of the National Electricity (New South Wales) Act 1997) or both (Environmental Planning and Assessment Model Provisions 1980, as adopted by clause 6 Yass LEP 1987. Both generating works and public utility undertakings may be undertaken with consent in zone 1(a) (clause9, Yass LEP 1987).

Draft Yass Valley Local Environmental Plan was endorsed by Yass Valley Council on 14 November 2012, and as at 18 February 2013 awaits making by the Minister. The part of the project site under Draft Yass Valley Local Environmental Plan is zoned RU1 (Primary Production). The objectives of the draft RU1 zone include 'To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.' Wind farms would be prohibited in that zone, however State Environmental Planning Policy (Infrastructure) 2007 would override the prohibition (clauses 8,33 and 34), resulting in development for the purpose of electricity generating works, such as the proposed wind farm, being permissible with consent.

Upper Lachlan LEP 2010

The part of the project site which is in the area of Upper Lachlan LEP 2010 is zoned RU2 Rural Landscape. The objectives of Zone RU2 Rural Landscape are as follows:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- to maintain the rural landscape character of the land;
- to provide for a range of compatible land uses, including extensive agriculture;
- to preserve environmentally sensitive areas including waterways and prevent inappropriate development likely to result in environmental harm;
- to protect the Pejar catchment area from inappropriate land uses and activities and minimise risk to water quality;
- to minimise the visual impact of development on the rural landscape;
- to minimise the impact of development on the existing agricultural landscape character;
- to protect and enhance the water quality of watercourses and groundwater systems and to reduce land degradation; and
- to maintain areas of high conservation value vegetation.

As above the project is 'electricity generating works' or 'public utility undertaking' (being one for the supply of electricity in pursuance of the National Electricity (New South Wales) Act 1997). Electricity generating works and public utility undertakings may be undertaken with consent in zone RU2 Primary Production (Dictionary and Land Use Table to the Upper Lachlan LEP 2010).

Boorowa LEP 2012

The part of the project site under Boorowa LEP 2012 is zoned RU1 (Primary Production), the objectives of which are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- to encourage diversity in primary industry enterprises and systems appropriate for the area;
- to minimise the fragmentation and alienation of resource lands;
- to minimise conflict between land uses within this zone and land uses within adjoining zones;
- to encourage development that is in accordance with sound management and land capability practices, and that takes into account the natural resources of the locality; and
- to support rural communities.

The project is 'electricity generating works' or 'public utility undertaking' (being one for the supply of electricity in pursuance of the National Electricity (New South Wales) Act 1997). Electricity generating works and public utility undertakings may be undertaken with consent in zone RU1 Primary Production (Dictionary and Land Use Table to the Boorowa LEP 2012).

Development Control Plans and local council policies

In the same way that the Minister may wish to (but is not required to) take into account the provisions of LEPs (EPAA former section 75J(3)), the Minister may wish to take into account the current Development Control Plans (DCP) and other policies of Upper Lachlan Shire which specifically addresses the development of wind farms.

Upper Lachlan Economic Development Plan and Strategy

The Economic Development Plan and Strategy includes as a current strength of the Shire 'potential to leverage off the wind farms for a potential renewable energy/clean energy hub or businesses attracted by this' (ULSC, 2007).

Upper Lachlan Development Control Plan 2010

Section 3.17 (Community Enhancement Programs), section 9.5 (Wind Farms) and Appendix A (Wind Farm Planning Agreement) of Upper Lachlan Development Control Plan 2010 (including amendments up to 22 September 2011) provide a guide to the Council's expectations in relation to wind farms, and accordingly have been considered by the Proponent as indicated in Table 6-4.

While the project does comply with most of the controls proposed by the DCP (see Table 6-4), it should be noted that there are some exceptions.

The project does not comply with set-back distances suggested in this DCP; however, it achieves compliance with the SA EPA Guidelines. 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. In Gullen Range Wind Farm Pty Limited v Minister for Planning [2010] NSWLEC 1102 (at [167]) the Court described the 2km setback proposed in the DCP as arbitrary, and rejected it. The project achieves the desired objectives of the DCP and complies with the other requirements, particularly the noise criteria.

Table 6-4 Criteria from the Upper Lachlan Shire DCP 2010 relating to wind farms

Special Development types – Wind Farms DCP Criteria	***Relevant section in this EA***
Any EIS (EA) as a minimum to contain:	
The location details of all wind farm infrastructure with accompanying maps at 1:25,000 scale including a site plan for turbines, access points, powerlines and native vegetation.	Section 3
Specifications of the proposed wind turbines	Section 3
Description of land use of the adjoining land	Discussed in Section 1.13
A detailed noise assessment of the noise impact of the proposal, including construction and operation of the wind turbines.	Section 10
An assessment on the visual impact for a distance of at least 10 kilometres	Section 9
Evaluation of electromagnetic radiation from the proposed infrastructure	Section 14.3
A construction program and environmental management plan	Discussed in Section 8
Evaluation of flora and fauna impacts	Section 11
The heritage significance of the site and surroundings	Section 12
A decommissioning and site restoration plan and program	Section 17
Demonstration that adequate consultation has been conducted with all issues addressed	Section 7
A post construction and commissioning program	Section 17
An assessment of any risks involved in soil disturbance, including contamination impacts on hydrology and archaeology issues	Sections 16 & 12
Assessment of the development regarding all relevant legislation and applicable policies	Section 1 & 6
Project design and development application guidelines:	
Development to be sited to minimise impacts to farming, grazing, forestry practices and tourism as well as adjoining land	Discussed in Sections 3 & 14
Assess the cumulative impact of the proposal in relation to existing or proposed wind farm developments	Section 9 & 10
Comply with the SA EPA noise criteria guidelines	Section 10
Locate the development 2km from any non-associated dwelling.	Section 6.1.10
Locate the development more than 2 times the tip height from a formed public road	Section 6.1.10
Locate the development more than two times the tip height from a non-associated property boundary	Section 6.1.10
Turbine locations to be sensitive to existing associated dwellings	Sections 9 & 10
Turbine locations should not surround a non-associated residence	Section 3.2
A communications study should address any potential interference and mitigation measures	Section 14.2

Special Development types – Wind Farms DCP Criteria	*Relevant section in this EA*
Construction to only occur on identified roads/routes	Section 13
Substantial investigation to be undertaken into the roads chosen for the preferred route, with bonds required for any potential damage to roads during construction. Internal roads to be adequately designed by the developer.	Section 13 & 17
All related infrastructure to the wind farm should be included in the Development Application and located in areas of low visual impact	Section 3 & 9
If appropriate, a safe viewing area for the public be provided	Not considered necessary
Within 6 months of wind turbine generators ceasing to operate, any right of carriage way are to be extinguished	Section 3
Within 12 months of wind turbine generators ceasing to operate, they are fully dismantled and removed from the site	Section 3
Details of the proposed electricity grid connection	Section 3.4

Yass Valley Policy: Development on Elevated Land

Yass Valley Policy on Development on Elevated Land (YVC, 2012) requires visual impacts of development from public roads, public places and adjoining allotments to be considered in relation to bulk and scale, and impacts on the skyline or significant views. Such visual assessment is contained in Section 9 of this EA.

6.2 Commonwealth Legislation

6.2.1 Environment Protection and Biodiversity Conservation Act 1999

This *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for a Commonwealth assessment and approvals system for:

- actions that have a significant impact on 'matters of national environmental significance';
- actions that (indirectly or directly) have a significant environmental impact on Commonwealth land; and
- 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:

- World heritage properties;
- National heritage places
- wetlands of international importance (Ramsar wetlands);
- Commonwealth listed threatened species and ecological communities;
- Commonwealth listed migratory species;
- nuclear actions;
- the Great Barrier Reef Marine Park;
- Commonwealth marine areas; and
- a water resource, in relation to coal seam gas and large mining development.

Threatened Species and Ecological Communities

The EPBC Act aims to ensure the conservation and recovery of flora and fauna species and communities at a state and national level. The requirements of EPBC Act under Part 13 - Species and communities, are that the Minister must establish a list of threatened species, threatened communities and key threatening processes. The list must contain threatened species and communities as contained in Schedules 1 and 2 of the *Endangered Species Protection Act 1992*. Listed species are divided into the following categories: Extinct, extinct in the wild, critically endangered, vulnerable and conservation dependent. Threatened communities are divided into the following categories: Critically endangered and endangered. Key threatening processes are contained in Schedule 3 of the *Endangered Species Protection Act 1992*.

A search for Matters of National Environmental Significance based on the study area and a 10 kilometre buffer was undertaken using the Commonwealth Government's Protected Matters Search Tool. This tool covers World Heritage properties, National Heritage places, significant wetlands, migratory species, nationally listed threatened species and communities and other matters protected by the EPBC Act. The report generated by the Matters of National Environmental Significance Commonwealth Government's Protected Matters Search Tool is provided in full and discussed within the Ecology Assessment, provided in Appendix C. A summary of the results of the Protected Matters Search Tool is provided in Table 6-5 below.

Table 6-5 Summary of the results of the Protected Matters search tool

Rye Park Wind Farm	
Threatened Species	21
Migratory Species	14
World Heritage Properties	-
Australian Heritage Sites	-
Ramsar Wetlands	3
Commonwealth Marine Areas	-
Commonwealth land	-

On the basis of the ecological investigations, the project is not considered likely to have an impact on EPBC listed species. To obtain certainty however, Epuron will submit an EPBC Act referral to the federal Department of the Environment to determine whether, on the basis of Matters of National Significance, the project would be considered a 'controlled action'.

Bilateral agreement

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 an Assessment Bilateral Agreement with New South Wales in December 2013. One of the aims of the agreement is to minimise duplication of environmental impact assessment processes, ensuring a co-ordinated assessment approach for actions requiring approval from both the Commonwealth and the State. In the event the project is considered a 'controlled action' under the EPBC Act the referral would likely be further assessed by the NSW Department of Planning under the bilateral arrangement in place.

Figure 6-1 below highlights the likely assessment process the project would follow should the EPBC Act referral be determined a Controlled Action by the Commonwealth.

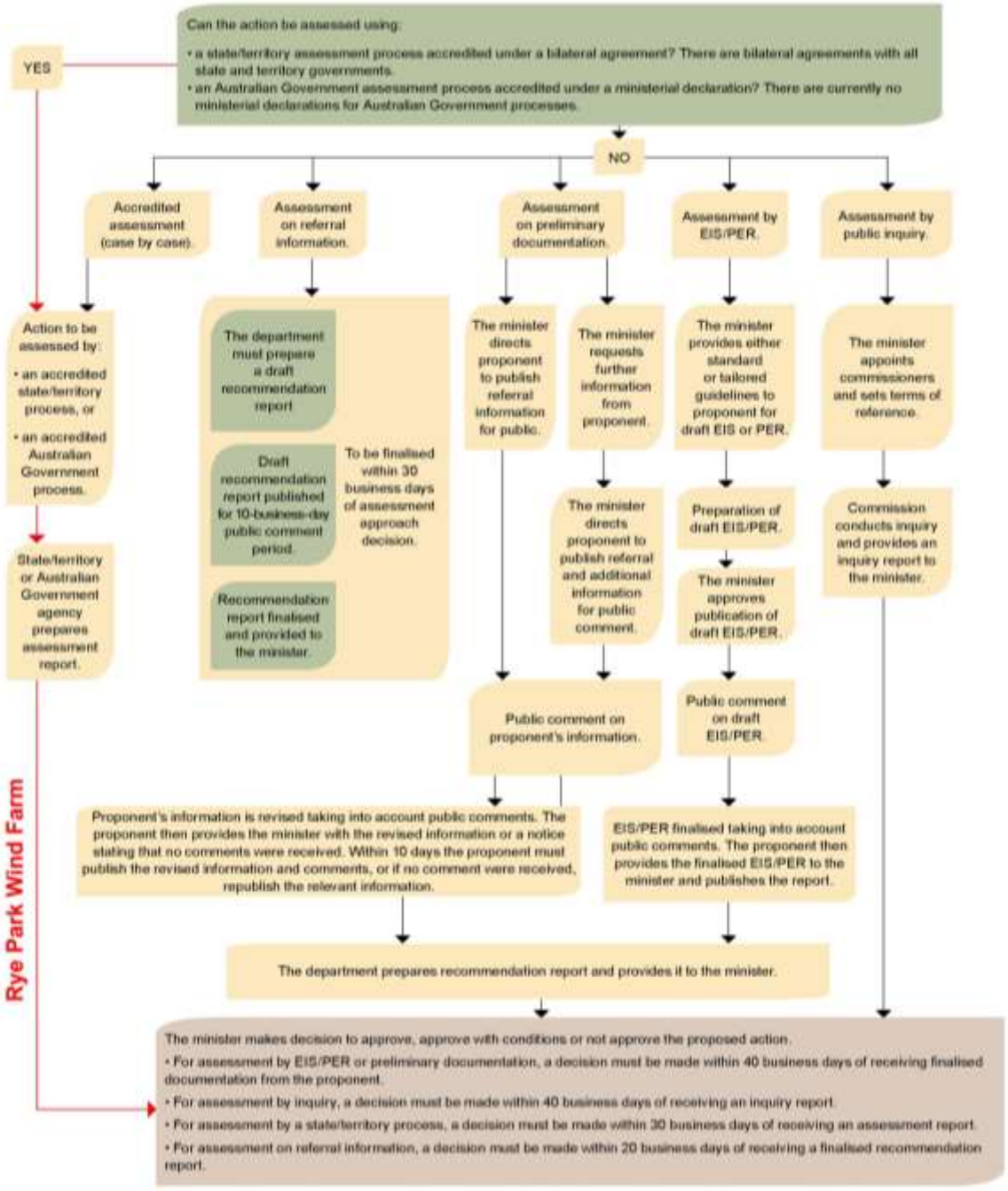


Figure 6-1 EPBC Act environment assessment process – assessment/decision whether to approve

6.2.2 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 11, Ecology Assessment.

7 Public Consultation

7.1 Community Attitudes

NSW Government Report 'Community Attitudes to Wind Farms in NSW', DECCW, 2010

In 2010 the NSW Government commissioned the report *'Community Attitudes to Wind Farms in NSW'* to assess residents attitudes towards targets set to achieve 20% renewable energy consumption by 2020 (Warren, Lumsden et al., 2005). The survey was conducted by telephone of 2022 resident's aged 18 years and older and 300 businesses across the 6 Renewable Energy Precincts, including the NSW/ACT Border East and ACT/NSW Border West Precincts and a control area in regional NSW.

The outcomes of the study are as follows:

- Of the total surveyed 81% believed wind power was acceptable for power generation.
- General awareness of wind turbines was very high, with 97% of people having heard about wind farms or wind turbines generating electricity and 81% of the population had seen a wind farm or wind turbine in person or via media.
- The majority (68%) of the population living in these precincts knew about wind farms currently operating in NSW.
- Eighty five per cent (85%) of the population across the precincts support wind farms in NSW, with 80% supporting them within their local precinct, and 79% support for a wind farm being built 10 km from their residence.
- A similar trend occurs with business opinion with 88% support for wind farms within NSW, 83% support for a wind farm in the precinct, 82% support for a wind farm 10 km from the residence and 60% support for a wind farm within 1-2 km of the residence or business.

The NSW Government study concludes that the general adult residents of the survey area are well aware of the potential of wind farms or wind turbines to generate renewable energy. Additionally, the respondents were generally aware of wind turbines and how wind turbines appear within the landscape and are generally supportive. The results further indicated that the respondents were generally not averse to the development of wind farms in the immediate locality.

CSIRO Report 'Exploring community acceptance of rural wind farms in Australia: a snapshot', CSIRO, 2012

The CSIRO released a report in 2012 exploring community acceptance of wind farms in rural Australia. This research explores community acceptance levels regarding Australian wind farms. The research employed a range of methods, including a literature and information review, a media analysis of newspaper articles, case studies, and semi-structured qualitative interviews with a range of stakeholders associated with wind farms.[2]

A summary of the outcomes of the study are as follows:

- There is strong community support for the development of wind farms, including support from rural residents who do not seek media attention or political engagement to express their views.
- The actual and perceived local costs and benefits of wind farms are strongly influenced by the design, implementation, and community engagement processes. Many of the benefits can be shared or communicated in ways that would enhance community support for the development of wind farms in a region. Many of the potential costs can be reduced by appropriate design, siting, and project implementation.

Based on the above independent surveys, it is reasonable to assume that the communities within the ACT/NSW Border Areas Precinct are generally supportive of wind farms. However, the surveys showed that a majority of the population did not feel like they had adequate information about wind farms, even in areas where general wind farm awareness was much greater.

2 'Exploring community acceptance of rural wind farms in Australia: a snapshot' N Hall, P Ashworth, H Shaw, CSIRO Science into Society Group 2012

7.2 Community Consultation

Wind farm developments and their approval in Australia have, at times, elicited polarised responses from the community, highlighting the need to appropriately identify and commence consultation with community stakeholders early in the development process.

Prospective wind energy projects in NSW are generally limited to sites with large elevated land parcels, good wind speeds, usually in rural areas, and with good electricity transmission line access. Such sites are relatively rare, and often, these sites are located in the vicinity of rural dwellings and in some cases in the vicinity of small to medium sized regional communities. This can cause conflict where some local community members feel impacted by the development and yet do not see any direct benefits from the development.

While unfortunate, the limited number of appropriate wind farm sites means that this conflict is often unavoidable and cannot be eliminated by simply moving the wind farm to a different location.

Accordingly, community consultation is focussed on understanding and mitigating the impacts of the wind farm, and on showing and maximising its benefits to the local community.

7.2.1 Project Consultation Plan

A Project Consultation Plan (PCP) was prepared by Epuron for the proposal (Attachment 6).

The PCP was prepared to guide stakeholder engagement and consultation activity during the development phase (up to project approval). The plan reflects the corporate requirements set out in Epuron's Community Consultation Framework and the Director Generals Requirements issued for the project by the NSW Department of Planning and Infrastructure.

The PCP is dynamic and can be periodically updated, as required, during the course of the development phase and community engagement activity.

The PCP highlights the key objectives of consultation for the proposal, which are:

- to minimise undue community concern in relation to the proposal, particularly at an early stage where little information on the project is known;
- to ensure the community and other stakeholders are fully informed and aware of the proposal, it's likely impacts, and its likely benefits;
- to ensure that Epuron fully understands the local context for the proposal, including any local impacts that the proposal may have or opportunities that it could provide;
- to incorporate the community's suggestions and feedback into the design of the wind farm where possible;
- to explain where and how this feedback can be and has been incorporated; and,
- in that context, to provide multiple opportunities for dialogue in various forms to allow the community to receive information and provide feedback about the proposal.

The approach taken to the project consultation plan was to use a variety of communication channels to achieve the desired objectives. These included:

- access to website containing corporate and project details;
- periodical project newsletters;
- media opportunities where available;
- public open house / information day in the local area;
- establishment of a Community Consultation Committee;
- letters to identified residents at a minimum within 2km of a proposed turbine; and
- phone calls and/or individual meetings with landowners at a minimum within 2km of a proposed turbine.

The plan was used to guide consultation during the development of the project. The plan was reviewed and adapted where necessary as community feedback was received so that consultation activities were a pragmatic response to the issues raised by the community.

Key consultation activities included a community open house day attended by specialists working on the project, the establishment of a Community Consultation Committee, follow-up phone calls, emails and other correspondence, including face-to-face meetings with neighbouring and concerned landowners.

As a result of the ongoing engagement and consultation with community stakeholders, as guided by the Project Consultation Plan, various matters were raised in the form of feedback in response to the available project information. As a result of this feedback a number of layout changes were incorporated into the project's design and or preparation of this EA. Design changes accommodated into the layout resulting from community feedback are listed in Table 5-1 and feedback matters raised by the CCC and incorporated into the project are listed in Table 7-3.

7.2.2 Implementation of the Project Consultation Plan

While the majority of the consultation process focussed on informing the community about issues relating to the project, activities to engage the community in two-way dialogue were also undertaken for the purpose of receiving feedback for incorporating community concerns, local knowledge and thereby maximising the suitability of the project to the site and the community's acceptance of the project. A schedule of the key consultation activity undertaken for the project prior to lodgement of the EA is outlined below and consultation activities are ongoing.

Table 7-1 Rye Park Wind Farm project consultation timeline

Activity	*Timing*	*Objectives*	*Stakeholders*	*Status*
Community Information Workshop	November 2009	Introduce Epuron and the proposal to landowners and community including preliminary layout	Involved landowners and selected stakeholders	Completed
Newsletter 1	December 2009	Inform community about project and initial information	Involved and uninvolved landowners (mail-out)	Completed
Newsletter 2	June 2010	Provide updated information and planning details including	Involved and uninvolved landowners (mail-out)	Completed
Newsletter 3	December 2011	Outline planning process and updated development progress	Involved and uninvolved landowners (mail-out)	Completed
Consultation with neighbours within 2km	January / February 2012 (ongoing)	To discuss project and impacts with neighbours including feedback	Uninvolved neighbours house within 2km of turbine	Completed (but ongoing)
Newsletter 4	March 2012	Advise consultation plans and release revised wind farm layout	Involved and uninvolved landowners (mail-out)	Completed
Establishment of Community Consultation Committee	April / May 2012	Establish formal mechanism for community participation	Invited members	Completed
CCC Meeting 1	27 June 2012	Provide project information and seek feedback	Invited members	Completed
Newsletter 5	June / July 2012	Update on studies and consultation and layout	Involved and uninvolved landowners (mail-out)	Completed
Community Open House	26 July 2012	Display revised layout, public road photomontages and traffic and transport plan. To discuss issues and seek feedback.	All project stakeholders and community	Completed
CCC Meeting 2	2 August 2012	Provide updated information and consider feedback including revised layout	Invited members	Completed
Newsletter 6	22 August 2012	Update on studies and consultation feedback contributing to preparation of the proposed final layout	Involved and uninvolved landowners (mail-out)	Completed

Activity	*Timing*	*Objectives*	*Stakeholders*	*Status*
CCC Meeting 3	24 October 2012	Provide proposed final layout incorporating consultation feedback and study results	Invited members	Completed
CCC Meeting 4	17 December 2012	Reviewed key elements of finalised EA and layout	Invited members	Completed
Pre DA submission follow up	December 2012 / January 2013	Consider feedback and any final amendments required prior to lodging EA for exhibition	Involved and uninvolved landowners, CCC, stakeholders and consultants (phone calls and meetings as required)	Completed
Newsletter 7	7 May 2013	Update community of EA planning process, wind farm layout and current industry news.	Involved and uninvolved landowners (mail-out)	Completed
CCC Meeting 5	22 July 2013	Discuss EA planning and exhibition process including project risks such as bushfire.	Invited members	Completed
CCC Meeting 6	30 September 2013	Discuss EA planning and exhibition process including proposal to establish a community enhancement fund.	Invited members	Completed

7.2.2.1 Community Open House

The community open house forum allows the opportunity for members of the community to speak individually or in small groups to the Proponent representatives. The open house format is helpful in avoiding potential conflict in 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 non-confrontational situation. It also allows the presentation of issues and information to be tailored to individual queries.

The community open house session for the project was held on the 26 July 2012 at the Memorial Hall in Yass Street Rye Park. A community newsletter, distributed to residents, preceded the event that was also advertised in the local Yass and Boorowa newspapers beforehand.

The event ran from 9:00 am to 5:00 pm and representatives from the Proponent were present to discuss the project specifics (including general questions about wind farms and wind farm development) and the environmental planning process.

Figure 7-1 Rye Park Wind Farm Community Open Day at Rye Park Memorial Hall

The objective of the open house was to display current project information and to seek feedback that would ultimately contribute towards preparation of the final design and wind farm layout.

On the day 51 people attended the event, primarily local residents within the vicinity of the wind farm, as well as community stakeholders. Outcomes and statistics observed from the event included;

- of the 51 people in attendance, the majority (approximately 40) were supportive of the project;
- approximately 11 people were opposed or expressed negative views to the project;
- 12 people asked for follow up information to be sent to them or arranged a follow up meeting; and
- 3 people/companies registered their interest in construction jobs and tender contracts.

Details of the proposed wind farm project that were on display included:

- latest wind farm layout showing the planned locations of wind turbines and other associated infrastructure including construction compounds, substations, overhead powerlines and access tracks;
- photomontages showing the likely view of the completed wind farm from a number of public road locations around the site;
- Traffic and Transport Report including a large map of the access roads and routes;
- general wind farm, industry and corporate information;
- the recent project newsletter; and
- member nomination forms for the Community Consultation Committee.

Notable observations or comments made on the day included:

- Some attendees were interested in the flora and fauna studies and also the construction management plan in relation to weed and erosion control.
- Most people were interested in viewing the photomontages to gain an understanding of the visibility of the project from public road routes such as Rye Park to Yass.
- Some people were concerned about the potential noise and health impacts that may result from the operation of the wind farm.
- Concerns for impacts to property values were also expressed.

- Copies of the following reports were on hand during the open day as reference for people to view on these two matters and to alleviate any concerns in this regard;
    - NSW Valuer General – Impact of Wind farms on Property Values – August 2009
    - NHMRC (National Health & Medical Research Council) Review of Wind Turbines & Health – July 2010
- A number of people expressed their support for the project and the potential benefits available to the local area (such as jobs and investment), including general support for renewable energy and wind farms.

7.2.2.2 Face-to-face consultation

A common criticism of major project developers is a lack of consultation with surrounding neighbours. While newsletters, websites and open houses forums are effective at engaging with the wider community, there is no guarantee that this information will be received or interpreted correctly by everyone.

Epuron has taken this on board in designing the project consultation plan and has placed an importance on consultation with the immediate neighbours of the project. During the feasibility phase of the project representatives from Epuron identified all landowners that reside or have property within a few kilometres of the project, particularly those residents within 2 km of a proposed turbine, and proceeded to make contact for consultation purposes as described in further detail in Section 7.2.2.3.

Landowners that reside or have property within 2km of a proposed turbine were contacted for consultation. In all cases this involved an initial phone conversation, email or letter box drop to introduce the proponent and the project, and in most cases a face-to-face meeting or discussion followed to provide additional detail about the project and to answer any questions raised by the landowner. Some absentee landowners have not engaged in consultation but remain on the project database to receive information such as newsletters. Landowner contact details were entered on the Epuron database to enable follow up dialogue and for future information about the project to be sent to landowners when required. At the time of this EA the database for the project had more than 150 landowner contact details which include those within 2 km of a proposed turbine and many other stakeholders beyond this group.

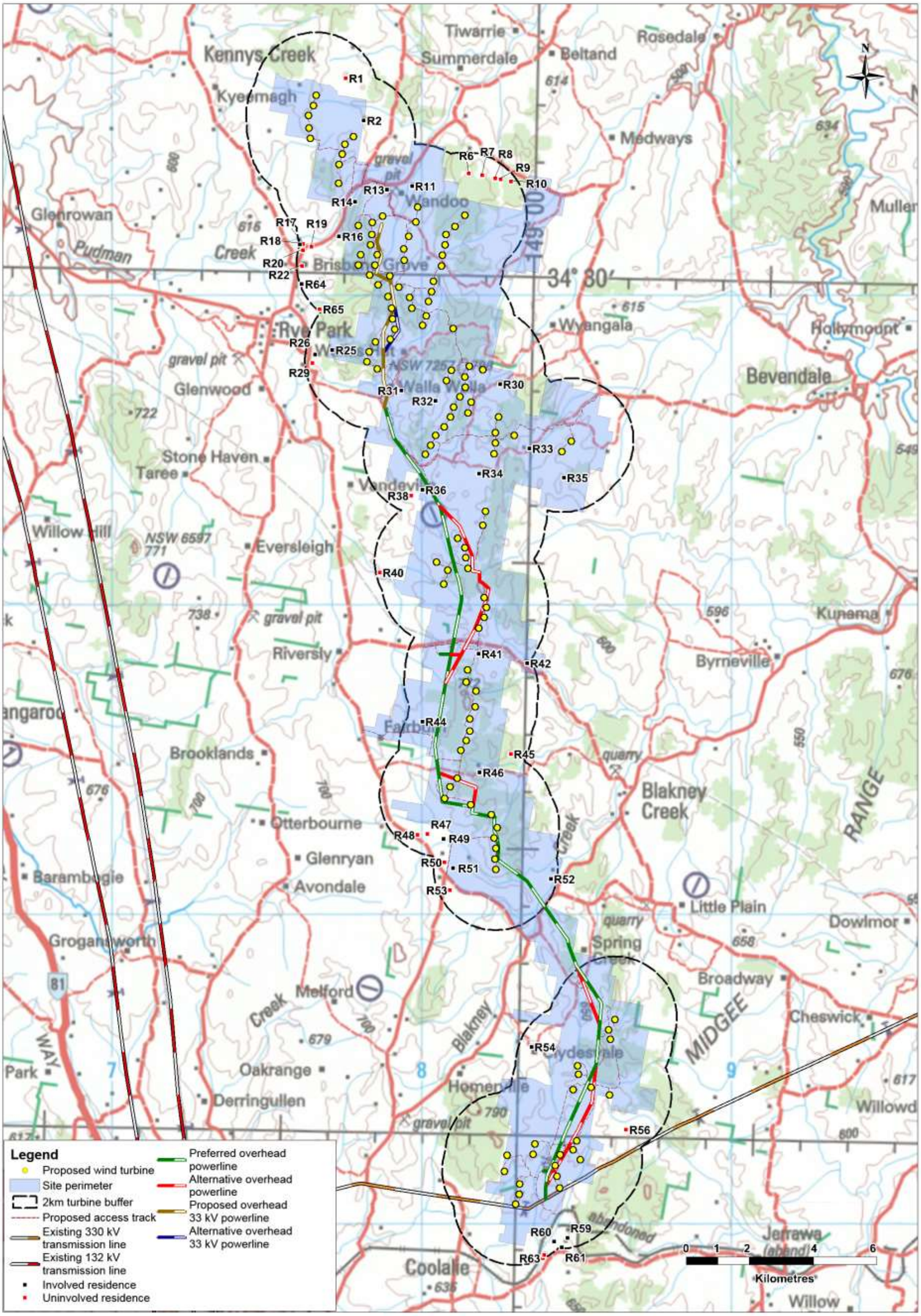


Figure 7-2 Involved and uninvolved residences within 2 km

7.2.2.3 Residents within 2 km

Uninvolved landowners with a dwelling within 2 km

Consistent with corporate requirements set out in Epuron's Community Consultation Framework and in consideration of the draft NSW Wind Farm Planning Guidelines, Epuron specifically focussed consultation efforts on those uninvolved landowners identified to have a dwelling within 2 km of a proposed wind turbine.

Uninvolved landowners that have a dwelling within 2km of a proposed turbine were contacted for consultation on a range of issues including an offer to prepare a photomontage. Many other stakeholders outside the 2 km group were also consulted as evidenced by the more than 150 entries in the projects contact database.

As set out in the DGR's and DP&I correspondence, consultation obligations and scope with this uninvolved landowner group included, but was not limited to, potential impacts around landscape and visual amenity issues, noise, health, property values, blade glint and shadow flicker. These landowners were also offered a photomontage from their dwelling to show what the wind farm would like, and if accepted, a photomontage was prepared and forwarded to the landowner at the EA lodgement stage. A photomontage was prepared for a few residents outside the 2 km group where required as a result of consultation about the project. All photomontages prepared are included in Appendix A.

Under the project consultation plan this group of uninvolved landowners were identified early on and actively contacted for an initial discussion. Wherever possible further engagement followed which included a meeting and or written correspondence to ensure information and feedback about the project was communicated in both directions with landowners or those occupants renting/living in the dwelling.

There are 22 uninvolved landowner dwellings that have been identified as being located within 2 km of a proposed wind turbine.

The following table lists the identified uninvolved landowner dwellings within 2 km of a proposed turbine and the consultation activity undertaken. These landowners are also shown in Figure 7-2.

Table 7-2 Consultation activity with uninvolved landowners with a dwelling within 2 km

Residence ID	Newsletter List	Telephone Contact	Face to Face Meeting	Written Correspondence	Photomontage Offered & Accepted
R1	yes	yes	no	yes	yes & yes
R6	yes	yes	yes	yes	yes & yes
R7	yes	yes	yes	yes	yes & yes
R8	yes	yes	yes	yes	yes & yes
R9	yes	yes	yes	yes	yes & yes
R10	yes	yes	yes	yes	yes & yes
R17	yes	yes	yes	yes	yes & yes
R19	yes	yes	yes	yes	yes & no
R20	yes	yes	yes	yes	yes & yes
R22	yes	yes	yes	yes	yes & yes
R29	yes	yes	yes	yes	yes & yes
R38	yes	yes	no	yes	yes & yes
R40	yes	yes	yes	yes	yes & yes
R45	yes	yes	no	yes	yes & yes
R47	yes	yes	no	yes	yes & yes
R48	yes	yes	yes	yes	yes & yes
R50	yes	yes	yes	yes	yes & no
R53	yes	yes	yes	yes	yes & yes
R56	yes	yes	yes	yes	yes & yes

Residence ID	Newsletter List	Telephone Contact	Face to Face Meeting	Written Correspondence	Photomontage Offered & Accepted
R62	yes	yes	yes	yes	yes & no
R63	yes	yes	yes	yes	yes & yes
R65	yes	yes	yes	yes	yes & yes

Involved landowners with a dwelling within 2 km

There are 26 involved landowners that have been identified to have a dwelling located within 2 km of a proposed wind turbine. This group was actively consulted in accordance with the project consultation requirements and have wind farm agreements in place for participating in the project.

Involved and uninvolved landowners with a property within 2 km

There are 16 involved landowners and 66 uninvolved landowners that have been identified to have a property, but no dwelling, that is in some part within 2 km of a proposed turbine. This group was actively consulted in accordance with the project consultation requirements.

7.2.2.4 Residents outside 2 km

Landowners and residents outside the 2 km dwelling consultation zone were engaged and consulted with as necessary and any feedback received was incorporated where possible. Landowner details were entered on the mail-out data base to receive correspondence such as newsletters and meetings/discussions were held with them as required.

A photomontage was prepared for a few residents outside the 2 km group where required as a result of consultation about the project.

7.2.2.5 Newsletters

Newsletters have been used throughout the development process as a means of informing the local community about the project, announcing upcoming activity and progress of development phases, as well as any status updates that may be relevant when milestones are achieved. Newsletters were also used to advertise events such as the community open house day.

Newsletters were distributed by mail and or email to all residents on the project database, which included those properties within a few kilometres of the project and many other stakeholders from nearby towns. At the time of this EA the database for the project had more than 150 landowner/stakeholder contact details entered. Additionally newsletters are also distributed by hand to letterboxes when visiting local towns such as Rye Park, Bevendale, Blakney Creek, Jerrawa, and Rugby and other community stakeholders outside the immediate project area. Newsletters were also distributed to identified absentee landowners and broader community stakeholders such as councils and local groups. Newsletters were also available on the project website, are delivered to letter boxes in the general area and were handed to stakeholders during consultation meetings.

Newsletter 1 - The first newsletter introduced the project in December 2009, introduced Epuron and the Rye Park Wind Farm project and advised residents of opportunities for community input.

Newsletter 2 - The second newsletter in June 2010 provided updated project information including grid connection plans and specialist studies to be undertaken.

Newsletter 3 - In December 2011 a newsletter provided updated project information including details related to receiving the Director General's Requirements for the project. It also described new 'SODAR' technology being utilised to measure wind speeds on site.

Newsletter 4 – The newsletter in April 2012 generally updated project information including a revised map showing the wind farm turbine layout, and information about the Community Consultation Committee to be established for the project.

Newsletter 5 - In July 2012 a Community Open House day was planned at the local Memorial Hall in Rye Park. Invitations were sent out to all landowners on the project database (including newspaper ads) informing them of the time and location of the event and the information to be displayed.

Newsletter 6 – A sixth newsletter was released in August 2012 providing results from field studies and feedback outcomes from the community consultation and their incorporation into the proposed final layout.

Newsletter 7 – In May 2013 a seventh newsletter was released to provide the community with an update on the EA process and timing. A project layout was provided including current industry information.

Further newsletters will continue to be provided to the community, including a newsletter to advise the Community of the submission and exhibition of the EA, and to indicate where the EA can be viewed by the public.

Copies of all relevant community consultation material including the project consultation plan, surveys, community newsletters, media releases, presentations and letters received from key stakeholders are included within Attachments 6 & 7.

7.2.2.6 Community Consultation Committee

Consistent with corporate requirements set out in Epuron's Community Consultation Framework and in consideration of the draft NSW Wind Farm Planning Guidelines, Epuron established a Community Consultation Committee (CCC) for the project. The proponent consulted with DPI in establishing the CCC for the project.

In April 2012 a CCC member nomination form was distributed to community stakeholders in the following manner by the proponent seeking expressions of interest from willing participants.

- project newsletter to all stakeholders on project database (more than 150),
- hand delivered by letterbox drop to residents in Rye Park, Rugby, Bevendale, Blakney Creek and Jerrawa,
- people attending the Community Open Day;
- project website; and
- notification letter to Yass Valley, Boorowa and Upper Lachlan Shire Councils.

The first meeting was held at the Yass Valley council chambers on 27 June 2012. During the first meeting the committee chairman asked that a letter be written to local residents, particularly those within 2 km of a proposed turbine, to advise them of the establishment of the committee and to determine their interest to be involved in the projects consultation process as a potentially affected party.

The purpose and objectives of the CCC are;

- to enable Epuron to formally provide the local community with information about the proposal;
- to enable the community to express and for Epuron to understand any concerns regarding the potential impacts of the proposal;
- to enable Epuron to consider whether and how to incorporate any suggestions and feedback into the design of the proposal;
- to demonstrate how and where feedback has been incorporated and resulted in amendments to the proposal;
- to formally advise potential community benefits that can be integrated into the proposal; and,
- to establish and strengthen good working relationships between the proponent and the local community.

While individual membership of the CCC changes from time to time, the committee membership generally comprises representation from the following groups within the community;

- an independent chairman;
- two involved landowners;
- two uninvolved landowners;
- a representative local community group;
- a representative from each of the three local councils (Yass Valley, Boorowa and Upper Lachlan); and
- the proponent (Epuron).

Around 8-10 members attended each CCC meeting and were representing one of the above groups. Other interested community members are generally welcome to attended meetings of the CCC as observers.

During the development phase the CCC met on six occasions at local venues including the Yass Valley council chambers and Rye Park Memorial Hall. Copies of the meeting presentation material, minutes of the meetings and CCC members in attendance are made available to the public on the project website and are included within Attachment 7. A summary of proceedings and key outcomes from meetings are also outlined in project Newsletters.

- meeting 1 – 27 June 2012;
- meeting 2 – 2 August 2012;
- meeting 3 – 24 October 2012; and
- meeting 4 – 17 December 2012
- meeting 5 – 22 July 2013
- meeting 6 – 30 September 2013

Epuron would like to sincerely thank those people who participated in the CCC meetings and contributed feedback about the project, on behalf of the community. This fed into the wind farm layout and design process wherever possible.

The CCC reviewed and discussed a wide range of matters and material relating to the project. The key feedback points provided by the CCC based on these matters, and how that feedback was considered or incorporated into the project, is set out in the following table.

Table 7-3 Key issues raised during the Community Consultation Committee meetings

Issue	*CCC Feedback Provided*	*How Considered or Incorporated into Project*
Construction access roads and access routes.	Members asked that all three involved councils are consulted when the Traffic and Transport report is released for consultation. Need to ensure nominated construction access routes are acceptable and any impacts on local roads are considered.	Epuron forwarded copies of the Traffic and Transport report to the three involved councils. Follow up discussions and or meetings have been held with councils and any feedback provided has been incorporated into the final version of the report. In some instances a more appropriate access route was identified.
Construction roadwork contracts.	Members from council, in particular Upper Lachlan, expressed a desire to tender for any roadwork contract associated with construction of the project.	Epuron has entered each council on the construction contractor's database for the project to be notified when any roadwork tenders are available for pricing.
Community fund….."*Epuron has been seeking feedback on how best to establish a community fund and to identify what type of local support is required from the project".*	"How best to establish a community fund". ▸ Councils prefer that if a community fund is established it is managed by them (local councils). ▸ Community wants to have a say in where and how any community funds are managed and spent. ▸ Draft Wind Guidelines say community contributions may be required under the EP&A Act 1979 or through a voluntary planning agreement. ▸ Community funds where implemented for other projects have been considered through combinations of the above. "Identify what type of local support is required from the project". ▸ Upgrade and improve local roads near the project. ▸ Improvements to the township of Rye	Following consultation feedback Epuron outlined its position, as follows, to the CCC regarding the establishment of a community fund for the project; ▸ Epuron designs its wind farms to minimise impacts to the environment and local community. ▸ Each project should be assessed (by DPI) specifically on its merits (no cash fund influences). ▸ Epuron strongly believes in the value of community contributions and believes that the final investor who will commit funds to the construction and operation of the project should engage with the community in a meaningful way. ▸ Epuron believes that such community contributions should be: ○ applied towards local environmental, social and community initiatives led by local residents; ○ directed to initiatives raised by

Issue	*CCC Feedback Provided*	*How Considered or Incorporated into Project*
	Park and better local amenities. ▸ Better mobile phone and internet reception in town. ▸ Chance to reopen some businesses in town. ▸ Provide attraction to keep younger people and families in the local area through long term benefits and job creation.	residents proximate to the development or likely to be impacted; ○ established at the commencement of operation and continue for the life of the development; and, ○ regularly reviewed to ensure they are providing ongoing benefits to the community. ▸ Epuron considers that the CCC working with the developer and ultimate project owner, is ideally placed to help develop a community fund and its administration process. ▸ Epuron, like most wind farm proponents, is not the ultimate project owner and accordingly it is not appropriate for Epuron to determine the final details of any community fund, and nor should these be determined as part of a development application or consent process. ▸ Accordingly, Epuron will not propose any specific amount payable to any community fund in its development application. However, it will commit to an ongoing consultation process to determine an appropriate basis for the establishment of a community fund. ▸ The EA's Statement of Commitments will set out the Community Fund details
Photomontages	Consistent with the draft wind guidelines the proponent should offer a photomontage to all uninvolved landowners with a dwelling within 2km of a proposed turbine.	All uninvolved landowners who have a dwelling within 2km of a wind turbine have been offered, and where accepted by the landowner, will be provided with a photomontage at the EA lodgement stage. A few landowners have declined to have a photomontage prepared. If requested by a landowner with a dwelling beyond the 2km boundary a photomontage will be considered and prepared on a merits basis. Epuron has received a request from two landowners beyond the 2 km boundary and has prepared photomontages.
Fire risk	A CCC member raised concern for potential increase to fire risk from the wind farm, particularly around Coolalie Road proximate to the existing transmission lines and nearby forested areas.	Consideration has been given in the EA to address issues including; Use of aerial water bombing during a fire. Consultation with local RFS. EA outlines wind farm operating protocol during a fire.
Increased CCC participation	Following the first CCC meeting it was requested that a letter be sent to all neighbouring landowners to seek interest for increased community participation on the CCC.	A letter was sent to neighbouring landowners seeking increased CCC membership and some landowners sought participation on the CCC as a result.

7.2.2.7 Media

Various forms of media have been utilised for communicating details about the project. Information articles have appeared in the local newspapers from time to time, Yass Tribune and Boorowa News, including advertisements for events such as the community open house day. Radio stations have featured various stories on the projects development progress from time to time usually coinciding with a project event or milestone.

Epuron's corporate website is also available for viewing company and project details at www.epuron.com.au

7.3 Government Consultation

7.3.1 Initial meetings

The proponent began consultation with the consent authority, the NSW Department of Planning and Infrastructure, during the second half of 2010, introducing the project and seeking advice on the assessment process.

During the development process the proponent and their consultants liaised with governmental stakeholders including:

- Neville Osborne, Kate Masters and Toby Philp, Department of Planning and Infrastructure.
- Chris Mackenzie Davey, Regional Coordinator NSW Renewable Energy Precincts, Office of Environment and Heritage, Department of Premier and Cabinet.
- Queanbeyan office of NSW Office of Environment and Heritage regarding ecology and cultural heritage matters.
- Three involved Local Councils, Yass Valley Council, Boorowa Council and Upper Lachlan Shire Council including their participation in the Community Consultation Committee.
- National Party Policy Committee, Chaired by Mike Blake, including a presentation and a wind farm site visit.
- State and Federal Members including visit to electoral office to provide project information.

7.3.2 Key Stakeholders

Planning for the development of the Rye Park Wind Farm has included specific consultation, including written correspondence and telephone discussions, with the stakeholders listed in Table 7-4.

Table 7-4 Key stakeholders

Sector	*Organisation or Group*
Local Community	The local community and landowners Local media Local groups and associations
Local Government	Boorowa Council Upper Lachlan Shire Council Yass Valley Council
NSW Government Agencies	Office of Environment and Heritage (OEH, formally DECCW) TransGrid NSW Roads and Maritime Service (RMS) NSW Rural Fire Service (RFS) Australian Rail Track Corporation (ARTC) Boorowa CMA NSW Renewable Energy Precincts Manager State Member NSW Department of Primary Industries NSW Office of Water NSW Trade and Investments NSW Land Property Management Authority

Federal Government Agencies	Civil Aviation Safety Authority Commonwealth Department of Defence Airservices Australia Federal Member
Additional Stakeholders	Aerial Agricultural Association of Australia Service providers and telecommunications operators

Consultation with stakeholders has occurred through a variety of means including phone conversations, face-to-face meetings, email and letter correspondence and in some cases attendance at local information days.

Through the feasibility and design stages of the project, consultation has involved the proponent informing the relevant stakeholders of the project details and seeking advice to enable the design of the wind farm and to reduce potential impacts to the existing environment. Specific issues raised by these stakeholders have been discussed within the relevant sections of this EA. The consultation process will continue through the development and operation of the wind farm.

8 Approach to Environmental Assessment

The approach to this Environmental Assessment was developed and submitted for the Preliminary Environmental Assessment (PEA), which accompanied the project application sent to the Department of Planning and Infrastructure on 14 January 2011. During the assessment the approach was expanded to include a wider range of issues as they were identified, however it has largely remained as described in the PEA.

8.1 Initial General Risk Analysis

The following section outlines the key issues in relation to the Rye Park Wind Farm, and summarises Epuron's approach to addressing each issue. As a general rule, in undertaking this assessment:

- Issues identified as "Key Issues" will be addressed through the engagement of an independent expert together with specific on-site assessment and field work.
- "Additional issues" will be addressed, where necessary, via desktop assessment, precedent and consultation.

The focus on this delineation is to ensure that every issue is adequately addressed considering the potential risks and impacts associated with the issue, and without burdening the EA with details which are unlikely to affect the ultimate assessment of the project.

Epuron has carried out a risk analysis based on the requirements of the DGRs and information collected to date on site, at nearby sites, generally within the region and based on similar proposals in other regions.

In relation to each risk, Epuron has established a priority which takes into consideration:

- the level of information already available about that issue;
- the extent to which site specific assessment is required to define that issue;
- the likelihood of that issue occurring, and potential impacts of that issue if it did occur; and
- the extent to which standard industry practice, statutory requirements, and standard consent conditions adequately address the issue.

The results of this general risk analysis can be seen in Table 8-1. The model considers the key assessment requirements from the DGRs and the nature of the potential impact on them (i.e. is it temporary, reversible, likelihood of secondary impacts), the receiving environment and the likelihood of the impact occurring. The assessment strategy was then determined based on the overall risk rating for each issue.

Where the overall risk rating was very low and where the issues have previously been assessed in relation to wind farms in general and have been demonstrated to not affect the assessment or the consent conditions, no further assessment was carried out.

Table 8-1 Risk analysis of additional issues

Aspect	Potential Impacts	Likelihood	Consequence	Level of Risk	Proposed Management	Mitigated Risk
Visual						
Visual impacts of turbines	Visual impact of turbines on the local community and significant vistas	Almost Certain	4	High	The results from visual assessment have led to the removal of a number of turbines that are prominent. See Table 5-1. The visual impact of the project has been assessed in Section 9 and vegetative screening will be offered to landowners who are in areas of high visual sensitivity.	Low – moderate
Visual impacts of infrastructure	Visual impact of supporting infrastructure on the local community and significant vistas	Likely	3	Moderate	Permanent supporting infrastructure will generally be located away from the community. Temporary infrastructure will be as unobtrusive as possible and will be removed after construction.	Low
Shadow flicker	5 involved dwellings have been assessed to experiences shadow flicker. Of which, 1 will exceed the limitations. 1 uninvolved dwelling has been assessed to experiences shadow flicker. It will exceed the limitations.	Likely	4	High	Appropriate mitigation measures will be negotiated and implemented, where necessary, including potential limiting hours of operation on selected turbines. The impact of shadow flicker has been assessed in Section 14.4.	Low
Blade glint	Sun reflecting off blades at certain times causing annoyance to local community and distraction to road users	Possible	3	High	Modern turbine blades have been designed to limit reflections with the use of matte finishes. The impact of shadow flicker has been assessed in Section 14.4.	Low
Cumulative impact within the area	Other wind farm developments in the vicinity compounding the above stated impacts to local community	Possible	3	High	Consider other projects proposed in the area to understand adjacent issues regarding cumulative effects.	Low – moderate
Noise Impacts						
Operational noise including low frequency noise or infrasound	Potential of exceedance of operation noise guidelines and limits at receptor locations nearby.	Unlikely	3	Moderate	The wind farm has been designed and modelled with extensive background noise monitoring to comply with the relevant standards. The results from background noise modelling have led to the removal of a number of turbines. See Table 5-1. In the event that noise from a turbine is exceeding the operational standards, mitigation measures would be investigated and implemented to ensure compliance	Low

Aspect	Potential Impacts	Likelihood	Consequence	Level of Risk	Proposed Management	Mitigated Risk
					including potentially operating the turbine in a reduced noise mode.	
Construction noise including traffic and vibration generating activities	Potential for exceedance of construction noise limits through activities such as increased traffic, heavy machinery, blasting and vibration.	Unlikely	4	Low	Construction activities would be located away from residential areas where possible and during permissible times. A construction noise management plan will be developed as part of the CEMP.	Low
Substation operation and transmission line noise	Potential for noise associated with the operation of electrical and substation equipment	Unlikely	4	Low	Substations and electrical infrastructure will be located away from residents	Low
Ecological Impacts						
Avifauna strikes	Potential of avifauna deaths or injury due to blade strike.	Likely	Minor	High	Wind farm design has implemented the recommendations from the BA and sited infrastructure away from sensitive areas i.e. rocky outcrops, identified nests and hollow bearing trees.	Low
Removal of vegetation or habitats	Local vegetation being removed or altered from the site to accommodate turbines associated infrastructure	Almost Certain	Minor	High	Turbines and infrastructure will be microsited where possible to avoid where possible or minimise the loss of vegetation. The loss of vegetation will be offset where required	Low
Threatened species	The development of wind farm infrastructure adversely effects identified species population	Possible	Minor	Moderate	Wind farm infrastructure has been microsited away from known threaten species populations where ever possible to minimise impacts	Low
Heritage Impacts						
Impact on Indigenous heritage values	Potential for disturbance to Indigenous heritage sites or objects.	Unlikely	Moderate	Moderate	Studies have shown that the site is of low Indigenous cultural significance. The impact on Indigenous heritage values has been assessed in Section 12.	Low
Impact on European heritage values	Potential for disturbance to European heritage sites or objects.	Unlikely	Moderate	Moderate	Studies have shown that the site is of low European cultural significance. The impact on European heritage values has been assessed in Section 12.	Low

Aspect	Potential Impacts	Likelihood	Consequence	Level of Risk	Proposed Management	Mitigated Risk
Traffic & Transport						
Overweight loads causing damage to local roads Impact of increased traffic loads	Impacts caused to the roads and users by over mass and oversized vehicles used during construction, operation and decommissioning periods.	Likely	Moderate	High	Careful selection of access routes and roads to be used during construction. Local improvements and upgrades will be applied where necessary. A Traffic Management Plan (TMP) will be developed in consultation with local councils and RMS. The impact on traffic and transport routes has been assessed in Section 13.	Low - moderate
Off-road driving causing erosion and disturbing natural habitats	Impacts caused to natural habitats when driving to off-road locations on site.	Possible	Moderate	High	The roads constructed on site will be well designed, all weather access tracks. A TMP will be prepared to guide the use, restriction, speed limits and maintenance requirements to ensure safe and proper use of off access tracks	Low
Hazards & Risks						
Impact of wind turbines on commercial and agricultural aircraft safety	Turbines may impact upon the safe operation of aircraft in the region for recreational and agricultural purposes.	Likely	Moderate	High	A 500 m no-fly zone has been implemented around the operation turbines and local air operators will be notified. Aircraft landing areas have been identified around the site and turbine placements comply with CASA take-off and landing clearance restrictions. The impact on aviation has been assessed in Section 14.1.	Low - moderate
Interference of television, radio, mobile phone coverage or electromagnetic fields	Potential signal interferences to services as a result of operational wind turbines.	Unlikely	Moderate	Moderate	A comprehensive study was undertaken using ACMA data or registered transmitters and receivers and this has been taken into account for the design of the wind farm. It is unlikely that that wind farm will affect signals from existing mobile phones towers, microwaves or digital television signals. The impact on communications has been assessed in Section 14.2.	Low
Fire or bushfire near the turbines or local	Ignition of a bushfire as a result of construction or operational activities.	Possible	Moderate	High	A bushfire management plan will be created in consultation with the RFS	Low – moderate

Aspect	Potential Impacts	Likelihood	Consequence	Level of Risk	Proposed Management	Mitigated Risk
community	Any compounding risk caused by the wind farm to an existing bush fire in the region.				While the use of aerial fire fighting may be limited in some situations, the wind farm access tracks will provide a small fire break and improved access for fire fighting. In the event of a bush fire on or in close proximity to the wind farm would be operated in accordance with the Bushfire Management Plan. Fire and Bushfire risks have been assessed in Section 14.5.	
Water Supply, Water Quality and Hydrology						
Impact of erosion and sediment run-off Use of local water and its effects on the waterways	Increase sediment run off and erosion. Excessive use of local water supply.	Possible	Moderate	High	Water will be sourced on and offsite and will be stored on site in temporary tank facilities, in addition to small amounts of captured rain water from buildings. A CEMP will be developed to manage soil erosion, drainage and sediment control. Hydrological impacts have been assessed in Section 15.	Low
Third order watercourse crossings	Increased sediment and erosion at existing road crossing on Blakney Creek	Possible	Minor	Moderate	Road crossing will be consistent with the Guidelines for Controlled Activities on Waterfront Land as assessed by the NSW Office of Water	Low
General Environmental Assessment						
Impacts on soils & landforms	Soil erosion due to inadequate construction techniques. Poor management controls for excavated materials and stockpiles.	Possible	Minor	Moderate	Vegetation removal will be minimised to prevent soil erosion and controls will be in place to minimise erosion and runoff due to high rainfall and wind events. The CEMP will address the impacts on soils and landforms	Low
Impacts on climate & air emissions	Dust and vehicle emissions may affect the local area during the construction and decommissioning periods	Possible	Minor	Moderate	During construction and high wind events, water trucks will be used to minimise dust. The exposed area of the construction footprint will only be a very small percentage of the overall site.	Low
Impacts on mineral exploration	Future prospecting may be limited due to wind farm infrastructure	Unlikely	Minor	Low	Consultation has occurred with the current mineral license holders and their future plans. The infrastructure footprint of the wind farm is a very small percentage of the total site.	Low
Social and economic	The flow on effects of investments and jobs in the local community are less than	Rare	Unlikely	Low	It is not anticipated that the wind farm will cause any negative social or economic impacts as they are generally	Low

Aspect	*Potential Impacts*	*Likelihood*	*Consequence*	*Level of Risk*	*Proposed Management*	*Mitigated Risk*
impacts	anticipated				considered to be possible. The benefits anticipated have been modelled against other constructed and operational projects in Australia.	
Property values	Potential of the wind farm to affect local land and property values	Unlikely	Minor	Low	A review of published studies in New South Wales confirms that wind farms do not negatively impact on property values.	Low
Impacts on health (electromagnetic fields & epilepsy)	Potential to impact human health as a result of wind farms and electrical infrastructure	Unlikely	Minor	Low	There is currently no published scientific evidence to link wind turbines with adverse health effects. Transmission lines would be constructed in accordance with the appropriate safety standards.	Low

8.2 Assessment Approach

8.2.1 Director General's Requirements

The DGRs are compiled by the DPI, with consultation from various government departments in order to identify the issues that the proponent must address in their Environmental Assessment.

Epuron has used these DGRs to structure this EA and has ensured that all issues raised have been individually addressed and consultation requirements have been met. A copy is found in Attachment 5.

8.2.2 Best Practice Guidelines

Epuron's assessment has in general followed the advice provided in a number of industry guidelines, including:

- the Draft NSW Planning Guidelines: Wind Farms; and
- Auswind's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia (ABS, 2008).

While much of the assessment pre-dated the draft NSW Wind Farm Planning Guidelines (2012), these draft guidelines have also been taken into account to the fullest extent possible.

The above 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.

8.2.3 Consultation

Epuron's approach is designed to satisfy the supplementary DGRs for community consultation (see Attachment 5), in addition to making use of all information provided by the relevant parties in relation to environmental issues which were identified though the consultation processes outlined in Section 7. This includes consultation with stakeholders and their input and which was used to refine the design of the project.

8.2.4 Specialist Studies

Independent consultants were engaged to complete specialist reports on the following key issues:

- Landscape and Visual – summarised in Section 9 and in full in Appendix A;
- Environmental Noise – summarised in Section 10 and in full in Appendix B;
- Ecology – summarised in Section 11 and in full in Appendix C; and
- Aboriginal and European Heritage – summarised in Section 12 and in full in Appendix D.

8.2.5 Wind Turbine Selection for Assessments

Some impact assessments require an understanding of specific wind turbine characteristics which are not known until the final wind turbine model has been selected. An approach is therefore required to carry out an assessment based on reasonable assumptions, and ultimately confirming that these assumptions are valid.

The majority of issues identified with respect to this proposed development are not impacted by specific turbine model selection. For example, the assessment of ecology and archaeology constraints is based on a development envelope, that is, the entire geographic area where infrastructure may be located. This approach allows ecological and archaeological constraints to be defined within the development envelope and as a consequence allows for minor relocation of infrastructure within the development envelope without further assessment.

However, the final turbine selection could have a material impact on some issues and in these cases the decision as to whether to present a representative or worst case turbine must be considered.

The approach taken is to present the worst case impact assessment for specialist studies where physical dimensions and technical characteristics of turbines are related to the extent of the potential impact. Examples of this are visual impacts and noise propagation. However as discussed in Section 3.1, the most likely turbine model to be ultimately selected for the project are not the largest and sit in the middle of the turbine size range (physical size and generation capacity). Therefore in this context, the EA also considers and presents the indicative or likely impacts.

Wind Farm Layout

The wind turbine layout design is based on a Vestas V112 turbine.

Wind farm layout and design is impacted by the minimum required spacing between turbines, which is a function of their rotor diameter. Therefore an assumption of the likely rotor diameter must be made at the time of the assessment.

The Vestas V112 is a mid to upper range turbine, known to be suitable for the site and has been installed in Australia. If a larger physical turbine is selected, fewer turbines may be installed, a consequence of the requirement for larger separation distances between turbines. In this scenario, some associated impacts may be reduced (such as visual impacts). Conversely, a layout using the smallest turbine option would represent the worst-case scenario in terms of the number of turbines able to be developed but may overstate other impacts. Use of the Vestas V112 is therefore considered a likely and representative turbine for the purposes of assessment.

Energy and Greenhouse Gas Calculations

The energy production and greenhouse calculations are based on an indicative 3.0 MW turbine.

Energy production calculations are most important for determining the options for connecting the wind farm into the transmission network. A wind farm output may be restricted by the size of the transmission line running through the site, or if other generators are already attached to the line. Energy production is also used to calculate the potential greenhouse gas emissions that would be reduced by the project.

A turbine with a name plate rating of 3.0 MW sits in the middle of the range of turbines under consideration and is a likely turbine size to be ultimately selected. It is therefore considered representative of the energy production and greenhouse abatement benefits from the project.

Visual Impacts

The photomontages, Zone of Visual Influence, and Shadow Flicker analysis are prepared using the Vestas V112, which is a turbine with a 112m rotor diameter on a 101 m hub height.

Photomontages, Zone of Influence and Shadow Flicker maps are created to assess the potential impact to visual amenity. Using a turbine with a large rotor diameter (blades) and a large overall tip height allows for the worst case scenario to be assessed. While there are turbines that have a tip height in excess of 157 m it is unlikely that these configurations would be used on this site.

In some cases, the worst case presents an unrealistic portrayal of impacts when compared to the most likely turbines to be selected for the project. Therefore, in some areas, the EA also considers and presents the indicative or likely impacts for comparison. Noting that the layout would require review and likely removal of a number of turbines to accommodate the physically largest turbine, this assessment would overstate the visual impacts. The photomontages were prepared using the likely turbine sizing of a 101 m hub height with a 112 m rotor diameter (tip height of 157 m) to present the likely and representative scenario.

Noise Impacts

The noise assessment was conducted using the Vestas V112 3.0 MW

Each turbine has a slightly different noise curve, and must be individually assessed prior to construction taking place to ensure that compliance will be achievable. Rather than testing every turbine model available, a

conservative approach has been adapted to demonstrate that compliance is achievable. Thus other turbines considered would theoretically comply with the same criteria.

The noise assessment presents the modelling of the Vestas V112 3.0 MW turbine as a conservative estimate for the project. The V112 presents the representative impacts as it has noise characteristics typical of modern wind turbines and therefore offers a good approximation of the likely noise impacts of the project. The physical and noise characteristics of these turbines are considered to be indicative of the wind turbines available. The analysis demonstrates that it is possible to achieve the noise limits set by the SA EPA guidelines and WHO guidelines using the Vestas V112.

The current layout, as presented in this EA, has been prepared to demonstrate that compliance can be achieved across a wide range of turbine models. 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 indicative 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 model. The Statement of Commitments affirms that modelling of the final turbine on the final layout would be undertaken to ensure compliance with the SA EPA guidelines and NSW draft Guidelines.

8.3 Environmental Management Plans

A Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) will be prepared to manage and mitigate environmental impacts on the wind farm site. The CEMP will incorporate all relevant processes and mitigation measures for the development/construction phase while the OEMP will incorporate measure for operations phase. The CEMP will be prepared prior to the commencement of construction and the OEMP will be prepared prior to the commencement of operations. The plans will generally address:

- Soil & Water Management;
- Fuel and Chemical Storage - to avoid the pollution of surface and ground waters;
- Erosion & Sediment Control Plan;
- Landscape Management Plan;
- Traffic and Transport;
- Fire Management;
- Waste Generation and Disposal;
- Rail Safety Management Plan; and
- Additional measures mentioned in the Statement of Commitments

The CEMP and the OEMP will follow the philosophy of adaptive management. The philosophy of adaptive management is followed when policies and practices are continually improved by learning from the outcomes of previous work. As part of the adaptive management process the management measures provided by the EMP will also include a review and assessment program where works and monitoring are regularly reviewed and reassessed to ensure the environmental outcomes are achieved. This process is illustrated in Figure 8-1.

During construction, the site will be protected from erosion and sedimentation by the installation and maintenance of standard erosion and sediment control measures, such as sedimentation fences and swales in accordance with *Managing Urban Stormwater: Soils and Construction 4th Edition* – Vol 1 (the "Blue Book") (CSIRO, 2012) and Managing Urban Stormwater: Soils and Construction (DEWHA, 2009).

Surface water management procedures will be maintained in accordance with an Erosion and Sediment Control Plan. This plan will detail the use of sedimentation fences, and drainage controls to direct surface water into appropriate sediment basins and through a filter before being discharged into the site drainage system.

Specific environmental management measures will be used around the batching plant area and other temporary facilities. The temporary concrete batching plants will have a bunded storage area and a temporary concrete slab beneath the loading area. To capture surface water, sediment runoff (including any imported materials which may influence the pH and water quality) a swale drain is anticipated around the perimeter of the batching plant. This will be channelled into an enclosed retention pond, where water will be evaporated off and any solid waste disposed of at landfill. To ensure water pH levels remain at a reasonable level as a result of the potential of mixing with imported materials, checks will be set up and if deemed appropriate acid dosing (anticipated to be hydrochloric) will be added to ensure pH is controlled or alternatively the contaminated water would be transported by tanker off site. This type of approach is common in the construction industry.

Controls to avoid spillage of oil or erosion and sediment loss from the site will be supported by emergency response procedures where required.

These management procedures will remain in place until the site is rehabilitated suitable for the intended land use. This will effectively protect the site and its surrounding areas from any significant impacts on topography, surface water and water quality.

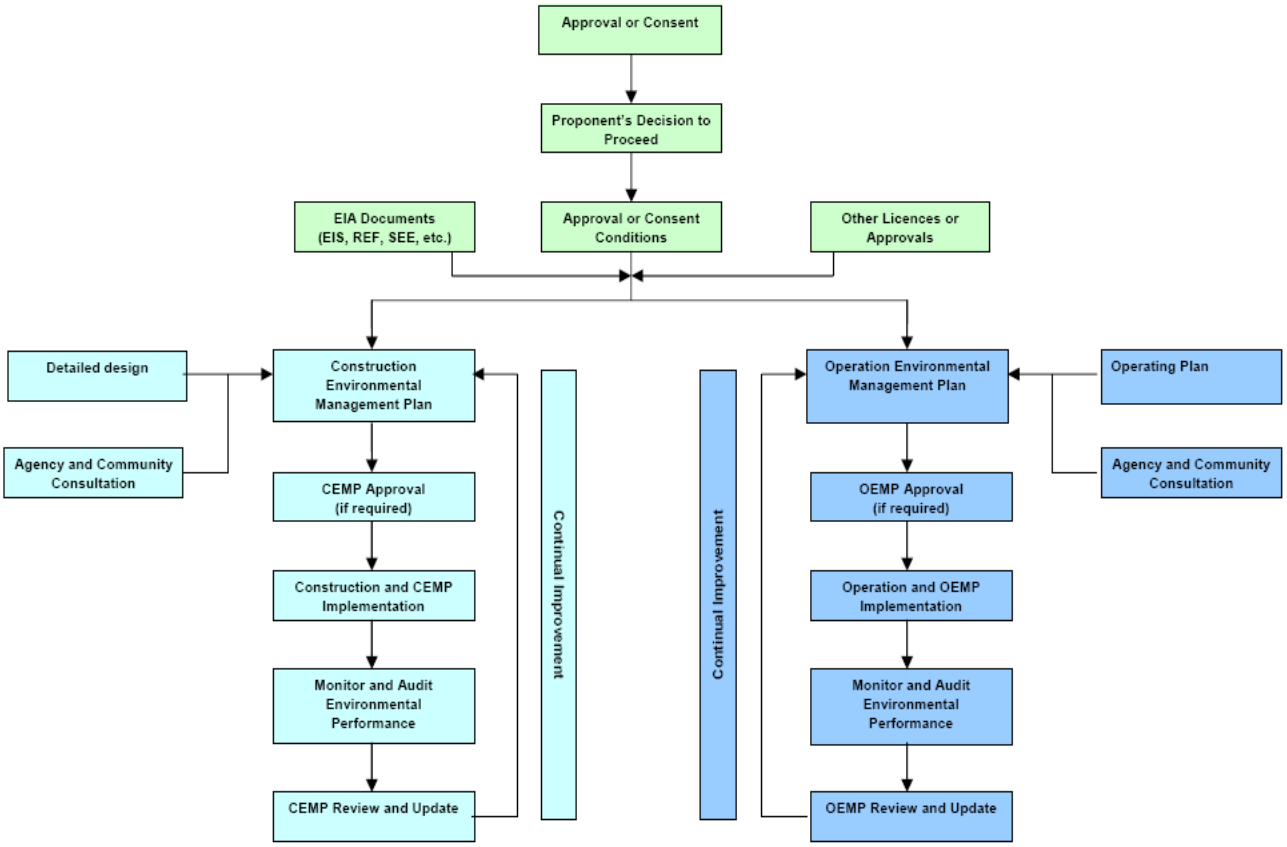


Figure 8-1 Post approval Environmental Management Plan process

9 Visual Assessment

9.1 Visual Amenity

The Rye Park Wind Farm Landscape and Visual Impact Assessment (LVIA) has been prepared by the landscape architectural consultancy and LVIA specialist Green Bean Design (GBD). The LVIA involved a comprehensive evaluation of the visual character of the landscape in which the wind farm would be located, and an assessment of the potential significance of landscape and visual impacts that may result from the construction and operation of the wind farm, taking into account appropriate mitigation measures.

This section presents a summary of the LVIA methodology as well as the key results and findings arising from the assessment. The detailed LVIA and photomontages prepared from publically accessible areas and uninvolved landowner dwellings within 2km of a wind turbine are included in Appendix A.

9.1.1 Methodology

The LVIA was undertaken in accordance with the DGRs and, although not directly applicable to the assessment process, is cognisant with the Upper Lachlan Shire Council's Development Control Plans (DCP) for Wind Power Generation.

The LVIA addresses key issues outlined in the Australian Wind Energy Association and Australian Council of National Trust's publication *Wind Farms and Landscape Values National Assessment Framework* (AusWEA, 2007), and encompasses the general assessment framework outlined in the National Assessment Framework. The LVIA has also given regard to the Draft NSW Planning Guidelines for Wind Farms (December 2011).

As well as consideration of existing guidelines, the LVIA methodology has been applied to a number of similar Part 3A Major Project wind farms prepared by GBD, for assessment by the NSW Department of Planning and Infrastructure (DoP&I).

The LVIA methodology included the following key activities:

- desktop study addressing visual character and identification of view locations within the surrounding area;
- fieldwork and photography;
- preparation of ZVI diagrams;
- assessment and determination of landscape sensitivity;
- assessment of significance of visual impact
- describing the potential impact of night time lighting
- determining the potential for cumulative impacts; and
- preparation of photomontages and illustrative figures.

9.1.2 Assessment

Visual components of the wind farm

The key visual components of the wind farm that are likely to be visible from surrounding areas include, but are not limited to:

up to 126 wind turbines;

- up to 126 individual 33kV external kiosk transformers and switchgear with associated control systems to be located in the vicinity of the wind turbine towers (in some turbine models transformer equipment will be integrated within the tower or nacelle);

- underground and overhead electrical and communication cable network linking turbines to each other within the project boundary;
- a new 330 kV wind farm connection substation located adjacent to the existing TransGrid 330 kV powerline (Yass – Bannaby) that traverses the southern section of the site;
- up to two new 22 kV or 33/330 kV or similar collection substations located across the wind farm;
- a new overhead powerline approximately 35 km in length, rated at up to 330 kV (nominal) capacity, running north-south along the length of the wind farm site to the two collection substations. The new powerline would be mounted on a single pole type structure and may be single-circuit or double-circuit as required;
- up to 6 permanent wind monitoring masts. The permanent monitoring masts may be either static guyed or un-guyed structures and will be to a minimum height of the wind turbine hubs;
- on site access tracks for construction, operation and ongoing maintenance; and
- Rye Park wind farm signage and maintenance facilities.

Temporary works associated with the construction of the wind farm that may be visible during construction and operational phases include mobile concrete batching plant and rock crushing facilities.

The wind turbines would be the most visible element of the wind farm from the majority of surrounding view locations. The final selection for the turbine model will be made closer to construction; however, a turbine representative of the larger options was selected for the visual assessment, with a tip height of 157m.

Table 9-1 Wind turbine parameters for LVIA (based on Vestas V112 3MW)

Element	*Description*
Tower height	101 m
Rotor Diameter	112 m
Overall height from ground level to tip of blade	157 m
Proposed number of wind turbines	126

Community Perceptions and Public Consultation

Individual perception is an important issue to consider in any visual impact assessment, as the attitude or opinion of an individual receptor adds significant weight to the level of potential visual impact. These attitudes or opinions of individual receptors toward wind farms can be shaped and formed through a multitude of complex social and cultural values.

Whilst published research into the potential landscape and visual impacts of wind farms is limited in Australia, there are general corresponding results between the limited number that have been carried out when compared to those carried out overseas.

A recent survey was conducted by ARM Interactive on behalf of the NSW Department of Environment, Climate Change and Water (September 2010). The survey polled 2,022 residents across the 6 Renewable Energy Precincts established by the NSW Government; including the NSW/ACT Border Region Renewable Energy Precinct. Key findings of the survey indicated that:

- 97% of people across the Precincts had heard about wind farms or turbines, and 81% had seen a wind farm or turbine (in person or the media);
- 85% of people supported the construction of wind farms in New South Wales, and 80% within their local region; and
- 79% supported wind farms being built within 10km of residences and 60% of people surveyed supported the construction of wind turbines within 1 to 2km from their residences.

These results are reflected in other surveys including the community perception survey commissioned by Epuron for the Gullen Range Wind Farm Environmental Assessment in (REARK, 2007). The results of the survey, which targeted a number of local populations within the Southern Tablelands, suggested that around 89% of respondents were in favour of wind farms being developed in the Southern Tablelands, with around 71% of respondents accepting the development of a wind farm within one kilometre from their residential dwelling.

Whilst individual perception and local community attitudes toward wind farm development are an important issue, these need to be considered in terms of potential landscape and visual impacts from a broad community perspective.

Proximity to Urban Areas

Larger urban centres and smaller localities surrounding the proposed Rye Park wind farm include:

- Rye Park (approximately 3.3 km to the west)
- Rugby (approximately 9.3 km to the north east)
- Yass - outlying north east portion (approximately 9.3 km to the south west);
- Bevendale (approximately 8.5 km to the east); and
- Jerrawa (approximately 6.9 km to the south east).

Existing Landscape

The landscape surrounding the wind farm is predominantly rural in character and occupied by medium sized landholdings as well as larger commercial pastoral operations. Areas of cultivated farmland and livestock pasture are interspersed with occasional rural homesteads surrounded by cultural planting and windbreaks.

Human modifications within the broader landscape are consistent with common adaptations to rural life and include roads (sealed and unsealed), drainage structures, agricultural buildings, electrical transmission infrastructure, and communication structures.

A series of hills are joined by ridgelines extending north to south across the wind farm site with areas of timber located on hillside slopes. The undulating topography within and surrounding the wind farm also creates a series of valleys from which views are largely contained and restricted.

Viewshed, Zone of Visual Influence and Visibility

A core component of the LVIA is defined by the description, assessment and determination of the viewshed, zone of visual influence and visibility associated with the wind farm. The relationship between viewshed, zone of visual influence and visibility is outlined in the following table. Extended descriptions are found in the full report in Appendix A.

Table 9-2 Definitions used in Landscape and Visual Impact Analysis

Term	*Definition*	*Relationship*
Viewshed	An area of land surrounding (up to 20km) and beyond the wind farm area which may be potentially affected by the wind farm from a visual impact perspective.	Identifies the majority of the LVIA study area that incorporates receptors that may be subject to a degree of visual impact.
Zone of Visual Influence (ZVI)	A theoretical area of landscape from which the wind farm structures may be visible.	Determines areas within a viewshed from which some or all wind turbines may be visible.
Landscape Character	Defined as 'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape' (SNH, 2009).	Determines the ability of the landscape to accommodate change.
Landscape Sensitivity	The British Landscape Institute describes Landscape Sensitivity as 'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'.	Quantifies the level of impact that a development would have on the landscape.
Visibility	A relative determination at which a wind turbine or group of turbines can be clearly discerned and described.	Describes the likely number and relative scale of wind turbines visible from a receptor location.

The distance effect within the 10 km viewshed is outlined in the following table. Distance effect is not site specific and can be applied consistently to any wind farm based on the size and distance of turbines to the viewer. Note, in all cases visibility is Nil where influenced or screened by surrounding topography and vegetation.

Table 9-3 Visual effect based on distance from wind turbines

Distance from turbine	*Distance effect*
>20 km	Wind turbines become indistinct with increasing distance. Rotor movement may be visible but rotor structures are usually not discernible. Turbines may be discernible but generally indistinct within viewshed resulting in Low level visibility and Nil where influenced or screened by surrounding topography and vegetation.
10 km – 20 km	Wind turbines noticeable but tending to become less distinct with increasing distance. Blade movement may be visible but becomes less discernible with increasing distance. Turbines discernible but generally less distinct within viewshed (potentially resulting in Low level visibility).
5 km – 10 km	Wind turbines visible but tending to become less distinct depending on the overall extent of view available from the potential view location. Movement of blades discernible where visible against the skyline. Turbines potentially noticeable within viewshed (potentially resulting in Low to Moderate level visibility).
3 – 5 km	Wind turbines clearly visible in the landscape but tending to become less dominant with increasing distance. Movement of blades discernible. Turbines noticeable but less dominant within viewshed (potentially resulting in Moderate level visibility).
1 – 3 km	Wind turbines would generally dominate the landscape in which the wind turbine is situated. Potential for high visibility depending on the category of view location, their location, sensitivity and subject to other visibility factors. Turbines potentially dominant within viewshed (potentially resulting in Moderate to High level visibility).
<1 km	Wind turbines would dominate the landscape in which they are situated due to large scale, movement and proximity. Turbines dominant and significant within viewshed (potentially resulting in High level visibility).

Landscape Character Areas and Landscape Values

Landscape character is defined as 'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape' (SNH, 2009).

The LVIA identified five Landscape Character Areas (LCAs), which generally occur within the viewshed of the project and include:

- LCA 1 – Undulating grassland;
- LCA 2 – Drainage lines;
- LCA 3 – Hills and ridgelines;
- LCA 4 – Timbered areas; and
- LCA 5 – Settlement.

The British Landscape Institute describes landscape sensitivity as 'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'.

In terms of overall landscape sensitivity, the LVIA determined that in aggregate each of the five LCAs within the 10km wind farm viewshed had a medium/medium to high sensitivity to accommodate change, and represents a landscape that is reasonably typical of other landscape types found in surrounding areas of the Southern Tablelands.

With a medium/medium to high sensitivity to accommodate change, some characteristics of the landscape are likely to be altered by the wind farm development; however, the landscape is likely to have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale features within the landscape character areas and portions of the wind farm area, together with the relatively low density and dispersed nature of human settlement patterns and potential receptors located within the wind farm viewshed.

The LVIA landscape values have been considered as a set of professional judgements on the importance to society of the local and regional landscape surrounding the proposed wind farm development. Whilst the landscape is likely to hold more significant value at a local level, for those who both work and reside within the landscape surrounding the proposed wind farm development, there are no specific references to designations or policies which indicate or recognise a 'high value' landscape. There are no 'iconic' landscape elements (including constructed or natural features) that occur within the local or regional landscape which have a broader public value or that are recognised at a national level. The majority of land within and surrounding the wind farm development is privately owned and, at a local and regional scale, opportunities for the broader public to access and explore the landscape and obtain distant and panoramic views are largely limited to existing rights of way such as road corridors. The proposed wind farm development is not considered to have the potential to have a significant impact on existing landscape values.

Table 9-4 Landscape Character Areas and Landscape Sensitivity

Landscape Character Area	Description	Landscape Sensitivity
LCA 1	Undulating grassland	Medium
LCA 2	Drainage lines	Medium
LCA 3	Hills and ridgelines	Medium
LCA 4	Timbered areas	Medium
LCA 5	Settlement	Medium

Typical view across undulating grassland (LCA 1)

Typical view across drainage lines (LCA 2)

Typical view across hills and ridgelines (LCA 3)

Typical views across timbered areas (LCA 4)

Typical views across settlement (LCA 5)

Figure 9-1 Example of Landscape Character Areas

Zone of Visual Influence Diagrams (ZVI)

The ZVI diagrams are used to identify theoretical areas of the landscape from which a defined number of wind turbines, or portions of turbines, may be visible within the viewshed. They are useful for providing an overview as to the extent to which the Rye Park Wind Farm may be visible from surrounding areas.

Three ZVI diagrams have been prepared to demonstrate the extent to which the wind turbines would be visible at a distance up to 20 km from the site. Three different ZVI diagrams have been prepared to show the zone of visual influence from:

- any part of the wind turbines (i.e. tip of blade).
- half the swept path of rotor (i.e. hub height to tip of blade); and
- the entire turbine structure (i.e. ground to tip of blade).

The ZVI methodology is conservative as the screening effects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI diagrams due to the presence of trees or other screening elements. A summary of the ZVI analysis in included in Appendix A.

The level of wind turbine visibility within the viewshed can result from a number of factors including the distance between a receptor and the wind farm, static or dynamic receptor locations (e.g. residents or motorists) or the relative position of the receptor to the wind turbines. Whilst the distance between a receptor and the wind turbines is a primary factor to consider when determining potential visibility, there are other issues, for example the level of tree cover, which may also affect the degree of visibility.

The ZVI diagrams are illustrated in Figure 9-2 to Figure 9-4, which show from each location the number of turbines visible in each category.

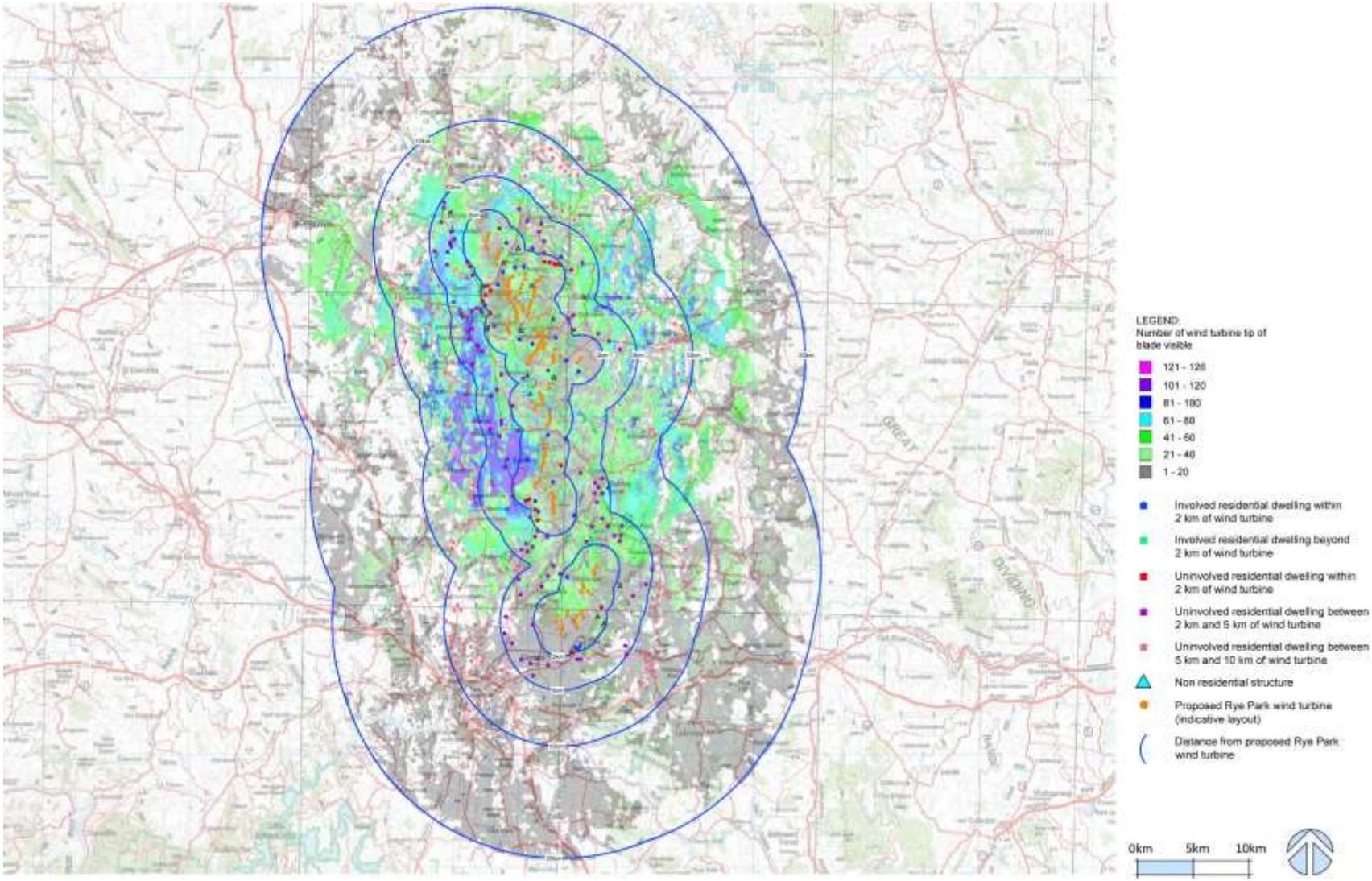


Figure 9-2 Zone of Visual Influence (turbine tips visible)

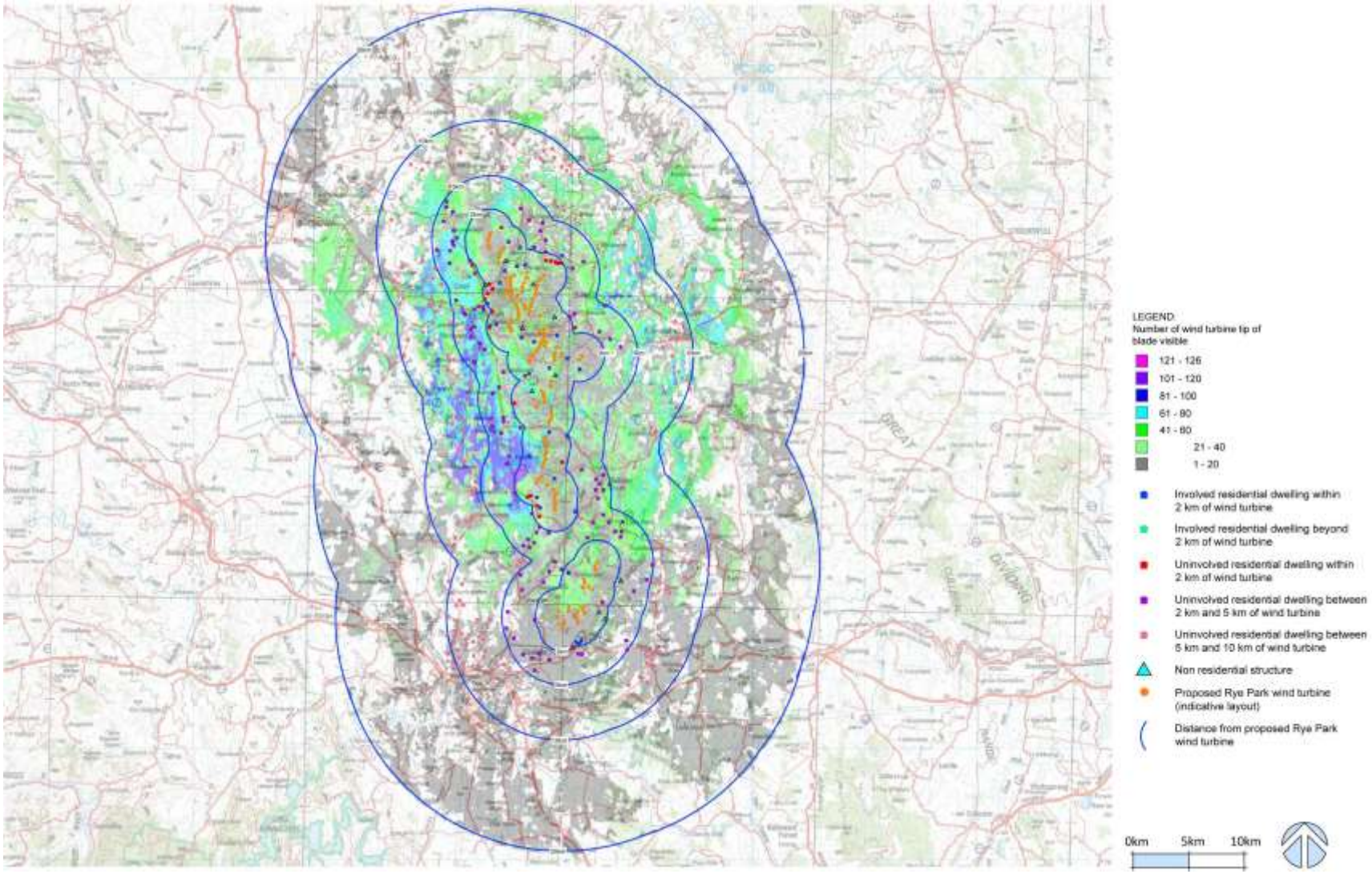


Figure 9-3 Zone of Visual Influence (turbine hubs visible)

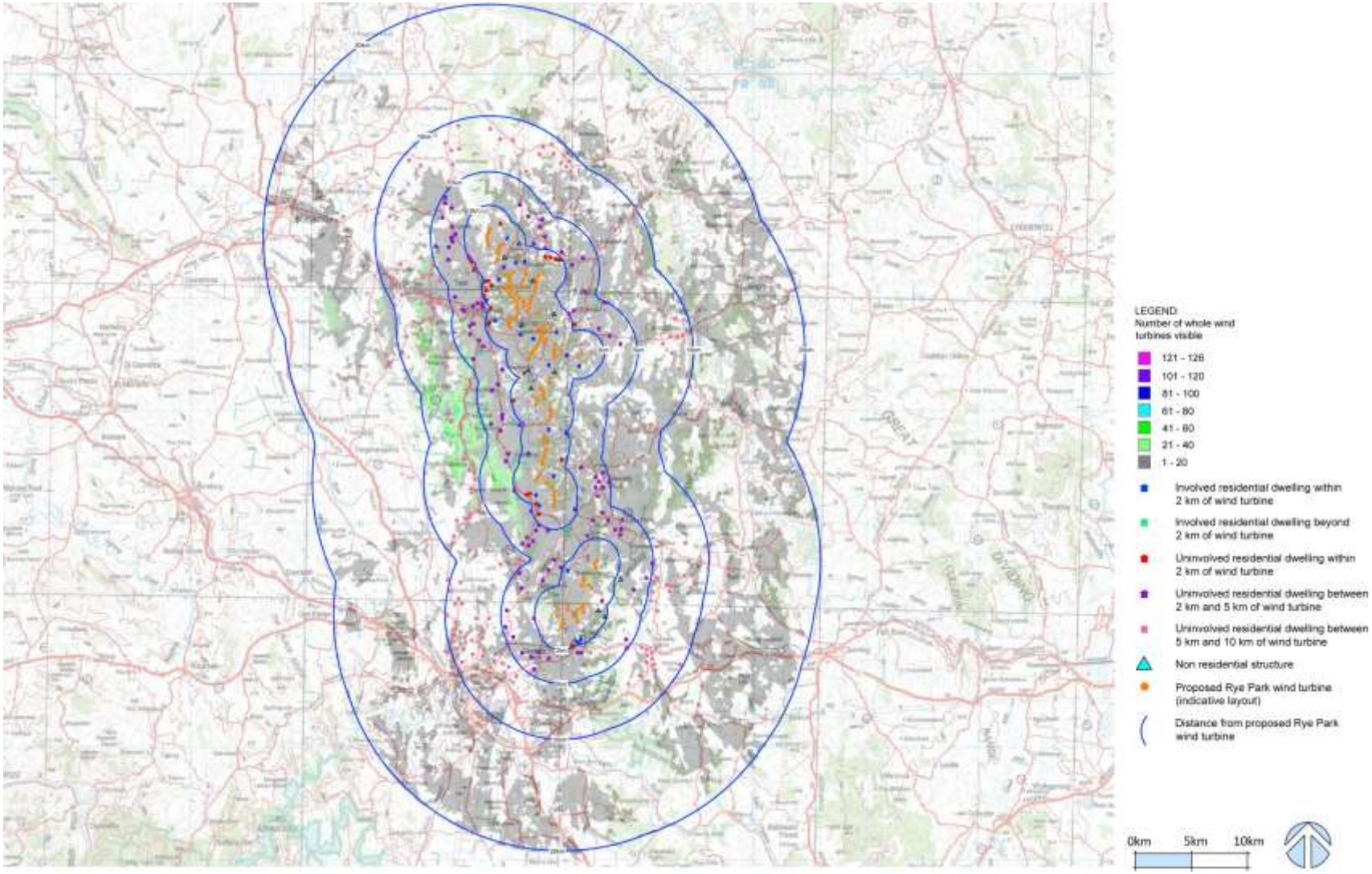


Figure 9-4 Zone of Visual Influence (whole turbines visible)

Photomontages

Photomontages have been prepared to illustrate the general appearance of the wind farm following construction. Nine locations were selected to illustrate the wind farm from public view points in the landscape surrounding the wind farm project area. These locations are shown in Figure 9-5 and listed below:

Table 9-5 Public photomontages locations

Photomontage Location	*LVIA Figure ref*	*Status:*
PM 1 Coolalie Road	Figure 32	Unsealed road corridor (minor local road)
PM 2 Rye Park Dalton Road	Figure 33	Sealed road corridor (minor local road)
PM 3 Maryvale Road	Figure 34	Unsealed road corridor (minor local road)
PM 4 Maryvale Road	Figure 35	Unsealed road corridor (minor local road)
PM 5 Little Plains Road	Figure 36	Unsealed road corridor (minor local road)
PM 6 Kershaw Street, Rye Park	Figure 37	Sealed road corridor (minor local road) within Rye Park village
PM 7 Wargeila Road	Figure 38	Unsealed road corridor (minor local road)
PM 8 and 10 Rye Park Dalton Road	Figure 39 and 70	Unsealed road corridor (minor local road)
PM 9 Blakney Creek Road	Figure 40	Unsealed road corridor (minor local road)

The public photomontages locations were selected following a review of preliminary ZVI maps, together with a site inspection to identify potential representative viewpoints. The public photomontage locations were selected from publically accessible sections of surrounding road corridors.

In addition to the public photomontages locations, a total of twenty two photomontages were prepared from uninvolved residential dwellings within 2 km of the Rye Park wind farm turbine locations. These photomontages locations are included in Appendix A.

The process used to generate the photomontages is detailed in Appendix A. An example of a public and uninvolved photomontage is illustrated in Figure 9-6 and Figure 9-7. All thirty two photomontages are included in Appendix A.

GBD undertook to independently verify the scale of the Rye Park wind turbines within the photomontages through a photographic comparison of the photomontage methodology against constructed and operational wind turbines. The results of this verification are included in Appendix A.

Whilst a professional photomontage provides an image that illustrates a realistic representation of a wind turbine, both in relation to its proposed location and its scale relative to the surrounding landscape, the LVIA acknowledges that large scale objects in the landscape can appear smaller in photomontage than in real life, and is partly due to the fact that a flat image does not allow the viewer to perceive any information relating to depth or distance.

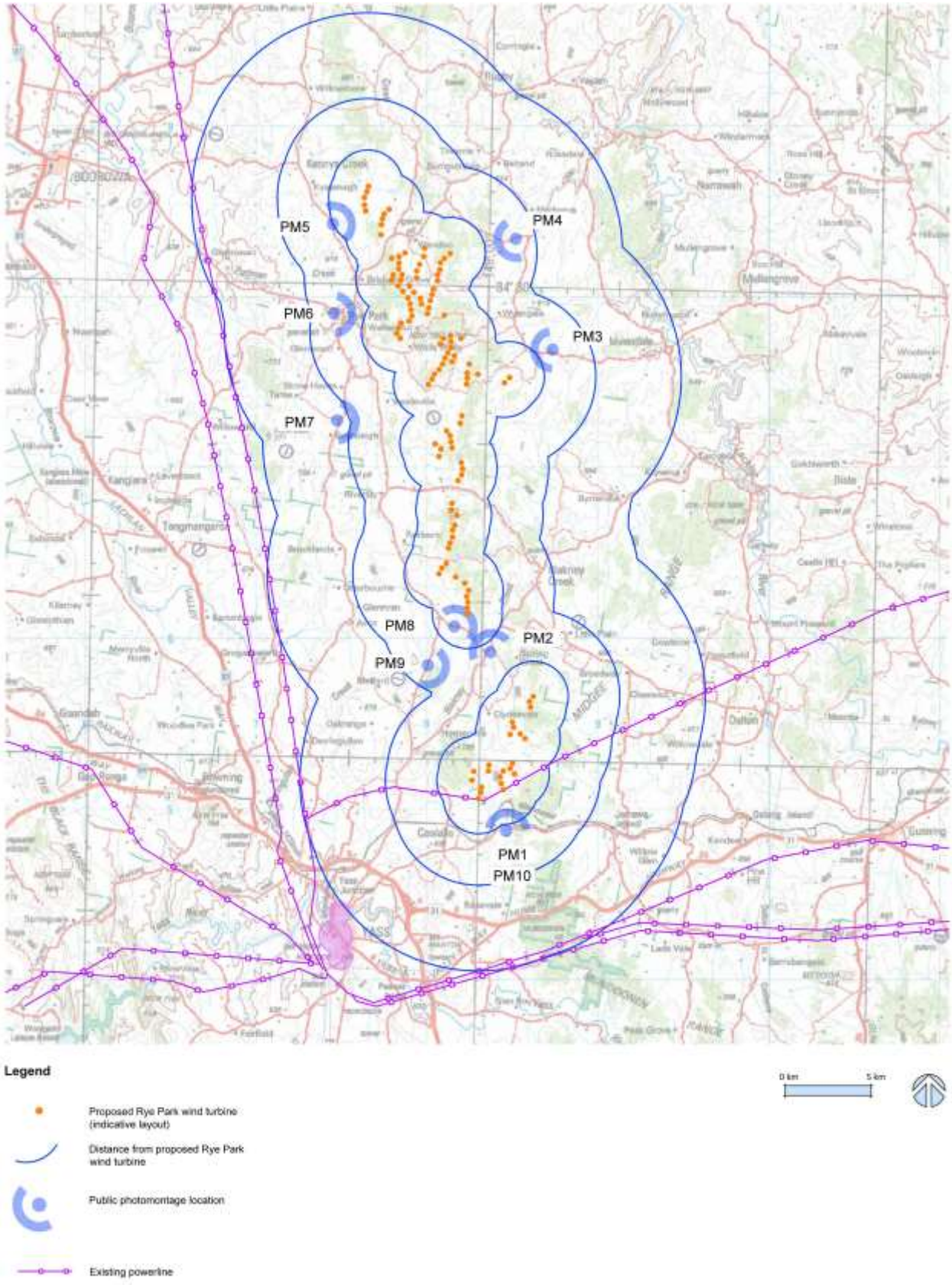


Figure 9-5 Photomontage Locations

Public view location PM8 Rye Park Dalton Road - Existing view north north west to east. Photo coordinate Easting:680991 Northing:6161071 (MGAz55)

Public view location PM8 Rye Park Dalton Road- Proposed view through 120°. Approximate distance to closest visible wind turbine 1,200 m

Notes

Composite panorama photograph taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D700 digital SLR camera with a 50mm lens results in a single photograph with a view angle equivalent to a 35mm digital SLR camera photograph taken with a 50mm lens.

Refer Figure 31 for photomontage locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D700 digital SLR camera with a 50mm lens

Figure 9-6 Public Photomontage Location PM8

Uninvolved residential dwelling R17- Existing view north to east south east. Photo coordinate Easting:676148 Northing:6181529 (MGAz55)

Uninvolved residential dwelling R17 - Existing view through 120°. Approximate distance to closest visible Rye Park wind turbine 1,960 m

Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

Figure 9-7 Photomontage for uninvolved residential dwelling R17

Night Lighting

Although not currently proposed, the Rye Park wind farm may require obstacle lighting in the future. The future requirement for lighting would be subject to the advice and endorsement of the Civil Aviation Safety Authority (CASA) (see Section 14.1). CASA is currently undertaking a safety study into the risk to aviation posed by wind farms to develop a new set of guidelines to replace the Advisory Circular with regard to lighting for wind turbines that was withdrawn by CASA in mid-2008.

Should future CASA regulations require a lighting assessment; the proponent will undertake an Aeronautical Impact Assessment, to first determine the risks posed to aviation activities by the wind farm. If required, an Obstacle Lighting Assessment would be undertaken by an Aeronautical Impact Assessment expert to stipulate the turbine lighting layout which would mitigate any risks to aviation. The outcomes of the Aeronautical Impact Assessment and the Obstacle Lighting Assessment would then be submitted to CASA for their comment.

A small number of existing night time light sources are present in the vicinity of the wind farm, including lights within and surrounding settlements, dispersed homesteads, vehicles travelling along local roads and communication towers. Potential night time light sources from the wind farm could result from:

- low intensity night lights for substations, control and auxiliary buildings; and
- night time obstacle lights mounted on some wind turbines (if required in the future).

Night time lighting has the potential to be visible from distant view locations, and well beyond the 10km viewshed for the Rye Park wind farm, although the level of impact will diminish when viewed from more distant view locations, with a greater probability of night time lighting being screened by landform and/or tree cover.

Electrical works

The Rye Park wind farm would include a range of electrical infrastructure to collect and distribute electricity generated by the wind turbines. Electrical works would include elements such as:

- 2 collection substations and 1 connection substation;
- a double circuit 330 kV powerline;
- generator transformers; and
- underground and overhead electrical and control cables.

These elements of the project are fully described and illustrated in Appendix A. The potential visual impact of electrical infrastructure works, including the proposed 330kV powerline route (and alternate route), has been assessed and is unlikely to have a significant impact on surrounding residential view locations.

The LVIA identified 27 residential view locations within 2 km of the proposed 330 kV powerline route (including the three alternative route options). An assessment of the potential visual significance of the proposed powerline indicated that:

- 9 of the 27 residential dwellings would have a Nil visual significance;
- 12 of the 27 residential dwellings would have a Low visual significance;
- 3 of the 27 residential dwellings would have a Low to Medium visual significance; and
- 3 of the 27 residential dwellings would have a Medium visual significance.

The electrical works would be contained within a landscape with an overall moderate visual absorption capability, which would have some ability to accept modifications and alterations without the loss of landscape character or significant deterioration of existing levels of visual amenity.

Pre-Construction and Construction Activities

The key pre-construction and construction activities that may be visible from areas surrounding the proposed wind farm include:

- ongoing detailed site assessment including sub surface geotechnical investigations;

- various civil works to upgrade local roads and access point;
- construction compound buildings and facilities;
- construction facilities, including portable structures and laydown areas;
- various construction and directional signage;
- mobilisation of rock crushing equipment and concrete batching plant (if required);
- excavation and earthworks; and
- various construction activities including erection of wind turbines, monitoring masts and substation with associated electrical infrastructure works.

The majority of pre-construction and construction activities, some of which would result in physical changes to the landscape, are generally temporary in nature and for the most restricted to various discrete areas within or beyond the immediate wind farm wind farm area. The majority of pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact for their duration and temporary nature.

The LVIA determined that the wind farm is likely to be an acceptable development within the viewshed, which in a broader context also contains approved wind farm developments and built elements such as roads, agricultural industry, aircraft landing strips, communication and transmitter towers and powerlines.

9.2 Results of Visual Impact Assessment

The significance of visual impact resulting from the construction and operation of the Rye Park wind farm would result primarily from a combination of:

- the overall sensitivity of visual receptors in the surrounding landscape; and
- the scale or magnitude of visual effects presented by the wind farm development.

The sensitivity of visual receptors has been determined and described in this LVIA by reference to:

- the location and context of the view point;
- the occupation or activity of the receptor; and
- the overall number of people affected.

The scale or magnitude of visual effects associated with the project have been determined and described by reference to:

- the distance between the view location and the wind farm turbines;
- the duration of effect;
- the extent of the area over which the wind farm could be theoretically visible (ZVI hub height)
- the degree of visibility subject to existing landscape elements (such as forested areas or tree cover).

The LVIA notes that although a large number of viewers in a category that would otherwise be of low or moderate sensitivity may increase the sensitivity of the receptor, it is also the case that a small number of people (such as residents) with a high sensitivity may increase the significance of visual impact.

The criteria used to establish the significance of visual impact are detailed in Appendix A. Residential dwelling locations are presented in Figure 28, located in Appendix A.

Residential viewpoints within 2km of the proposed wind turbine locations

The LVIA identified a total of 51 potential involved and uninvolved residential view locations within the Rye Park wind farm 2 km viewshed. Unoccupied residential dwellings have been included and assessed as part of this LVIA where structures and buildings were considered to be habitable at the time of the field work.

An assessment of each potential residential view location indicated that for the Rye Park wind turbine design layout:

- 10 of the 51 residential view locations have been determined to have a low visual significance;
- 10 of the 51 residential view locations have been determined to have a low to medium visual significance;
- 12 of the 51 residential view locations have been determined to have a medium visual significance;
- 17 of the 51 residential view locations have been determined to have a medium to high visual significance; and
- 2 of the 51 residential view locations have been determined to have a high visual significance.

Other viewpoints

The LVIA determined that the majority of residential dwellings and public viewpoints located beyond the 2 km wind turbine offset are unlikely to be significantly impacted by the wind farm development. The localised influence of topography, as illustrated in the ZVI diagrams, has a direct and marked impact on the extent and nature of views within the 2 km and wider viewshed.

Overall conclusion

Taking into account the mitigation measures outlined in Section 9.4, the LVIA concludes that the Rye Park wind farm project would have an overall medium visual significance on the majority of uninvolved residential view locations within the 10 km viewshed as well public view locations.

9.3 Cumulative Visual Impact Assessment

An assessment of cumulative environmental impacts considers the potential impact of a proposal in the context of existing developments and future developments to ensure that any potential environmental impacts are not considered in isolation.

'Direct' cumulative visual impacts may occur where two or more winds farms have been constructed within the same locality and are simultaneously viewed from the same receptor location.

'Indirect' cumulative visual impacts may also arise as a result of multiple wind farms being observed from the same receptor location, but do not overlap or occur within a single field of view.

'Sequential' cumulative visual impacts may also arise as a result of multiple wind farms being observed at different locations during the course of a journey (e.g. from a vehicle travelling along a highway or from a network of local roads), which may form an impression of greater magnitude within the construct of short term memory.

Existing, approved and proposed wind farms within the regional locality of the Rye Park wind farm are identified in Appendix A.

Following consultation with a number of Local Government Authorities there are no known smaller wind farm developments that have been approved, or are currently being assessed by Boorowa Council, Upper Hunter Shire Council or Yass Valley Council.

Long distance views (around 30 km) can be obtained toward the operational Gunning and Cullerin wind farms from elevated areas of the landscape to the south east of the Rye Park project area. Although visible, these wind farm developments are unlikely to result in any significant additional level of 'direct' and 'indirect' cumulative impact for view locations within the Rye Park 10 km viewshed due to the distance effect on overall visibility between the wind farm developments.

Intervisibility with the proposed Bango and Rugby wind farms

The proposed Bango and Rugby wind farm developments are currently in the planning stage. The proposed location and number of turbines associated with each development was not publically known or made available during the preparation of this LVIA. The potential for cumulative impact will be dependent on a number of factors such as the separation distance between turbines and layout of turbines relative to the proposed Rye Park project.

Whilst some degree of intervisibility between all 3 projects is expected, the nature and extent of the undulating landform surrounding each of the project sites, would partially limit the overall potential for 'direct' and 'indirect' views for many of the residential dwellings located between them.

A sequential view would occur for motorists travelling along local roads although the journey between the wind farms would include a range of views extending toward and beyond turbines. The extent and overall visibility of turbines would be influenced by the direction of travel relative to the alignment of wind turbines as well as the relatively short travel time along the local road network alongside and between the wind farm turbines.

Although there are other wind farm developments proposed in the vicinity of the Rye Park wind farm it is not certain all projects will be constructed, if approved, due to competing access to the electricity network and economic market limitations.

9.4 Mitigation Measures

It is inevitable that wind turbines of the size proposed for the Rye Park wind farm will have some significance of visual impact. However, a number of mitigation measures have been incorporated into the design of the wind farm, or form wind farm commitments, with the aim of minimising visual impact. These include:

- Consideration of a non-reflective finish of the structures to reduce visual contrast between turbine structures and the viewing background (this is subject to final turbine selection and supplier specifications);
- A commitment to consult and negotiate visual impact mitigation measures, where required, which may include landscape planting at landowner residence within 3km of a wind turbine.
- A commitment to minimise activities that may require night time lighting and, if necessary, use low intensity lighting designed to be mounted with the light wind farming inwards to the site to minimise glare;
- Substation and other ancillary infrastructure have been sited sympathetically with the nature of the locality and away from major roads and residential dwellings where practical to minimise visual impact;
- The majority of electrical connections within the site (i.e. cables between the turbines) have been designed to be located underground (where practical), in order to further reduce potential visual impacts.

These are outlined in the Statement of Commitments in Section 17.

10 Operational and Construction Noise

10.1 Noise

10.1.1 Background

SLR Consulting Australia Pty Ltd (SLR Consulting) were engaged as the acoustic consultants for the proposed Rye Park Wind Farm. A full Noise Impact Assessment (NIA) of the operational and construction noise has been completed and can be found in Appendix B.

The assessment predicts noise levels for receptors within 2 km of a proposed WTG and compares the predicted level to the limits set out in the South Australian Environmental Protection Authority (SA EPA) Environment Noise Guidelines for Wind Farms (February 2003) and World Health Organization (WHO) limits, as appropriate. The assessment procedure involved the following:

- Noise monitoring was conducted by Epuron in the period 8 June 2012 through to 22 August 2012 at twenty locations to determine baseline conditions and establish indicative criteria for surrounding residential receivers.
- The captured data was screened for validity, with data monitored during periods of rain or where the average wind speed at the microphone position likely exceeded 15 m/s (10 m AGL) being discarded from the data set. A regression analysis of all valid data is used to determine a line of 'best fit' from which the noise limit is established.
- Noise was predicted using ISO 9613-2:1996 as implemented in the SoundPLAN computer noise model. The model predicts noise levels through spherical spreading and includes the effect of air absorption, ground attenuation and shielding. The predicted noise levels for the wind range 3 to 12 m/s are then calculated from the sound power levels determined in accordance with the recognised standard IEC-61400-11:2002.
- WTG noise was then assessed against relevant criteria prescribed by the SA EPA Guideline and World Health Organisation (WHO) goals where appropriate to determine compliance.
- The model was then mitigated using Sound Management Mode for some turbines.

10.2 Assessment

The criteria were determined using the following approach:

- Unattended noise loggers were deployed at receptor locations around the proposed wind farm site by Epuron Pty Ltd.
- The loggers were set up to collect background noise data (L_{A90}) in 10-minute intervals. Simultaneous wind speed measurements at wind masts around the site were used to correlated wind speed to background noise.
- The data set was then analysed by SLR Consulting to exclude data that is not representative due to influence of rain or other localised, non-wind induced sources of noise.
- A polynomial line is then plotted through the data set to establish a background noise regression curve. This sets the noise limit for that measurement site, which is either:
    - 35 dBA or Background Noise (L_{90}) + 5 dBA, whichever is higher; for non-project involved receivers (SA EPA Criteria)
    - 45 dBA or Background Noise (L_{90}) + 5 dBA, whichever is higher; for project involved receivers (WHO Criteria)

The assessment of noise from WTG's was completed by plotting the predicted noise levels against the limit curves for all wind speeds. The assessment was conducted for WTG's at 80 m hub height with data based on 84 m as supplied by

the WTG manufacturer, as no 80 m data was available. This difference in height is considered immaterial given the small difference in height relative to the uncertainty in the measurement data. An example regression plot is shown in Figure 10-1; the assessment curves for the same location are shown in Figure 10-2. Note that '*' indicates that a location is project-involved.

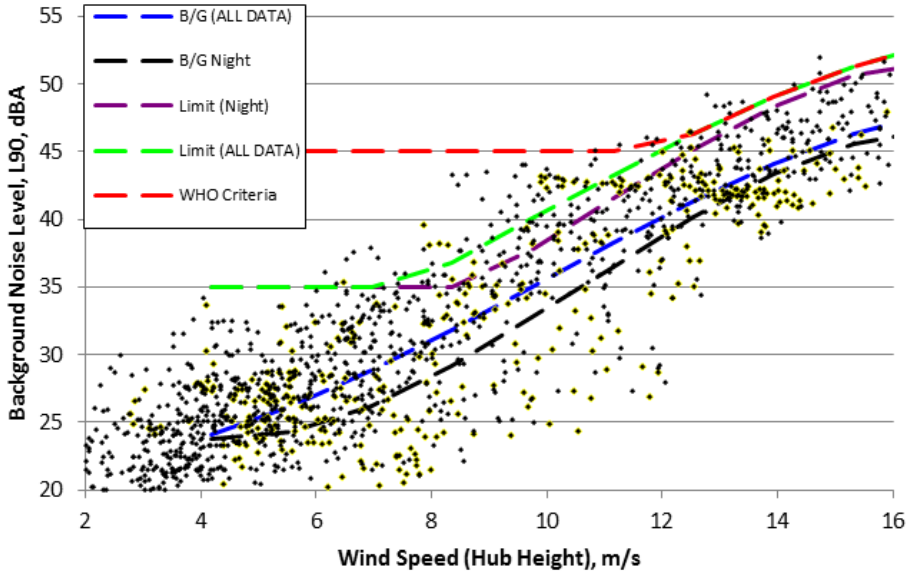


Figure 10-1 Example Background Noise Regression Curve (R44)*

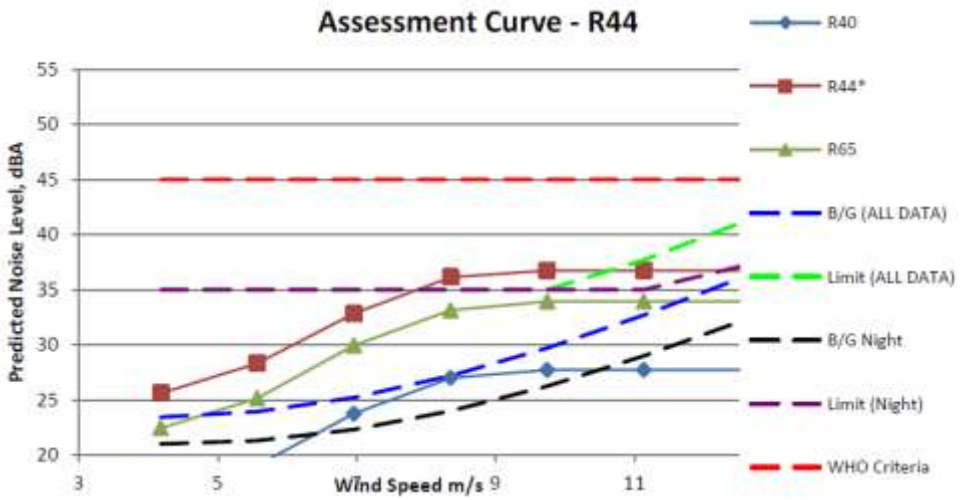
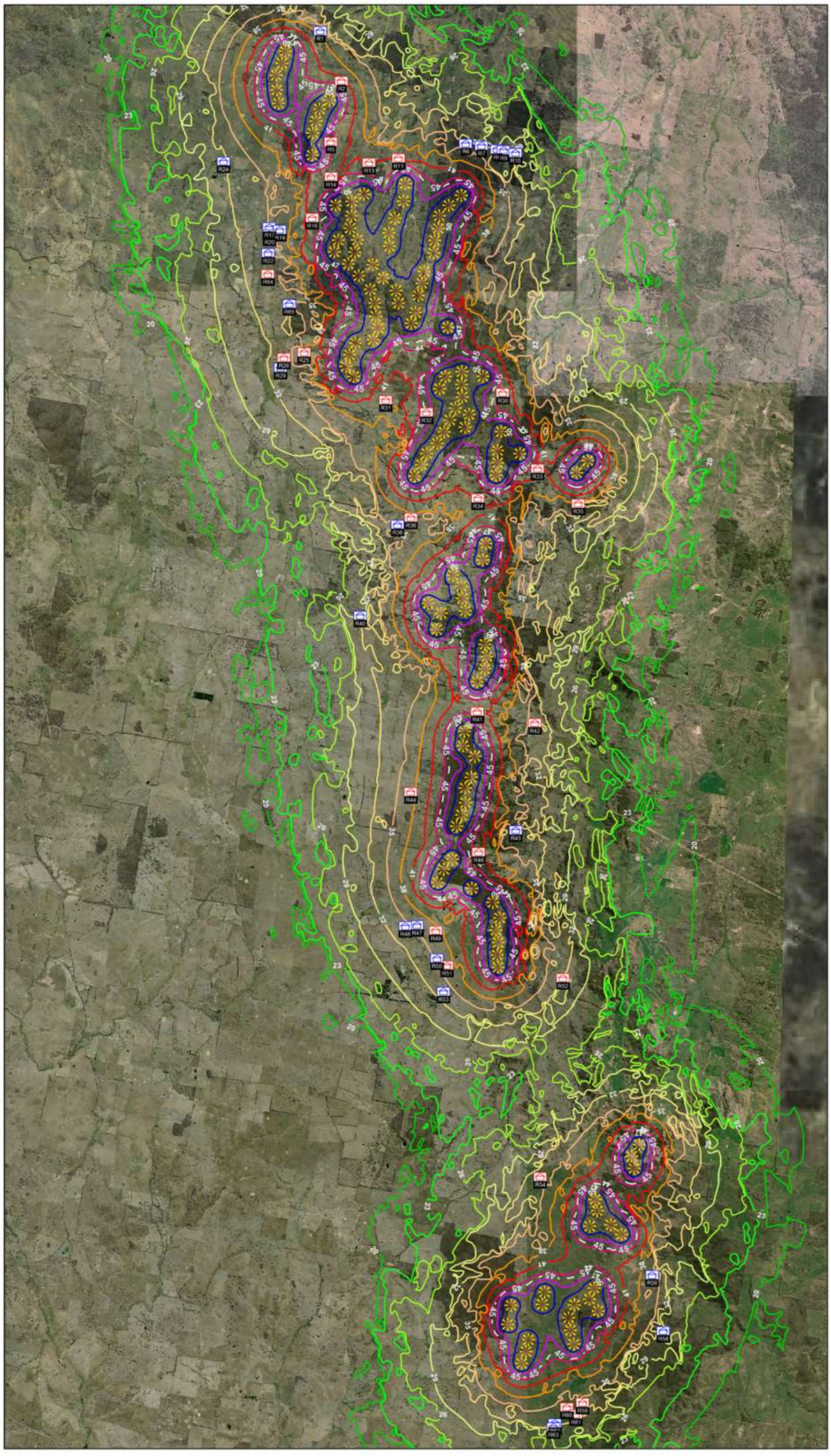


Figure 10-2 Example Assessment Curve (R44)*

In addition to these assessment curves, predicted noise contours have been created for the project, these are shown in Figure 10-3.



CLIENT:
Epuron Projects Pty Ltd
EPURON

PROJECT:
Rye Park Wind Farm
Noise Impact Assessment

TITLE:
Layout Revision 5

DESCRIPTION:
126 X Vestas V112 3.0 MW
Hub Height - 80 m

MAP NO: 1

Predicted
Noise Level
dBA, Leq

	<=	20
20 <	<=	23
23 <	<=	26
26 <	<=	29
29 <	<=	32
32 <	<=	35
35 <	<=	38
38 <	<=	41
41 <	<=	44
44 <	<=	47
47 <	<=	50
50 <		

PREDICTION METHOD: ISO 9613-2:1996

PROJECT NO.: 640.01808

REPORT NO.: 640.01808-R1

DATE: 18/04/2013

PREPARED: PS

LEGEND

- Project Involved Receiver
- Wind Turbine
- Non Project Involved Receiver
- Limit line

SCALE AND ORIENTATION

N

Scale 1:96145
0 0.5 1 2 3 4 km

SLR
SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 6, 131 Bulleen Rd
Balwyn North VIC 3104

Figure 10-3 Predicted Noise Levels Contour Map, LAeq, vref=8m/s

Noise predictions were made for receptors within 2 km of a proposed WTG. Dwellings further than this distance are deemed to comply if dwellings closer to turbines comply with the SA EPA noise limit. WTG noise for a layout of 126 Vestas V112 WTG's of hub height 80m has been predicted and assessed against relevant criteria prescribed by the SA EPA Guideline and World Health Organisation (WHO) goals where appropriate. As some minor exceedances (1.0 dBA or less) were predicted in the initial layout, additional analysis was conducted to determine if full compliance can be achieved using the Sound Management Mode on some turbines. The contribution of each turbine to the receiver locations was calculated. Those turbines that contributed most to the overall noise level were remodelled in Sound Management Mode (Mode 2). The mitigated scenario was then remodelled in SoundPLAN software and compared to the noise limit curve for all wind speeds. A total of 12 turbines were set to Sound Management Mode. The results are shown in Table 10-1, Note that '*' indicates that a location is project-involved. The results display the anticipated noise levels and noise criteria. As there are no exceedances none are shown. It is recommended that consideration of noise predictions with respect to criteria require reading the full Noise Assessment in Appendix B.

The noise levels of the mitigated layout were predicted to meet the relevant criteria at all receptor locations. It should be further noted that all predicted noise levels are considered to be conservative with the model assuming 'hard ground' and average downwind propagation from all WTG's to each receiver or a well-developed moderate ground based temperature inversion.

The project is yet to select and finalise the WTG make and model. Upon finalising the WTG selection a revised noise prediction and assessment will be completed to confirm compliance. The proponent is committed to ensuring compliance with the appropriate standards and noise criteria. The compliance program will commence 3 months before construction commencement and continue on a permanent basis for 2 years post commissioning. Permanent noise loggers will be installed at selected receivers for the duration of the compliance program, with noise data regularly downloaded and any potential exceedances noted for detailed analysis. The selected house locations will comprise of all houses within 2km of a turbine and selected representative houses within 2-5km.While the appropriate standards and noise criteria are met there may be situations and conditions where the wind farm can be heard but it should be at levels that will not cause any undue nuisance or interference with amenity values.

As requested by the NSW Department of Planning and Infrastructure, additional assessments have been undertaken under the recently released NSW Draft Wind Farm Noise Guidelines. Assessments into low frequency noise and tonality have been undertaken and the results do not indicate any further investigation into these Special Audible Characteristics is required under the draft guidelines. Tonality compliance measurements will be demonstrated at nearby receptors in accordance with the SA EPA guidelines.

*Table 10-1 Anticipated noise levels and noise criteria (note * denotes project involved landowner and highlighted green cells refer to reference wind speed)*

Background Location = R2		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0039x^3 + 0.0826x^2 - 0.533x + 29.031	29	29	31	33	36	40	44	50	57	64
SA EPA Criteria		35	35	36	38	41	45	49	55	62	69
NIGHT BG Regression Line	-0.0146x^3 + 0.5005x^2 - 3.2897x + 32.238	26	27	29	32	35	38	42	45	48	49
EPA Night Criteria		35	35	35	37	40	43	47	50	53	54
WHO Criteria		45	45	45	45	45	45	49	55	62	69
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R1		25.1	27.9	31.5	34.9	36.6	37.1	37.1	37.1	37.1	37.1
*R2**		29.7	32.5	36.1	39.5	41.2	41.7	41.7	41.7	41.7	41.7

Background Location = R6		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0091x^3 + 0.3063x^2 - 1.804x + 28.225	25	26	28	30	32	34	36	39	40	42
SA EPA Criteria		35	35	35	35	37	39	41	44	45	47
NIGHT BG Regression Line	-0.0145x^3 + 0.4377x^2 - 2.8665x + 30.122	25	25	27	29	31	33	35	36	37	37
EPA Night Criteria		35	35	35	35	36	38	40	41	42	42
WHO Criteria		45	45	45	45	45	45	45	45	45	47
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R6	22.2	22.2	25.0	28.6	32.0	33.7	34.2	34.2	34.2	34.2	34.2
R7	20.9	20.9	23.7	27.3	30.7	32.4	32.9	32.9	32.9	32.9	32.9
R8	19.4	19.4	22.2	25.8	29.2	30.9	31.4	31.4	31.4	31.4	31.4
R9	18.8	18.7	21.5	25.1	28.5	30.2	30.7	30.7	30.7	30.7	30.7
R10	18.8	18.8	21.6	25.2	28.6	30.3	30.8	30.8	30.8	30.8	30.8

Background Location = R13		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0038x^3 + 0.0503x^2 - 0.0495x + 25.298	26	27	29	31	34	37	41	46	52	59
SA EPA Criteria		35	35	35	36	39	42	46	51	57	64
NIGHT BG Regression Line	0.0176x^3 - 0.2545x^2 + 1.994x + 20.174	25	27	28	30	32	36	41	48	57	69
EPA Night Criteria		35	35	35	35	37	41	46	53	62	74
WHO Criteria		45	45	45	45	45	45	46	51	57	64
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R11**		29.0	31.8	35.4	38.8	40.5	41.0	41.0	41.0	41.0	41.0
*R13**		29.2	32.0	35.6	39.0	40.7	41.2	41.2	41.2	41.2	41.2

Background Location = R14		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0021x^3 + 0.0772x^2 - 0.2551x + 24.263	25	26	27	29	32	35	38	43	48	53
SA EPA Criteria		35	35	35	35	37	40	43	48	53	58
NIGHT BG Regression Line	0.02x^3 - 0.2626x^2 + 1.0216x + 24.109	25	25	25	26	28	31	37	44	53	66
EPA Night Criteria		35	35	35	35	35	36	42	49	58	71
WHO Criteria		45	45	45	45	45	45	45	48	53	58
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R5**		32.4	35.2	38.8	42.2	43.9	44.4	44.4	44.4	44.4	44.4
*R14**		30.3	33.1	36.7	40.1	41.8	42.3	42.3	42.3	42.3	42.3
*R16**		30.7	33.5	37.1	40.5	42.2	42.7	42.7	42.7	42.7	42.7

Background Location = R19		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0063x^3 - 0.0518x^2 + 0.3486x + 29.281	30	31	31	32	34	36	39	42	47	52
SA EPA Criteria		35	36	36	37	39	41	44	47	52	57
NIGHT BG Regression Line	0.0022x^3 + 0.0703x^2 - 0.6383x + 29.799	29	29	30	31	33	35	38	42	46	51
EPA Night Criteria		35	35	35	36	38	40	43	47	51	56
WHO Criteria		45	45	45	45	45	45	45	47	52	57
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R17		23.1	25.9	29.5	32.9	34.6	35.1	35.1	35.1	35.1	35.1
R19		24.8	27.6	31.2	34.6	36.3	36.8	36.8	36.8	36.8	36.8
R20		23.2	26.0	29.6	33.0	34.7	35.2	35.2	35.2	35.2	35.2
R22		22.6	25.4	29.0	32.4	34.1	34.6	34.6	34.6	34.6	34.6

Background Location = R24		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0006x^3 + 0.1121x^2 - 0.721x + 29.856	29	30	31	32	35	37	41	44	49	54
SA EPA Criteria		35	35	36	37	40	42	46	49	54	59
NIGHT BG Regression Line	-0.0012x^3 + 0.2153x^2 - 1.8413x + 31.706	28	28	29	31	34	37	41	46	52	58
EPA Night Criteria		35	35	35	36	39	42	46	51	57	63
WHO Criteria		45	45	45	45	45	45	46	49	54	59
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R24		19.4	22.2	25.8	29.2	30.9	31.4	31.4	31.4	31.4	31.4

Background Location = R25		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0114x^3 - 0.1507x^2 + 0.8519x + 21.455	23	24	24	25	26	29	32	36	42	50
SA EPA Criteria		35	35	35	35	35	35	37	41	47	55
NIGHT BG Regression Line	0.0022x^3 + 0.0046x^2 + 0.1516x + 19.907	21	21	22	23	24	26	27	30	32	35
EPA Night Criteria		35	35	35	35	35	35	35	35	37	40
WHO Criteria		45	45	45	45	45	45	45	45	47	55
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R25**		25.4	28.2	31.8	35.2	36.9	37.4	37.4	37.4	37.4	37.4
*R26**		21.6	24.4	28.0	31.4	33.1	33.6	33.6	33.6	33.6	33.6
R29		21.7	24.5	28.1	31.5	33.1	33.6	33.6	33.6	33.6	33.6

Background Location = R30		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0021x^3 + 0.0379x^2 - 0.071x + 26.561	27	28	29	30	32	34	36	40	43	47
SA EPA Criteria		35	35	35	35	37	39	41	45	48	52
NIGHT BG Regression Line	8E-05x^3 + 0.1703x^2 - 2.0978x + 31.624	26	25	25	26	28	30	33	37	41	46
EPA Night Criteria		35	35	35	35	35	35	38	42	46	51
WHO Criteria		45	45	45	45	45	45	45	45	48	52
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R30**		31.0	33.8	37.4	40.8	42.4	42.9	42.9	42.9	42.9	42.9
*R33**		29.4	32.2	35.8	39.2	40.9	41.4	41.4	41.4	41.4	41.4

Background Location = R32		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.002x^3 + 0.1453x^2 - 0.8862x + 31.129	30	30	32	33	35	37	40	42	45	49
SA EPA Criteria		35	35	37	38	40	42	45	47	50	54
NIGHT BG Regression Line	-0.0001x^3 + 0.121x^2 - 0.9889x + 31.088	29	29	30	31	33	36	38	42	45	49
EPA Night Criteria		35	35	35	36	38	41	43	47	50	54
WHO Criteria		45	45	45	45	45	45	45	47	50	54
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R31**		27.9	30.7	34.3	37.7	39.1	39.5	39.5	39.5	39.5	39.5
*R32**		33.7	36.5	40.1	43.7	44.5	44.7	44.7	44.7	44.7	44.7

Background Location = R34		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0104x^3 + 0.3096x^2 - 0.7489x + 22.545	24	26	29	32	36	39	42	45	47	48
SA EPA Criteria		35	35	35	37	41	44	47	50	52	53
NIGHT BG Regression Line	-0.0233x^3 + 0.7447x^2 - 5.1951x + 34.199	24	25	27	30	34	37	41	44	46	47
EPA Night Criteria		35	35	35	35	39	42	46	49	51	52
WHO Criteria		45	45	45	45	45	45	47	50	52	53
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R34**		29.5	32.3	35.9	39.3	40.8	41.2	41.2	41.2	41.2	41.2
*R35**		25.9	28.7	32.3	35.7	37.4	37.8	37.8	37.8	37.8	37.8

Background Location = R36		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0018x^3 + 0.0976x^2 - 1.1709x + 25.238	22	22	23	24	25	27	30	34	38	43
SA EPA Criteria		35	35	35	35	35	35	35	39	43	48
NIGHT BG Regression Line	-6E-05x^3 + 0.1693x^2 - 2.0032x + 24.906	19	19	19	20	22	24	27	31	35	40
EPA Night Criteria		35	35	35	35	35	35	35	36	40	45
WHO Criteria		45	45	45	45	45	45	45	45	45	48
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R36**		25.2	28.0	31.6	35.2	35.8	36.0	36.0	36.0	36.0	36.0
R38		23.9	26.7	30.3	33.9	34.7	35.0	35.0	35.0	35.0	35.0
*R64**		22.0	24.8	28.4	31.8	33.5	34.0	34.0	34.0	34.0	34.0

Background Location = R41		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0129x^3 + 0.408x^2 - 2.1358x + 21.869	19	21	23	25	29	32	35	37	39	40
SA EPA Criteria		35	35	35	35	35	37	40	42	44	45
NIGHT BG Regression Line	-0.0324x^3 + 0.894x^2 - 5.6692x + 26.728	16	18	20	24	27	30	33	34	33	29
EPA Night Criteria		35	35	35	35	35	35	38	39	38	35
WHO Criteria		45	45	45	45	45	45	45	45	45	45
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R41**		31.1	33.9	37.5	40.9	42.6	43.1	43.1	43.1	43.1	43.1
*R42**		22.0	24.8	28.4	31.9	33.5	34.0	34.0	34.0	34.0	34.0

Background Location = R44		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0064x^3 + 0.3077x^2 - 2.1782x + 27.62	23	24	25	28	30	33	37	41	45	49
SA EPA Criteria		35	35	35	35	35	38	42	46	50	54
NIGHT BG Regression Line	-0.0051x^3 + 0.2755x^2 - 2.1163x + 25.414	21	21	23	24	27	30	33	37	41	45
EPA Night Criteria		35	35	35	35	35	35	38	42	46	50
WHO Criteria		45	45	45	45	45	45	45	46	50	54
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R40		15.9	18.7	22.3	25.7	27.3	27.7	27.7	27.7	27.7	27.7
*R44**		25.2	28.0	31.6	35.1	36.4	36.7	36.7	36.7	36.7	36.7
R65		21.9	24.7	28.3	31.7	33.4	33.9	33.9	33.9	33.9	33.9

Background Location = R46		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0034x^3 + 0.0984x^2 - 0.7685x + 26.6	25	26	27	29	32	36	40	46	52	60
SA EPA Criteria		35	35	35	35	37	41	45	51	57	65
NIGHT BG Regression Line	-0.0223x^3 + 0.7267x^2 - 5.1643x + 33.143	23	23	25	28	32	36	40	43	45	46
EPA Night Criteria		35	35	35	35	37	41	45	48	50	51
WHO Criteria		45	45	45	45	45	45	45	51	57	65
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R45		24.2	27.0	30.6	34.1	35.2	35.6	35.6	35.6	35.6	35.6
*R46**		30.6	33.4	37.0	40.4	41.9	42.4	42.4	42.4	42.4	42.4

Background Location = R49		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0042x^3 + 0.1889x^2 - 0.8856x + 25.226	25	26	27	29	31	34	36	39	42	45
SA EPA Criteria		35	35	35	35	36	39	41	44	47	50
NIGHT BG Regression Line	-0.0258x^3 + 0.7838x^2 - 5.8263x + 32.991	20	20	22	24	27	30	33	35	35	33
EPA Night Criteria		35	35	35	35	35	35	38	40	40	38
WHO Criteria		45	45	45	45	45	45	45	45	47	50
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R47		23.5	26.3	29.9	33.4	35.0	35.4	35.4	35.4	35.4	35.4
R48		22.3	25.1	28.7	32.1	33.7	34.1	34.1	34.1	34.1	34.1
*R49**		25.4	28.2	31.8	35.2	36.7	37.2	37.2	37.2	37.2	37.2

Background Location = R51		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0112x^3 + 0.4204x^2 - 3.0804x + 31.643	25	26	27	29	32	35	38	41	44	46
SA EPA Criteria		35	35	35	35	37	40	43	46	49	51
NIGHT BG Regression Line	-0.018x^3 + 0.7135x^2 - 5.7973x + 34.583	21	21	23	26	30	35	40	45	50	54
EPA Night Criteria		35	35	35	35	35	40	45	50	55	59
WHO Criteria		45	45	45	45	45	45	45	46	49	51
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R50		23.4	26.2	29.8	33.3	34.5	34.9	34.9	34.9	34.9	34.9
*R51**		24.5	27.3	30.9	34.4	35.4	35.7	35.7	35.7	35.7	35.7
R53		21.4	24.2	27.8	31.3	32.2	32.5	32.5	32.5	32.5	32.5

Background Location = R52		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	0.0016x^3 + 0.1009x^2 - 0.9471x + 30.519	28	29	30	31	33	35	39	42	47	52
SA EPA Criteria		35	35	35	36	38	40	44	47	52	57
NIGHT BG Regression Line	-0.0062x^3 + 0.2728x^2 - 2.0066x + 26.692	23	23	24	26	28	30	33	36	39	41
EPA Night Criteria		35	35	35	35	35	35	38	41	44	46
WHO Criteria		45	45	45	45	45	45	45	47	52	57
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R52**		20.3	23.1	26.7	30.2	31.1	31.5	31.5	31.5	31.5	31.5

Background Location = R54		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0033x^3 + 0.3137x^2 - 2.6897x + 34.152	28	28	30	32	35	40	45	50	57	64
SA EPA Criteria		35	35	35	37	40	45	50	55	62	69
NIGHT BG Regression Line	-0.0094x^3 + 0.4771x^2 - 3.5489x + 32.598	25	26	28	31	36	40	46	52	58	65
EPA Night Criteria		35	35	35	36	41	45	51	57	63	70
WHO Criteria		45	45	45	45	45	45	50	55	62	69
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R54**		21.3	24.1	27.7	31.2	32.7	33.2	33.2	33.2	33.2	33.2

Background Location = R56		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0086x^3 + 0.321x^2 - 2.0034x + 29.155	26	27	28	30	33	35	38	41	44	46
SA EPA Criteria		35	35	35	35	38	40	43	46	49	51
NIGHT BG Regression Line	-0.0136x^3 + 0.5228x^2 - 4.3054x + 33.647	24	24	25	27	29	33	36	39	42	45
EPA Night Criteria		35	35	35	35	35	38	41	44	47	50
WHO Criteria		45	45	45	45	45	45	45	46	49	51
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
R56		23.7	26.5	30.1	33.5	34.6	35.0	35.0	35.0	35.0	35.0
R58		16.3	19.1	22.7	26.2	27.5	27.9	27.9	27.9	27.9	27.9

Background Location = R60		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
B/G Regression Line	-0.0195x^3 + 0.5635x^2 - 3.7504x + 38.008	31	31	33	35	37	40	42	43	43	41
SA EPA Criteria		36	36	38	40	42	45	47	48	48	46
NIGHT BG Regression Line	-0.0316x^3 + 0.8557x^2 - 5.917x + 41.243	29	29	31	34	36	38	39	39	37	32
EPA Night Criteria		35	35	36	39	41	43	44	44	42	37
WHO Criteria		45	45	45	45	45	45	47	48	48	46
Wind Speed (Hub Height)		4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2
*R59**		22.2	25.0	28.6	32.0	33.6	34.1	34.1	34.1	34.1	34.1
*R60**		20.9	23.7	27.3	30.7	32.4	32.9	32.9	32.9	32.9	32.9
*R61**		20.0	22.8	26.4	29.8	31.5	32.0	32.0	32.0	32.0	32.0
R62		20.4	23.2	26.8	30.2	31.8	32.3	32.3	32.3	32.3	32.3
R63		19.9	22.7	26.3	29.7	31.3	31.8	31.8	31.8	31.8	31.8

10.3 Detailed Tonality Assessment

Examining the Vestas V112 data provided by the manufacturer3, $\Delta L_{A,k}$ is less than 4 dB at all wind speeds and therefore does not attract a penalty under the Joint Nordic Method. In addition to this test a one-third octave band test was completed using the noise levels as predicted by the SoundPLAN model. Levels were assessed against the description of tonality as defined in the NSW Industrial Noise Policy. The policy states that the presence of excessive tonality is defined as when the level of one-third octave band measured in the equivalent noise level L_{eq}(10 minute) exceeds the level of the adjacent bands on both sides by:

- **5 dB or more** if the centre frequency of the band containing the tone is above 400Hz
- **8 dB or more** if the centre frequency of the band containing the tone is 160 to 400Hz inclusive
- **15 dB or more** if the centre frequency of the band containing the tone is below 160Hz

The predicted noise level in one third octave bands did not meet the descriptions as stated above and would therefore be deemed 'non tonal' in the field.

10.4 Van den Berg Effect

The phenomena commonly referred to as the 'van den Berg effect' actually includes several effects. They are:

- Increased WTG Sound Power Level due to higher wind shear across the blade of the turbine
- Enhanced propagation of noise due to higher wind shear
- Lower ground level background masking noise for a given operational wind speed due to higher wind shear
- Increased modulation character of the turbine due to higher wind shear

These effects all occur as a result of high wind shear (stable atmosphere) conditions. A brief evaluation of various wind shear values at the site using a simplified model has been undertaken for Rye Park Wind Farm. This may better direct decisions regarding the potential for increased noise impact under different atmospheric conditions once further research findings improves the general understanding of these phenomena. Several values of wind shear exponent value (α) have been proposed as defining a stable atmosphere. A wind shear exponent value of greater than 0.55 has been suggested as a 'highly stable' atmosphere for rural environments; van den Berg suggests that a wind shear exponent value of 0.41 is appropriate. To further examine the prevalence of high wind shear values, detailed analysis of wind shear was conducted, with the percentage likelihood of wind shear exponent for each season and time period (Day/Evening/Night). Figure 10-2 shows the results for two values of (α) presented in research papers discussed.

Table 10-2 Likelihood of high wind shear exponent

Season	α > 0.41 Day	Evening	Night	α > 0.55 Day	Evening	Night
Summer	2.1%	7.2%	13.9%	0.5%	0.7%	1.9%
Autumn	4.5%	6.1%	10.4%	1.4%	0.6%	2.6%
Winter	9.8%	14.7%	18.9%	2.1%	2.2%	3.8%
Spring	4.9%	7.9%	14.6%	1.4%	0.7%	2.3%

The values presented show that high wind shear does not occur for more than 30% of any time period in any season. The NSW INP deems this as being sufficiently occurring to define it as a prevailing meteorological feature for a site.

While the data shows that stable atmosphere conditions may exist for short periods of time, the results of the analysis undertaken indicate that stable atmospheres do not to occur at this site on a long term basis and are not deemed a feature of the site under NSW INP.

10.5 Wind Turbine Vibration

Vibration or more specifically the oscillatory movement of receptor structures could potentially propagate from a source (in this case a wind farm) through either a ground path (ground borne vibration) or an airborne path as sound which could couple with lightweight structures and produce a movement in the structure.

Ground borne vibration levels attenuate with distance with varying amounts dependent upon such variables as frequency and geotechnical parameters. There are a few documented research reports with regards to wind farm generated ground vibration. These are: The Snow Report (*Low Frequency Noise & Vibration Measurements at a Modern Wind Farm*, ETSU W/13/01392/REP, D J Snow, 1997) and Detailed *Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Wind Farms* were undertaken by the Applied and Environmental Geophysics Group of Keele University as part of a comprehensive report giving '*Recommendations on The Siting of Wind Farm in the Vicinity the Eskdalemuir, Scotland*'. The Eskdalemuir report details results taken from St Breock Downs Wind Farm (possibly the same measurements taken in the Snow Report). From the documented seismic vibration measurements taken at 25 metres from a single WTG a peak particle velocity (PPV) of approximately $8x10^{-5}$ mm/s has been calculated. This is approximately 2500 orders of magnitude lower than project criteria. Whilst we note that turbines proposed for Rye Park Wind Farm are larger than those measured above we are confident that ground vibration will be completely imperceptible at surrounding receptors. Furthermore, our own experience and observations at other operating wind farms has not indicated perceptible ground vibration at any distance from turbines.

A good deal of misunderstanding and attention has been given in recent times to low frequency noise and infrasound generated by wind farms. Infrasound at sufficient levels has the potential to be perceived as vibration or alternatively cause the movement of lightweight structures which then in turn are perceived as vibration. It should be noted that the sometimes audible cyclical modulation of aerodynamic noise, the '*swish swish*' of blades, is often mistakenly identified as low frequency noise, where it actually is the low frequency modulation of audible noise.

The subject of infrasound is most complex, dealing with frequencies that are sub audible, requiring alternative frequency weighting scales, specialist measurement equipment and techniques, and evaluating the variance of hearing sensitivity in a population at low frequency. Furthermore, infrasound levels depend on many variables including turbine type and size, wind conditions (including turbulence), propagation distance, building structure and materials, room sizing and positioning within room.

Comprehensive review, measurement testing and evaluation are offered in numerous technical reports investigating infrasound and low frequency noise from wind farms including;

- *A Review of Published Research on Low Frequency Noise and its Effects* - Report for Defra by Dr Geoff Leventhall assisted by Dr Peter Pelmear and Dr Stephen Benton - 2002 (refer to http://www.defra.gov.uk/environment/quality/noise/research/lowfrequency/documents/lowfreqnoise.pdf)
- *The Measurement of Low Frequency Noise at Three UK Wind Farms* - report for DTI by Hayes McKenzie Partnership – 2006 (refer to http://www.berr.gov.uk/files/file31270.pdf)
- *Wind turbines & Infrasound 2006* - Report for Canadian Wind Energy Association (CanWEA) by Howe Gastmeier Chapnik Limited (HGC Engineering) - 2006 (refer to http://www.canwea.ca/images/uploads/File/CanWEA_Infrasound_Study_Final.pdf)
- *Wind Farms Technical Paper – Environmental Noise* – report for Clean Energy Council Australia by Sonus Pty Ltd – 2010 (refer to http://www.cleanenergycouncil.org.au/cec/mediaevents/media-releases/November2010/sonus-report.html)

The consensus drawn by all investigations is that infrasound noise emissions from modern WTG's are significantly below the recognised threshold of perception for acoustic energy within this range.

10.6 Night time operational noise

The NSW Draft Guidelines section of the NIA (Appendix B, Section 9) assesses the noise against night-time criteria for the mitigated scenario, a process has also been completed for the full (non-mitigated scenario, as shown in the NIA

for comparative purposes (Appendix B, Section 7.1 Table 15). The function of this NIA is to show that compliance is possible; night-only criteria are considered from that point onwards.

For clarity night-only criteria is considered when compliance for the all-day criteria is achieved. With the full layout (non-mitigated scenario) the all-day criteria is not met and subsequently the night time criteria cannot be achieved, but has been presented for comparative purposes. Wind turbines were placed into sound-management mode i.e. mitigated layout to achieve compliance and subsequently the night-only criteria are considered.

The background noise data was reprocessed to define background noise curves for the daytime period (7.00 am to 10.00 pm) and night-time period (10.00 pm to 7.00 am) as defined by the draft guideline. Daytime background noise curves were typically 0.5 to 1dB higher than the background noise curves based on the full data set. Night-time background noise curves were typically 2 to 4 dB lower than the background noise curves based on the full data set. For further technical information refer to the NIA in Appendix B

The new background noise curves were used to update the noise limit curves for all receptors and all predicted results for the mitigated and non-mitigated were assessed against these criteria. There were no exceedances of the daytime only criteria for any receiver. Table 10-3 shows the exceedances for all project uninvolved locations for the night-time criteria. Only R47 has a night time exceedance. The exceedance for this location is 0.4dBA. Note that Max exceedance refers to the maximum exceedance out of all the wind speeds, in the case of R47 this is 0.4dBA. This is a relatively minor exceedance which would be difficult to measure in the field.

Table 10-3 NSW Draft Wind Farm Guidelines exceedances – night-time criteria

			Wind speed (m/s, 10m AGL)										
Receiver	**Background Location**		3	4	5	6	7	8	9	10	11	12	Max
R47	R49* (* refers to project associated landowner)	**Exceedance dBA**						0.4					0.4
		NSW Draft Guideline Night Criteria dBA	35.0	35.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	38.0	
		Mitigated Predicted Noise Levels dBA	23.5	26.3	29.9	33.4	35	35.4	35.4	35.4	35.4	35.4	

10.7 Cumulative impacts

The background noise monitoring carried out for the purpose of the assessment is not impacted by an existing wind farm and is thus in accordance with the SA EPA guidelines that state:

> *"Separate wind farm developments in close proximity to each other may impact on the same relevant receiver. Therefore, as for staged development, any additional wind farm that may impact on the same relevant receiver as an existing wind farm should meet the criteria using the background noise levels as they existed before the original wind farm site development. The noise generated by existing WTGs from another wind farm should not be considered as part of the background noise in determining criteria for subsequent development"*

Despite none of the wind farms having a confirmed layout, turbine selection or approval/construction go ahead a preliminary evaluation has been made on the cumulative impacts and compliance.

There are three wind farms currently in development in the vicinity of Rye Park Wind Farm: Rugby Wind Farm, Bango Wind Farm, and Yass Valley Wind Farm. There is one approved wind farm in the vicinity, Conroy's Gap Wind Farm. The cumulative impact of both Yass Valley Wind Farm and Conroy's Gap Wind Farm on noise levels will be negligible as they are over 20km from Rye Park Wind Farm.

Both Bango Wind Farm and Rugby Wind Farm are not yet approved and are currently in the development process. As such final turbine locations and turbine models have yet to be chosen and confirmed. The cumulative noise impact has been modelled using both wind farms based on available public data.

The impact of Bango Wind Farm on dwellings assessed in the NIA in Appendix B is likely negligible. The cumulative noise levels are likely to meet the compliance criteria at all dwellings assessed in the NIA in Appendix B.

The preliminary cumulative impact of Rugby Wind Farm on noise levels is predicted to only marginally increase the predicted noise levels at some receivers. The likely cumulative noise level at each dwelling still meets the relevant compliance criteria.

The small increase in noise levels due to cumulative impact from both Bango and Rugby is due to:

- the distance of the adjacent wind farms to Rye Park Wind Farm; and
- the dominant contribution of predicted noise levels is from Rye Park Wind Farm turbines itself.

A more detailed explanation is detailed below. It is important to emphasise that all modelling has been conducted based on a worst case model and is considered conservative (ISO9613-2).

A further factor to consider is the operational timing of the wind farms. If the Rye Park Wind Farm begins construction or operates before other wind farms in the area then the predicted noise levels would not need to factor in cumulative impacts against the criteria. If other wind farms begin operation before the Rye Park Wind Farm then cumulative impacts become a factor. In the case that all wind farms are operating the assessment shows that all relevant receivers in the NIA in Appendix B are predicted to be within the nominated WHO guideline noise limits. A revised NIA will be completed once the turbine layout and model are finalised. At this point the latest information about neighbouring wind farms will be addressed.

Bango Wind Farm

Publicly available information for Bango Wind Farm shows that that the wind turbine area is at least 4 km's from any dwelling assessed in the NIA in Appendix B (Bango Wind Farm Newsletter #2 February 2012). At this distance the impact of the addition of one wind turbine at a sound power level of 106.5dBA would increase the noise level at a dwelling by a small amount in the order of 0.1dBA based on conservative modelling assumptions (ISO9613-2). In reality the potentially most impacted dwellings would be those that sit in between the two wind farms, however these dwelling would not receive the full predicted noise level from both wind farms at the same time as the wind cannot blow from two different directions (noting that the greatest noise impact on a dwelling is when the dwelling is downwind from a turbine – as assumed in ISO9613-2).

The small increases in noise levels are due to the noise impact being greatest from the closest noise sources, in this case Rye Park Wind Farm. The compliance margin or difference between predicted noise levels and compliance criteria is greater than 0.9dBA at all receivers except R32 and R38. To increase the predicted noise level at a receiver by 0.9dBA, 9 turbines located at 4km from the receptor would be required. This is unrealistic given the minimum spacing requirements of wind turbines of at least 250m and as such would not affect compliance at these receptors.

For the two receptors that have a compliance margin less than 0.9dBA, they both are at least 7km from the closest wind turbine area of Bango Wind Farm. In addition to this considerable distance over 25 turbines are closer to each receptor and dominate the noise level contribution. As such compliance remains unchanged at all receptors with cumulative impacts accounted for.

Rugby Wind Farm

Publicly available information for Rugby Wind Farm shows that that the wind turbines are located directly north of Rye Park Wind Farm. Noise modelling of this layout (ref: WTG_Rev63) was carried out based on an indicative turbine, in this case a turbine with Sound Power Level of 106.5dBA and based on conservative modelling (ISO9613-2). The predictions show that the cumulative wind farm noise level increases by less than 0.9dBA at all assessed receptors except one, in most instances the predicted cumulative increase is negligible and less than 0.1dBA. As such the compliance criteria is met based on predicted cumulative noise levels.

We note that the receiver R1 is an uninvolved landowner with Rye Park Wind Farm, however, it is an involved landowner as part of Rugby Wind farm. Should Rugby Wind Farm proceed to be constructed first (or both wind farms are operating), receptor R1 will have a noise criteria of 45dBA according to the WHO guidelines. The cumulative noise modelling shows that compliance is predicted to be achieved. If Rye Park Wind Farm proceeds to be constructed first R1 will comply according to SA EPA guidelines as assessed in the NIA in Appendix B.

10.8 Substations

Australian Standard AS 60076 Part 10 2009: "Power Transformers – Determination of sound levels" indicates that the 200 MVA transformer facility may produce sound power levels up to 98 dBA and a 450 MVA transformer may produce sound power levels up to 103 dBA. The dominant frequency of such transformers is 100 Hz.

Noise predictions for transformer substations have been made using CONCAWE algorithms assuming an absolute 'worst case' meteorology enhancement condition of downwind 3 m/s and Pasquill Stability Class F temperature inversion. Noise predictions for transformer substations have been made and compared to the appropriate NSW INP limit and were found to comply at all receptor locations. The modelling results are shown in Table 10-4.

Table 10-4 Anticipated substation noise level and NSW industrial noise policy criteria

Location	Predicted Noise Level, Leq dBA	RBL (Night)	Noise Limit (Intrusive Criteria)	Compliance
R41	30.6	20	35	Yes
R59	29	31	35	Yes
R61	27.3	31	35	Yes
R62	27	31	35	Yes
R63	26.5	31	35	Yes
R60	22.5	31	35	Yes

10.9 Transmission Line Noise

The appropriate criteria as determined by the NSW Industrial Noise Policy (INP) would be 35dBA assuming a minimum RBL value of 30dBA. It is conservatively estimated that the minimum criteria level of 35dBA would be complied with at a distance of 240 metres. The proposed transmission line is further than 240m from any receptors and as such any transmission line noise will comply with the NSW INP minimum limit at all residential receivers.

10.10 Contingency Strategy and Adaptive Management for Operational Noise

If noise impact complaints arise and upon assessment the wind farm exceeds the relevant criteria then a contingency strategy will be implemented that consists of an 'adaptive management' approach which could be implemented to mitigate or remove the impact. This process could include;

- receiving and documenting noise impact complaint through 'hotline' or other means;
- investigating the nature of the reported impact;
- identifying exactly what conditions or times lead to the impacts;
- operating WTGs in a reduced 'noise optimised' mode during identified times and conditions (sector management);
- turning off WTG's that are identified as causing the impact; and
- providing acoustic upgrades (glazing, façade, masking noise etc.) to affected dwellings

The type of mitigation required would depend on the conditions which occur when the noise is shown to have an impact as well as site-specific details at the location where the impact is demonstrated. Any noise impact would need to be appropriately investigated by a qualified acoustics consultant to understand which mitigation strategy is most appropriate. Nominating an appropriate management technique is the responsibility of the wind farm operator and would depend on the nature and times of the impact. Specific details of the steps to mitigate potential adverse noise impacts would form a part of an Operational Environmental Management Plan for the project which would be completed following approval of the wind farm. The Operational Environmental Management Plan would also include a noise and vibration management plan that would detail how monitoring and compliance checks will be carried out and steps/methods that would be taken to address adverse noise impacts.

10.11 Construction

The criteria for construction noise are provided in the Interim Construction Noise Guidelines (ICNG) (DECCW, 2009).

Proposed construction activities associated with the wind farm include construction of access roads, establishment of turbine tower foundations and electrical substation, digging of trenches to accommodate underground power cables, erection of turbine towers, and assembly of WTG's.

The anticipated construction period is anticipated to be less than 24 months, with civil works expected to span approximately 12 to 15 months, however, due to the large area of the wind farm site, intensive works will be located within close proximity to individual residential receivers for only very short and intermittent periods of time.

Construction noise has been predicted at all receivers using SoundPlan Noise modelling software. To examine the possible worst case construction noise impacts for all nearby receivers, four different construction scenarios were modelled at each turbine location and the highest noise levels for each receiver predicted. These are:

- construction of access roads;
- establishment of turbine foundations;
- trench excavation; and
- WTG erection and assembly.

The equipment required to complete the above tasks will typically include;

- excavator/grader, bulldozer, dump trucks, vibratory roller
- bucket loader, rock breaker, drill rig, excavator/grader, bulldozer, dump truck, flatbed truck, concrete truck
- cranes, fork lift, and various 4WD and service vehicles.

Predicted construction noise levels against the relevant criteria are shown in Table 10-5. A number of receivers are deemed 'noise affected' under the ICNG. As per the Guidelines, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. No receptors would be considered as being 'highly noise affected' as defined by the Guideline. In order to ensure all appropriate measures are being taken to manage construction noise, a more detailed construction management plan should be developed by the proponent. This document will provide detailed guidance on various noise mitigation strategies for the construction stage.

Table 10-5 Predicted construction noise levels

*Location**	*Construction Activity*				*RBL*	*Noise Management Level*
	Establishment of Turbine Tower Foundations	*Trench Excavation*	*Construction of Access Roads*	*WTG Erection & Assembly*	*Day*	*Day (RBL+10) OR 40 dBA*
R1	52	39	41	39	26	36
R2	59	45	48	45	26	36
R6	49	36	38	36	26	36
R7	49	35	37	35	26	36
R8	47	34	36	34	26	36
R9	47	33	36	33	26	36
R10	45	32	34	32	26	36
R11	50	37	39	37	26	36
R13	55	42	44	42	26	36
R14	56	43	45	43	23	35

Location*	Construction Activity				RBL	Noise Management Level
	Establishment of Turbine Tower Foundations	Trench Excavation	Construction of Access Roads	WTG Erection & Assembly	Day	Day (RBL+10) OR 40 dBA
R16	57	43	46	43	23	35
R17	45	31	34	31	27	37
R19	47	33	36	33	27	37
R20	44	31	34	31	27	37
R22	43	29	32	29	27	37
R24	43	29	32	29	27	37
R25	49	35	38	35	22	40
R26	44	31	33	31	22	40
R29	46	32	35	32	22	40
R30	57	44	47	44	25	40
R31	48	35	37	35	28	40
R32	55	42	44	42	28	40
R33	49	36	39	36	25	40
R34	56	42	45	42	24	40
R35	55	42	44	42	24	40
R36	52	38	41	38	22	40
R38	49	36	38	36	22	40
R40	35	21	24	21	27	40
R41	59	45	48	45	20	40
R42	45	32	34	32	20	40
R44	45	31	34	31	27	40
R45	46	32	35	32	23	40
R46	53	40	43	40	23	40
R47	50	37	39	37	26	40
R48	48	35	37	35	26	40
R49	49	36	38	36	26	40
R50	46	33	35	33	26	40
R51	48	34	37	34	26	40
R52	45	31	34	31	31	40
R53	46	33	35	33	26	40

*Location**	*Construction Activity*				*RBL*	*Noise Management Level*
	Establishment of Turbine Tower Foundations	*Trench Excavation*	*Construction of Access Roads*	*WTG Erection & Assembly*	*Day*	*Day (RBL+10) OR 40 dBA*
R54	47	34	36	34	25	40
R56	49	36	38	36	24	40
R58	37	24	27	24	24	40
R59	44	31	34	31	31	40
R60	46	33	35	33	31	40
R61	44	31	33	31	31	40
R62	45	32	34	32	31	40
R63	45	31	34	31	31	40
R64	43	29	32	29	22	410
R65	45	31	33	31	27	40

10.12 Blasting, Traffic and Night Time Deliveries

Blasting impact has been assessed and found to be acceptable. With a maximum instantaneous charge (MIC) of up to 80 kg, the air blast overpressure is anticipated to be below the acceptable level of 115 dB Linear for all existing residences. Similarly, vibration levels are anticipated to be well below the acceptable criteria.

Should blasting be required there would be specific notification to nearby residences.

Construction traffic noise impact has been assessed and the 'worst case' maximum construction traffic generated scenario would comply with the NSW Road Noise Policy requirements. The projected increase in road traffic noise levels on all local roads is expected to be greater than 2 dBA during peak construction periods, however, road traffic noise levels are anticipated to meet the *Environmental Criteria for Road Traffic Noise (ECRTN)* and subsequent *Road Noise Policy (RNP)* target for a local road of daytime $L_{Aeq(1\ hour)}$ = 55 dBA at a typical setback distance of 50m. We note that being a rural farming community that most receptors are at much greater setback distances from their road frontage and therefore will easily meet the ECRTN requirement.

There could potentially be deliveries of equipment scheduled for out of hours, necessitated by traffic congestion considerations and safe passage of heavy vehicle convoys or especially long loads. Night-time traffic has the potential to cause sleep disturbance to residential receivers along the route.

Preliminary calculations indicate that maximum noise levels at a residence approximately 50 metres from the road as a result of a heavy vehicle pass-by would be in the range 45-55 dBA. Assuming a 10dBA transmission loss through an open window this would result in 35 to 45 dBA inside.

The NSW RNP states that:

> *"Maximum internal noise levels below 50-55dBA are unlikely to awaken people from sleep" and "One or two noise events per night, with maximum internal levels of 65-70 dBA are not likely to affect health and wellbeing significantly."*

In order to further minimise potential noise impacts associated with night-time deliveries some potential measures to be considered are:

- Prior notification of affected public where night-time convoys are scheduled
- Restricted use of exhaust/engine brakes in built up areas
- where possible deliveries will be organised for standard hours

- consultation with neighbours about scheduling activities to minimise noise impacts
- deliveries and access will have a nominated off site truck parking area away from residences for trucks arriving prior to gates opening
- the number of trips and vehicles to and from the site will be optimised e.g. amalgamation of loads instead of multiple smaller loads
- organise designated access routes to the site through consultation with potentially noise-affected residences and other sensitive land uses, and make drivers aware of nominated vehicle routes.

In addition respite periods will be provided which will restrict the number of nights per week and/or the number of nights per calendar month that deliveries are made in consultation with residences who will be most affected.

10.13Night time construction noise

Construction activities associated with the project are planned to be undertaken during standard construction hours as set out in the Interim Construction Noise Guideline (ICNG). Any construction activities outside of the standard construction hours will only be undertaken in the following circumstances;

- Construction activities that generate noise that is:
  - no more than 5dB(A) above rating background level at any residence in accordance with the ICNG (Table 2 of the ICNG); and
  - no more than the noise management levels specified in Table 3 of the ICNG at other sensitive receivers; or
- for the delivery of material required outside those hours by the NSW police Force or other authorities for safety reasons (section 10.11.2); or
- where it is required in an emergency to avoid the loss of life, property and/or to prevent environmental harm; and
- works as approved through the out-of-hours work protocol outlined in the Construction Noise and Vibration Management Plan as part of the Construction Environmental Management Plan.

Table 10-6 shows all noise affected receivers for this construction activity for the night period. Note that the minimum RBL under NSW INP is 30 dBA which therefore creates a minimum noise management level of 35 dBA for the night-time period.

Table 10-6 Night Construction Noise Levels – Noise Affected Receivers

Location	*Construction Activity*	*RBL*	*Limit*
	WTG Erection & Assembly	*Night*	*Night (RBL+ 5) OR 35 dBA*
R1	39	29	35
R2	45	29	35
R6	36	28	35
R7	35	28	35
R11	37	24	35
R13	42	24	35
R14	43	24	35
R16	43	24	35
R25	35	21	35
R26	31	21	35

Location	Construction Activity	RBL	Limit
	WTG Erection & Assembly	Night	Night (RBL+ 5) OR 35 dBA
R29	32	21	35
R30	44	23	35
R32	42	30	35
R33	36	23	35
R34	42	26	35
R35	42	26	35
R36	38	18	35
R38	36	18	35
R41	45	18	35
R42	32	18	35
R44	31	21	35
R45	32	24	35
R46	40	24	35
R47	37	18	35
R48	35	18	35
R49	36	18	35
R50	33	19	35
R51	34	19	35
R52	31	20	35
R53	33	19	35
R54	34	24	35
R56	36	23	35
R64	29	18	35
R65	31	21	35

A total of 19 locations are deemed 'noise affected' by the Guideline for night-time construction. Tower erection near these locations should occur during the daytime, if possible. No predicted levels exceed 75 dBA and therefore no receptors would be considered as being 'highly noise affected'.

A number of portable concrete batching plants with a combined Sound Power Level of 115 dBA will be required to supply concrete onsite. The proposed locations of these batching plants are listed in

Table 10-7. They are often located within or near to the construction compounds where equipment is stored for the duration of the construction phase of the project.

Table 10-7 Concrete Batch Plant Locations

Name	Easting	Northing	Nearest Receivers
CBP1	683952	6150712	R59, R60, R61
CBP2	678143	6183725	R13, R14

Using the existing SoundPLAN noise model, predicted noise levels for the proposed batch plant site at the nearest affected properties were calculated under worst case conditions. Results for those locations that exceed the night-time criteria are shown in Table 10-8.

Table 10-8 Concrete Batch Plant Noise Level Prediction

Location	Predicted Noise Level, dBA	RBL – Night, dBA	Night-time Noise Management Level, dBA
R2	35.6	29	35
R13	36.9	24	35
R14	49	24	35
R16	37.6	24	35
R41	41.9	18	35
R59	36.6	30	35
R61	35.1	30	35
R62	39.4	30	35
R63	38.7	30	35

All other locations are predicted to be below the night-time Noise Management Levels in the Interim Construction Noise Guideline. Some mitigation may be possible for these sources, particularly if they are near other project equipment infrastructure which may provide some localised shielding of the concrete batching plants. This should be addressed in any further management plans for construction noise for the project, as described in Section 10.14

10.14 Mitigation for Construction Noise

The Interim Construction Noise Guidelines recommend that where residences are deemed 'noise affected', that work practices and mitigation measures deemed feasible and reasonable should be applied. Possible mitigation measures may include:

- Scheduling construction works for less critical times of day
- Using alternative, quieter equipment
- Noise controls including temporary walls/earth berms and exhaust silencers
- Keeping the community informed about upcoming works in the area
- Detailed tracking regarding complaints about construction noise, including how each complaint was addressed.

A detailed construction noise management plan will be developed closer to the construction of the wind farm to ensure that all reasonable steps are taken to reduce noise from construction sources including batching plants, and that appropriate community engagement occurs with respect to construction noise.

11 Ecology

11.1 Introduction

A Biodiversity Assessment (BA) has been prepared to assess the ecological impacts of the proposal, as required in the DGR table in 6.1 of this EA. The BA covers construction and operational impacts of the proposed wind farm.

The BA provides an assessment of impact under s.5a of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This specifies factors to be considered for species, population and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Additionally, the BA characterises the nature and potential magnitude of impacts for threatened and migratory species, communities and populations listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in accordance with the *Significant Impact Guidelines* (2006).

The report can be seen in its entirety in Appendix C.

11.1.1 Site description

11.1.1.1 Regional

The project area is located on the edge of the Southern Tablelands and South West Slopes of NSW. It lies within the Murrumbateman subregion of the South Eastern Highlands IBRA region, characterised by undulating topography with rounded hills and plateaus, and also within the Northern Inland Slopes (formerly the Upper Slopes) subregion of the South Western Slopes IBRA region. The latter subregion is characterised by steep granite hills with small basalt outcroppings, shallow soils and dry forest types (Morgan, 2011).

The project area is mostly located within the Dalton Hills Mitchell Landscape extending slightly into the Boorowa Volcanics Mitchell Landscape to the west. It is located at the intersection of four sub-regions of two Catchment Management Areas (CMA):

- Upper Slopes and Murrumbateman sub-regions of the Lachlan CMA.
- Upper Slopes and Murrumbateman sub-regions of the Murrumbidgee CMA.

Bango Nature Reserve is located adjacent to the south-western border of the project area.

The region has extensive areas of clearing for agriculture including grazing and cropping with significant loss of biodiversity (ACTCOE, 2000; DSEWPC, 2009) . Regional biodiversity issues include fragmentation, managing weeds and pest vertebrates and providing conservation outcomes for native grasslands and woodlands and associated flora and fauna species on private land (CMA, 2012).

11.1.1.2 Project area

The project area encompasses the property boundaries of involved landholders and is approximately 14, 000 ha.

The project area is characterised by cleared farmland, mostly derived from Box Gum Woodland on the lower slopes and flats with Inland Scribbly Gum Dry Forest vegetation on the steeper sheltered slopes. Remnant stands of the original vegetation remain as paddock trees or larger scattered patches of forest/woodland on the lower slopes with more extensive forested areas on the ridge tops. The pasture ranges from exotic to native species dominated. This pattern of vegetation and land use onsite is common across the locality.

11.2 Approach, Survey Methods and Effort

11.2.1 Impact assessment approach

The BA was preceded by a Biodiversity Constraints analysis to spatially identify key ecological values that represent a constraint to the proposal. The layout was iteratively refined by the Proponent in response to the identified

constraints. All field surveys and the *Biodiversity Constraints Analysis* were undertaken based on a development envelope, that is, a broad area within which the wind farm components and associated infrastructure would be located. A larger area than needed is considered, giving the proponent flexibility to make design changes in response to biodiversity values and constraints identified.

The development envelope has been progressively refined over the course of the assessment phase from zones covering ridgelines (termed 'clusters' in **ngh**environmental 2012) and wide buffers around proposed track and electricity transmission lines (ETL) (November 2011 surveys) to a 100 m buffer around indicative layout for April 2012 and November 2013 surveys. The impact assessment relates to discreet turbine and associated infrastructure locations rather than a development envelope.

11.2.2 Desktop assessment

A desktop assessment was undertaken involving database searches of NSW and Commonwealth threatened (and migratory) species, populations and communities. Database searches included the *Atlas of NSW Wildlife* database, searched by the Upper Slopes sub-region of the Lachlan CMAs (searched 14 October 2011). For flora species additional searches were also undertaken for the Murrumbateman sub-region of the Lachlan CMA and the Upper Slopes and Murrumbateman sub regions of the Murrumbidgee CMA (16 August 2012). An EPBC Act *Protected Matters Search* was also completed using 10 km radius from the centre ridge line of the project area (searched 14 October 2011).

Topographic maps, aerial imagery, previous surveys, web-based literature and other databases (i.e. Department of the Environment (DEH) website for Species Profiles and Threats (SPRATs), Birds Australia and Shorebirds 2020 websites), recovery plans, conservation advice and policy statements for nationally listed species and ecological communities were also consulted. These information sources were used to identify known and potential ecological values, as well as analyse landscape connectivity.

11.2.3 Field work

The project area has been visited several times during the preparation of the BA and includes:

- A broad brush site two-day reconnaissance was undertaken by two ecologists over 26-27 October 2011, prior to field surveys, to understand the variability of the site and general habitat types and condition.
- A suite of field surveys were undertaken over five days within the development envelope and project area between 31 October and 4 November 2011.
- Further flora and fauna surveys, including assessments of new areas and targeted surveys of more constrained areas, were undertaken over five days between 10 and 14 April 2012.
- A suite of targeted surveys were undertaken for specific threatened species, primarily fauna, between July and December 2013; these surveys ranged from two to seven days in duration.

11.2.3.1 Flora methods and effort

Approximately 180 person hours was spent in total on the general flora survey incorporating 59 quadrat/random meander sites and 128 inspection points. Approximately 7 and 5.5 person hours was spent on specific targeted searches within the originally proposed substation site and higher quality areas in the vicinity of RYP_120 during the November 2011 and November 2013 surveys respectively. Survey methods are described in detail in the appended BA and included:

- quadrats;
- random meanders;
- inspections;
- threatened flora targeted searches; and
- understorey condition assessment.

11.2.3.2 Fauna methods and effort

Fauna survey comprised of a series of general and species-specific targeted methodologies to evaluate the potential impact of the wind farm on species known for the project area, or with potential to occur. Survey types and methods are listed below and Table 11-1 shows the target species for each survey type and total survey effort:

General surveys included:

- habitat assessment;
- hollow-bearing tree survey
- bird utilisation surveys including recording abundance and classifying flight height;
- reptile hand searches targeting the potential threatened reptile habitat;
- microbat census using 'Anabat' ultrasonic microbat call detection recording equipment; and
- nocturnal surveys including call playback and spotlighting, focussing on threatened owls and mammals in suitable habitat.

Targeted surveys included:

- Squirrel Glider cage-trapping and targeted nocturnal survey;
- Swift Parrot surveys (capture migration to mainland);
- Superb Parrot surveys (habitat use and flight path mapping);
- Koala RapSAT surveys (scat search surveys);
- Striped Legless Lizard artificial tile surveys;
- Golden Sun Moth surveys; and
- Threatened large forest owls call playback and spotlighting surveys.

Table 11-1 Fauna surveys, target species and survey effort

Survey Type	Target Species	Date	Sampling Method	Survey Effort	Comment
Habitat Assessment	All species, predominantly threatened	November 2011	100 x 100 quadrat	• 54 quadrats	
		April 2012	100 x 100 quadrat	• 20 quadrats	
Hollow-bearing Trees	All hollow-dependent fauna	November 2011	100 x 100 quadrat	• 35 quadrats	
		April 2012	100 x 100 quadrat	• 2 quadrats	
		November 2013	HBTs mapped within 100m of infrastructure in mod-good condition vegetation	• 7 search areas	
Birds	All birds	November 2011	Utilisation Surveys	• 18 surveys of 30 minutes duration **Total effort = 9 person hrs**	
		April 2012	Utilisation Surveys	• 6 surveys of 20 minutes duration **Total effort = 2 person hrs**	
		November 2013	Utilisation Surveys	• 8 surveys of 20 minutes duration **Total effort = 2.7 person hrs**	All birds observed during Superb Parrot transects were also recorded substantially increasing survey effort for birds in general (25 hrs).
	Swift Parrot / All birds	July 2013	Point-count method	• 10 search areas • 6 surveys at 60 mins each (2 people) (1 site visited twice) • 5 surveys at 45mins each (1 person) (3.75 person hrs) **Total effort = 15.75 person hrs**	Surveys undertaken to coincide with the winter migration of the Swift Parrot to mainland from Tasmania.
	Superb Parrot	November 2013	1km transects Flight path mapping	• 25 transects of 1 hr duration **Total effort = 25 person hrs** • 3 days x 8 people of flight path mapping **Total effort = 72 person hrs**	Method and survey effort developed in consultation with Damon Oliver (OEH Threatened Species Team Leader)
Reptiles and Amphibians	All species, primarily Pink-tailed Worm-lizard	November 2011	Active searching (rock, log, branch rolling)	• 11 surveys of 20 – 60 minutes duration **Total effort = 4 person hrs**	

Survey Type	Target Species	Date	Sampling Method	Survey Effort	Comment
	All species, primarily Striped Legless Lizard	November 2012	Funnel Traps	• 2 sites off Flakney Ck Rd along proposed TL **Total effort = 24 traps x 4 nights (96 traps nights)**	Method and survey effort developed in consultation with Rod Piestch (OEH Senior Threatened Species Officer)
	Striped Legless Lizard	November to December 2012	Artificial Tiles	• 10 sites of 50 tiles each • 10 independent checks **Total effort = 50 tiles x 10 sites (500 tiles) checked 10 times each**	
	All Frogs	November 2011	Frog vocalisation survey	• 10 minutes duration	
Microbats	All microbats	November 2011	Anabat surveys	• 9 overnight surveys	
		April 2012	Anabat surveys	• 6 overnight surveys	
		November 2013	Anabat surveys	• 7 overnight surveys	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)
Squirrel Glider	Squirrel Glider	April 2012	Cage trapping	• 2 trap sites near RYP_92 and RYP_105 **Note: RYP_105 is now removed from layout* **Total effort = 8 traps x 4 nights, 8 traps x 3 nights (56 trap nights)**	
Golden Sun Moth	Golden Sun Moth	November 2012		**Total effort = 10 sites visited between 1 and 4 times each.**	
Koala	Koala	July 2013, November 2013	Spot Assessment Technique (RapSAT)	**Total effort =** 7 grids (33 plots)	Method and survey effort developed in consultation with Rod Piestch (OEH Senior Threatened Species Officer)
Nocturnal Survey					
Evening listening / stagwatch	Forest Owls Squirrel Glider	November 2011	N/A	• 3 surveys each by 2-3 people for 30 minutes **Total effort = 3.5 person hrs**	
		April 2012		• 6 surveys by 60 minutes **Total effort = 6 person hrs**	

Survey Type	*Target Species*	*Date*	*Sampling Method*	*Survey Effort*	*Comment*
Call Playback (including listening period)	Forest Owls Squirrel Glider	November 2011		• 5 surveys of 20 minutes duration **Total effort 1.6 person hrs**	
		April 2012		• 3 surveys of 30 minutes duration **Total effort = 1.5 person hrs**	
		November 2013		• 4 surveys of 30 minutes duration **Total effort = 2 person hrs**	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)
Spotlighting	Squirrel Glider Arboreal mammals	November 2011	Vehicle and foot surveys	• 3 vehicle-based surveys • 5 foot-based surveys between 15 minutes and 2 hours **Total effort = 11.75 person hrs**	
		April 2012	Foot surveys	9 foot-based surveys between 30 and 50 minutes **Total effort = 5.5 person hrs**	
		November 2013	Foot surveys	4 foot-based surveys between 30 and 60 minutes **Total effort = 3.5 person hrs**	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)

11.2.3.3 Target species listed by Office of Environment and Heritage

Table 11-2 addresses each species-specific survey requirement recommended by OEH (received by **ngh**environmental 11 June 2013). The table considers the survey effort implemented for this assessment and provides a justification for any deviation from the OEH requirements (for, example, where no suitable habitat for the species occurs or where the level of impact that would be imposed by the wind farm is manageable with regard to the species).

After the initial November 2011 survey was undertaken, further targeted surveys were undertaken to fill survey effort gaps and to determine the presence / absence of a species. OEH requested specific survey requirements for the Superb Parrot, Koala, Striped Legless Lizard, Squirrel Glider, threatened forest owls, threatened microbats, woodland birds, and Golden Sun Moth. Substantial targeted surveys were therefore undertaken in November to December 2013 for the above species; the survey effort and survey locations for these species-specific surveys were developed in consultation with OEH and documented in *Rye Park Biodiversity Assessment - targeted fauna survey V2 2013)*.

Table 11-2 Species specific survey requirements issued by OEH

Species	*OEH recommended survey requirements (paraphrased)*	*Surveys in accordance with OEH*	*Justification for any deviation from OEH requirements*
Flora			
Box Gum Woodland	Identify the extent and condition of this community in the study area and locality.	Yes.	59 quadrat/random meander sites and 128 inspection points (approximately 180 person hours). Vegetation type mapped to the site boundaries. Condition mapped for the development envelope. Infrastructure was designed to avoid good condition areas for Box Gum Woodland (i.e. turbines moved out of Box Gum Woodland remnants or removed from layout altogether). The community has a long history of grazing, with much of the development located within low condition areas. The survey effort employed is considered adequate to the nature and quality of habitat found within the project area.
Silky Swainson Pea, Mountain Swainson Pea, Tarengo Leek Orchid, Crimson Spider Orchid, Yass Daisy.	Systematic surveys using 10m transects through woodland and grassland areas. Surveys should be undertaken during the flowering periods.	Yes, within the originally proposed substation site. Random meanders substituted for transects within proposed transmission line routes	59 quadrat/random meander sites and 128 inspection points (approximately 180 person hours) Box Gum Woodland and derived grassland in moderate or good condition is considered to be the most likely habitat these species would be found. Targeted transects for threatened flora were conducted in higher quality areas of Box Gum Woodland and derived grassland within the originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas). Random meanders were substituted for transects within the high quality habitat in between RYP_109 and RYP_120 given the large area to be covered and the nature of the impacts in this area (limited to the establishment of transmission pole footings and an access track). Both methods are considered acceptable under the Draft Threatened Species Survey Guidelines (DECC 2004). These surveys failed to locate any threatened flora. In addition, five flora quadrat surveys were conducted in moderate or good condition Box Gum Woodland and failed to detect any threatened flora. No threatened flora were detected during the other 54 quadrat/random meander sites and 128 inspection points (approximately 180 person hours) conducted across the broader site or while travelling between these sites.
Fauna			
Regent Honeyeater	Diurnal fixed-width transects or point counts surveys and call playback during breeding season. Surveys can be conducted at any time of year, but optimal conditions during spring and summer.	No. But the species was indirectly surveyed through utilisation bird surveys.	26 bird surveys (11.5 person hours) were conducted across the project area during November 2011 and November 2012. Primary breeding and foraging habitat is not widely available within the project area (i.e. riparian areas of Red Ironbark, Red Gum and Casuarinas, or wetter areas supporting Box-ironbark Eucalypt associations). Two species of mistletoe were recorded on site, but are not widely distributed and occur in low densities. Casuarina and Red Gum are not recorded on site. Potential foraging habitat is primarily present within the Box Gum Woodland within the project area. The Guidelines suggest bird searches of woodland patches with heavily flowering trees, especially around water points, such as creek lines. Woodland patches within the impact area were surveyed during bird surveys. The method employed such as listening for calls during the known breeding season (November) within the most appropriate habitat type available within the impact area is considered adequate to

			detect this species. Given that core breeding habitat is not available on site, foraging resources are generally limited (i.e. not wetter more fertile areas), and known records indicate movement of the species east of the project area, the proposal is not considered to adversely affect the existence of this species
Swift Parrot	Diurnal fixed-width transects and/or point-count surveys during Autumn-Winter.	Yes.	10 point-count surveys undertaken during July 2013 during the species winter migration to the mainland from Tasmania.
Brown Treecreeper, Diamond Firetail, Hooded Robin, Speckled Warbler, Grey-crowned Babbler, Little Lorikeet, Black-chinned Honeyeater, Turquoise Parrot, Varied Sittella.	Diurnal bird census in the early morning or late afternoon at a minimum of three locations within the subject site. Surveys should be 45 minutes duration and separated by a period of one week. Can be undertaken at any time of the year, but not in high-wind and/or rainy days.	Yes.	42 bird surveys (29.45 person hours) were conducted across the project area during November 2011, April 2012, July 2013, and November 2013, with emphasis on wooded areas. The survey effort undertaken is above that recommended by OEH. Additionally, infrastructure has been designed to avoid high habitat value areas for woodland birds and to maintain habitat connectivity (i.e. turbines moved out of Box Gum Woodland remnants or removed from layout altogether).
Scarlet Robin, Flame Robin	As above, but surveys are optimal between July-January, but can be undertaken at any time of the year.	Yes.	As above.
Gang-gang Cockatoo, Glossy Black-cockatoo	Diurnal bird surveys, using a combination of stag-watching and listening for calls of the birds returning to nests in the late afternoon during the known breeding season. Surveys should target hollow-bearing trees (hollows > 10 cm).	No. But both species were not observed during bird surveys	Both species were not observed during bird surveys despite a total of 42 bird surveys undertaken, indicating they are unlikely to be a permanent resident of the project area. Both foraging (Casuarina) and nesting resources for the Glossy Black-cockatoo are absent from the project area and the species is not expected to occur there. The gang-gang was not observed during bird surveys and therefore stag watch surveys were not considered necessary for this species. The survey effort employed is considered adequate for the extent and quality of habitat found within the project area.
Superb Parrot.	Undertake surveys during breeding season using 1 km transects within the project area to determine local flight	Yes.	Surveys deviated from initial OEH requirements but subsequent transect and flight path mapping methodology was developed in consultation with OEH specific to this species.

	paths and usage of the project area. Undertake flight path mapping at advantage points across the project area.		
Barking Owl, Powerful Owl	Nocturnal call playback (1 site per 100 ha). Identify and map all hollow-bearing trees and estimate the availability within the locality.	Slight deviation	10 nocturnal surveys conducted (spotlighting, evening listening, and call playback). Nocturnal call playback was undertaken in suitable potential habitat for these species in accordance with the draft guidelines for threatened species assessment (DEC 2005); however, call playback targeted potential habitat of this species and was not undertaken every 100 ha across the project area given much of the habitat in other unsurveyed areas was unsuitable or marginal. These species are considered further in the impact assessment.
Squirrel Glider	Live-trapping in trees, with traps spaced 50-100m apart, for minimum of 4 nights. Infra-red cameras are supported as a trade-off survey intensity.	Yes.	Cage trapping (56 trap nights) was conducted at two locations of suitable habitat in April 2012, with 9.5 hrs of evening listening, and 20.75 hrs of spotlighting (foot and vehicle) also completed in total. Additional survey effort completed in November 2013 was developed in consultation with OEH and constituted targeted spotlighting in areas of potential habitat that were considered the most appropriate habitat for this species. This species is considered further in the impact assessment.
Koala	Undertake regularised Grid Based Spot Assessment Technique (RapSAT). Map potential Koala habitat in the study area.	Yes.	Survey effort and location of RapSAT grids were developed in consultation with OEH prior to field surveys.
Spotted-tailed Quoll	Use digital infrared cameras in suitable habitats, such as drainage lines. Install cameras for a minimum of four weeks.	No.	The project area does not support habitat for this species. The spotted-tailed Quoll was given a low potential impact rating as rocky habitats (i.e. boulders and cliff faces) required for breeding by quolls are not present within the project area. While this species can also den in large logs and hollows these habitat features are absent from the impact area. Therefore impact of the proposal is negligible and intense survey effort was not warranted.
Eastern False Pipistrelle, Eastern Bentwing-bat, Greater Broad-nosed bat, Yellow-bellied Sheathtail-bat, Greater Long-eared Bat.	Conduct surveys using Anabat recorders and stag-watching. Identify important foraging habitat in the study area and locality. Hollow-bearing tree surveys of the subject site, study area, and locality.	Yes.	23 Anabat surveys were undertaken in 22 different locations. Hollow-bearing trees were mapped in areas of mod-good condition habitat considered potential habitat for these species. As it is difficult to determine abundance or flight paths from Anabat survey there are limitations to determining important foraging habitat given the mobility of microbat species. It is therefore considered that forest and woodland areas in general represent a constraint for these species, as do hollow-bearing trees. However, infrastructure has been designed to avoid high habitat value areas (woodland habitat) to mitigate impact to microbats. Microbats were considered further in the impact assessment and were noted as focus species for a bird and bat monitoring program.
Grassland Earless	Spider tubes should be used to	No.	11 herpetofauna searches in suitable habitat including active searching and rolling of rocks, logs and other debris.

Dragon	survey areas of suitable habitat (natural temperate grassland or nearby secondary grassland dominated by Wallaby Grass). 10-wk survey season from February to April with tubes checked twice a week.		In the project area, rocky outcrops generally occur on hill crests in cleared and forested areas and are sparsely distributed, occurring mostly in the northern portion of the site. Primary habitat for these species does not occur within the project area. The survey effort is considered adequate for the extent and quality of habitat available within the project area.
Pink-tailed Worm-lizard, Little Whip Snake	Rock rolling and active searching under logs and debris. Undertake surveys between mid-August and end of October. Daily temperatures to not exceed 25 degrees. Surveys in the locality for habitat of the species.	Yes, for the Pink-tailed Worm-lizard.	
Striped Legless Lizard	Pitfall trapping in suitable habitat (natural temperate grassland or nearby secondary grassland dominated by Kangaroo Grass). Trapping should last for 6 weeks (mid-November to mid-late December). Roof tiles should also be used 4 months prior to checking.	Yes.	Survey effort and location of artificial tiles sites were developed in consultation with OEH prior to field surveys.
Golden Sun Moth	Surveys should target areas with greater than 40% *Austrodanthonia* (Wallaby Grass) in ground cover. Conduct surveys when known populations in the local area are in flight.	Yes.	Surveys undertaken by Kris Nash, an expert in Golden Sun Moth survey especially within the ACT region.

11.3 Results - Flora

11.3.1 Disturbance and weeds

Most areas of forest have a low diversity of tree age groups, being mostly dense young regrowth as a result of previous clearing. Many areas of the site have been grazed and show evidence of this in the low diversity of native pasture species and forbs.

Common weeds associated with grazing are widespread and have invaded areas of more intact woodland and forest vegetation. Two noxious weeds declared for the Boorowa LCA were detected during the surveys:

- Scotch Thistle; and
- Blackberry

Large areas of the site are now dominated by the colonising species Sifton Bush, declared noxious in many shires within NSW however, it is not declared noxious within the Boorowa Local Control Area (LCA) (within which the site occurs).

11.3.2 Vegetation types

Eleven vegetation types occur within the development envelope. These vegetation types are described in the BA, and their distribution across the project area shown in the BA. Vegetation types include:

- Inland Scribbly Gum – Red Stringybark open forest;
- Blakely's Red Gum - Yellow Box grassy tall woodland;
- Blakely's Red Gum - Yellow Box grassy tall woodland derived grassland;
- Argyle Apple – Acacia mearnsii valley open forest;
- Brittle Gum - peppermint open forest;
- Red Box Woodland;
- Phragmites Swamp;
- Sifton Bush Shrubland;
- native pasture;
- exotic pasture; and
- planted vegetation.

These vegetation types and their distribution across the project area are described in the BA in Appendix C.

11.3.3 Threatened flora and vegetation communities

The database searches (EPBC Act protected matters search and NSW Wildlife Atlas) indicated 27 threatened species or their habitat and five endangered ecological communities could occur in the project site. No threatened flora species were detected during the surveys. A threatened species evaluation was undertaken to evaluate the presence of habitat in the project area and the likelihood of occurrence and impact from the proposal for each species and community returned from database searches. This evaluation is presented in full in Appendix B.1 of the BA. Table 11-3 below lists threatened flora species or EECs that are considered possible to occur and have at least marginal or (potential or known) habitat present in the project area.

Table 11-3 Threatened flora and ecological communities with potential to occur in the project area

Species	*Status*	*Habitat*	*Identified on site?*	*Further Assessment of Significance (Y/N)?*
Hoary Sunray	E EPBC	Grasslands and grassy woodlands, often	No	No

Species	Status	Habitat	Identified on site?	Further Assessment of Significance (Y/N)?
(Leucochrysum albicans var. tricolor)		colonising disturbed sites such as road verges.		
Yass Daisy (Ammobium craspedioides)	V TSC V EPBC	Moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Can persist in lightly grazed situations.	No	Yes
Tarengo Leek Orchid (Prasophyllum petilum)	E TSC E EPBC	Box Gum Woodland and Natural Temperate Grassland.	No	No
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived native grasslands	EEC TSC CEEC EPBC	Open woodland community occurring on the slopes and in valleys at the project area	Yes	Yes

11.3.3.1 Endangered Ecological Community: Box-Gum Woodland

The definition of Box Gum Woodland listed under the NSW TSC Act includes White Box, Yellow Box and Blakely's Red Gum Woodland recorded during the surveys and includes: 1) Woodland areas with or without native understorey; and 2) Grasslands and pastures dominated by native grasses that are derived from this community. The Commonwealth EPBC Act sets more stringent criteria for the recognition of the Box Gum Woodland Critically Endangered Ecological Community (CEEC) listed under that Act.

The proposal would require the removal of both TSC and EPBC listed EEC as follows:

- TSC EEC Up to 28 ha to be removed or modified.
- EPBC EEC Up to 12 ha to be removed or modified.

All areas of EEC identified within the project area would be classified as 'moderate to good' condition under the NSW OEH Biometric condition definition (DECC 2008).

11.3.4 Vegetation Condition

Vegetation condition varies considerably throughout the project area and includes woodland and fragmented woodland which has been logged and is regenerating, native pasture with scattered trees, pasture dominated by exotic species, and to a lesser degree relatively undisturbed forest. Woodland areas do not support a mosaic of tree ages and largely consist of regrowth and single age stands. The majority of the site has been subject to long-term grazing which has reduced native flora species diversity. In many areas, the canopy layer is present but the mid- or shrub-layer is absent.

Common weeds associated with grazing are widespread and have invaded areas of more intact woodland and forest vegetation. Two noxious weeds declared for the Boorowa LCA were detected during the surveys:

- Scotch Thistle
- Blackberry

Large areas of the site are now dominated by the colonising species Sifton Bush, declared noxious in many shires within NSW however, it is not declared noxious within the Boorowa Local Control Area (LCA) (within which the site occurs).

11.4 Results - Fauna

11.4.1 Habitat types

Fauna habitat in the project area includes:

- woodland;
- forest;
- mixed native/exotic pasture with scattered trees; and
- native pasture.

Additional habitat features occur within the four main habitat types:

- hollow-bearing trees;
- rocky outcrops; and
- aquatic areas.

Habitat condition across the project area was variable due to different soil types, disturbance histories and land management. Generally the habitat quality was higher in the southern portion of the proposal area, and more degraded in the northern portion. Areas where habitat types intersect, providing ecotones, tended to provide the highest habitat quality.

11.4.2 Fauna species recorded during field surveys

A total of 143 fauna species were recorded during the field surveys and these are listed in Appendix A.2 of the BA. In summary the total numbers for each fauna group included:

- Ninety-nine bird species;
- Fifteen mammal species (excluding microbats) of which five are introduced species;
- Twelve microbat species;
- Fifteen reptile species; and
- Two amphibian species.

11.4.3 Raptors

Five species of raptors were seen in the project area, all considered common in the region:

- Brown Falcon Falco berigora.
- Nankeen Kestrel Falco cenchroides.
- Black-shouldered Kite Elanus axillaris.
- Brown Goshawk Accipiter fasciatus.
- Wedge-tailed Eagle Aquila audax.

Raptors were seen in a variety of landscape positions, mostly in pasture with scattered trees or along the edges of forest or woodland. One inactive Wedge-tailed Eagle nest was identified. A Nankeen Kestrel nest was observed along Flakney Creek Road near a proposed transmission line and access tracks.

11.4.4 Threatened and migratory fauna

The Commonwealth and State online database searches and NSW Wildlife Atlas threatened species records returned two amphibian, five microbat, 33 bird, one invertebrate, five marsupial and three reptile species listed as threatened in the Upper Slopes sub-region of the Lachlan CMA. A threatened species evaluation was

undertaken to evaluate the presence of habitat in the project area and the likelihood of occurrence and impact from the proposal for each species and community identified. This evaluation is presented in full in Appendix B.2 of the BA. The evaluation concluded that 17 threatened species have potential to be present on parts of the project area, based on habitat and site quality and known distribution. Additionally, 16 threatened species were recorded during the field surveys including: one invertebrate species, one reptile species, nine birds, and three microbats. Table 11-4 lists threatened fauna species that were recorded during field surveys and species considered possible to occur.

Table 11-4 Threatened fauna with potential to occur in the project area

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
Invertebrates					
Golden Sun Moth Synemon plana	E TSC CE EPBC	Grassy Box Gum Woodlands and natural temperate grasslands.	Present	South of RYP_144 near proposed transmission line; north of RYP_73; west of RYP_99; south of RYP_101 near proposed transmission line; west of RYP_120 and RYP_127; and east of RYP_131.	Yes
Amphibians					
Sloane's Froglet *Crinia sloanei*	V TSC	Periodically inundated areas in grassland, woodland and disturbed habitats.	Possible	N/A	No
Reptiles					
Pink-tailed Legless or Worm Lizard *Aprasia parapulchella*	V TSC V EPBC	Open woodland with predominantly native grasses and natural temperate grasslands on well-drained slopes with scattered, partially-buried rocks.	Possible	N/A	No
Rosenberg's Goanna *Varanus rosenbergi*	V TSC	Heath, open forest and woodland.	Possible	N/A	No
Striped Legless Lizard *Delma impar*	V TSC V EPBC	Temperate lowland grasslands, secondary grasslands and occasionally open Box Gum Woodland.	Present	RYP_27	Yes
Birds					
Barking Owl *Ninox connivens*	V TSC	Dry box-dominated forest and woodlands and roosts in dense foliage of *Acacia, Casuarina* or *Eucalyptus* species.	Possible	N/A	No
Black-chinned Honeyeater *Melithreptus gularis gularis*	V TSC	Drier open forests or woodlands most often dominated by box and ironbark eucalypts.	Possible	N/A	No
Brown Treecreeper (eastern subspecies) *Climacteris picumnus*	V TSC	Occurs in eucalypt woodlands, mallee and drier open forest, preferring woodlands lacking dense understorey	Present	RYP_102-104 in November 2011, April 2012, and November 2013.	No

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
victoria					
Diamond Firetail *Stagonopleura guttata*	V TSC	Woodland remnants of grassy eucalypt woodlands, including Box-Gum, grassland and riparian areas, and sometimes lightly wooded farmland.	Present	In paddock tree east of the transmission line between RYP_101 and RYP_102 in November 2011 (outside project area); north of RYP_102 in November 2013 (outside project area).	No
Flame Robin *Petroica phoenicea*	V TSC	Native vegetation with an open understory. It breeds in upland forests and woodlands and migrates to more open lowland habitats in winter.	Present	Near RYP_95 in November 2011 and April 2012; near RYP_103 during November 2013; near Flakney Ck Rd in November 2013.	No
Gang-gang Cockatoo *Callocephalon fimbriatum*	V TSC	Varies from open forests and woodlands to heavily timbered and mature wet forest.	Possible	N/A	No
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V TSC	Box Gum Woodlands, open forests, scrub lands, even farmlands and suburbs.	Possible	N/A	No
Hooded Robin (South eastern form) *Melanodryas cucullata cucullata*	V TSC	Woodland remnants with high habitat complexity and uses stumps, posts or fallen timber.	Present	RYP_103 and around RYP_106 and RYP_107 in April 2012; near RYP_120 in November 2013; east of RYP_53 in November 2013.	No
Little Eagle *Hieraaetus morphnoides*	V TSC	Open eucalypt forest, woodland or open woodland.	Possible	N/A	No
Little Lorikeet *Glossopsitta pusilla*	V TSC	Open eucalypt forest and woodland.	Possible	N/A	No
Painted Honeyeater *Grantiella picta*	V TSC	Dry open forests and woodland with mistletoe.	Present	All records in November 2013: west of RYP_4; Flakney Ck Rd; and west of RYP_106 to RYP_120.	Yes
Powerful Owl *Ninox strenua*	V TSC	Dry sclerophyll forest including Argyle Apple and roosts in dense mid-canopy trees or tall shrubs, often associated with drainage lines.	Possible	N/A	No
Regent Honeyeater *Xanthomyza phrygia*	V TSC	Box-ironbark eucalypt associations including Yellow Box and Blakely's Red Gum.	Possible	N/A	Yes

Species	*Status*	*Habitat*	*Likelihood of occurrence*	*Location in project area*	*Further Assessment of Significance (Y / N)*
Scarlet Robin *Petroica boodang*	V TSC	Dry eucalypt forests and temperate woodland. Fallen timber is an important habitat feature	Present	In forest south of RYP_105 (now removed from layout) in November 2011; south of RYP_56 in April 2012; and near Flakney Ck Rd in November 2013.	No
Speckled Warbler *Pyrrholaemus saggitatus*	V TSC	Eucalypt woodland with a grassy understorey.	Present	Near RYP_106 and RYP_107 in April 2012 and November 2013; east of RYP_42 in November 2013.	No
Spotted Harrier *Circus assimilis*	V TSC	Grassy open woodland and riparian woodland.	Possible	N/A	No
Square-tailed Kite *Lophoictinia isura*	V TSC	Open forest, woodlands and mallee.	Possible	N/A	No
Superb Parrot *Polytelis swainsonii*	V TSC V EPBC	Box Gum Woodland and can nest in isolated paddock trees.	Present	On transmission line between RYP_101 and RYP_102 in November 2011; Flakney Ck Rd in November 2013, and south of project area between RYP_110 and RYP_120 in November 2013; several records along access roads outside of project area and to west of project area in November 2011 and November 2013. Nests near RYP_120 and east of RYP_143.	Yes
Swift Parrot *Lathamus discolour*	E TSC E EPBC	Eucalypt forests and woodlands.	Possible	N/A	No
Turquoise Parrot *Neophema pulchella*	V TSC	Grassy woodland and open forest including Box Gum Woodland.	Possible	N/A	No
Varied Sittella *Daphoenositta chrysoptera*	V TSC	Eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches.	Present	RYP_106 and RYP_107 in April 2012 and November 2013.	No
White-fronted Chat *Epthianura albifrons*	V TSC	Open grassland habitats inland form the coast or damp open habitats.	Present	Outside of impact area in April 201; north of RYP_27 and west of RYP_120 in November 2013.	No
Mammals (excluding microbats)					
Koala *Phascolarctos cinereus*	V TSC	Eucalypt woodland and forest communities.	Possible	N/A	No
Squirrel Glider *Petaurus norfolcensis*	V TSC	Mature or old growth Box, Box-Ironbark woodlands and River Red	Possible	N/A	No

Species	*Status*	*Habitat*	*Likelihood of occurrence*	*Location in project area*	*Further Assessment of Significance (Y / N)*
		Gum forest.			
Microbats					
Eastern Bent-wing Bat *Miniopterus orianae oceanensis*	V TSC	Forage over canopy in range of forest types. Breeds in caves and mine tunnels.	Present	RYP_104 and in the forest south of this site, near RYP_143, RYP_82, RYP_80, RYP_25 and RYP_9 in November 2011. One location in April 2012 (RYP_105 – now removed from layout). At RYP_84 and RYP_90 during November 2012.	Yes
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V TSC	Forages below or near the canopy and along tracks, uncommon on ridge tops where soil fertility is low. Roosts in tree hollows and buildings.	Present	RYP_80 in November 2011	No
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V TSC	Wide-ranging species across northern and eastern Australia. It roosts in tree hollows.	Present	Near RYP_7 in November 2011	Yes

11.5 Impact Assessment

11.5.1 Types of impacts

Three primary adverse biodiversity effects were assessed:

- Habitat loss (vegetation clearance);
- Blade-strike (bird and bat collisions with turbines or barotrauma); and
- Alienation or barrier effects (behaviour change in fauna).

Additionally, as there are a number of developments including wind farms in the region, cumulative impacts from vegetation clearing and operational or alienation effects were assessed.

11.5.2 Flora impacts (vegetation clearance)

At the time of this assessment, the proposal included scope for the development of 126 turbines. This may be reduced, however the calculations for magnitude of impact remain based on the worst-case scenario (126 turbines). The proposal would result in the removal of vegetation under the development footprint, including the turbine towers and surrounding hardstand and crane operation areas, substation and control building and access tracks. Electrical cabling (33kV) would be installed within areas disturbed for the access tracks.

Estimates of permanent habitat loss for each of the affected vegetation types are presented in the tables below Table 11-5, Table 11-6), based on the final indicative infrastructure layout provided by the proponent (several layout revisions have taken place to reduce impacts since the beginning of site investigations – refer Section 11.7.1).

Overall impact areas have been determined based on worse case infrastructure footprints provided by the proponent. Impact areas by vegetation type were calculated using GIS mapping software, however it should be noted that some total habitat loss figures are likely to be *overestimated* due to overlaps of infrastructure, for example tracks crossing hardstand areas and tracks within overhead transmission easements. It should be noted that for the purposes of these calculations, exotic dominated pasture is not considered to constitute habitat.

Table 11-5 Estimated permanent impact areas by vegetation condition

Vegetation types	***Permanent habitat loss within each condition class (ha)***					***Total within project area (ha)***
	Good	**Moderate**	**Poor**	**Unknown**	**Total**	
Box Gum Woodland	10	1	14	0	25	1,555
Box Gum Woodland Derived Grassland	0	1	6	0	6	1,513
Inland Scribbly Gum Forest	41	30	19	0	90	3,753
Argyle Apple Forest	0	0	0	0	0	59
Brittle Gum Forest	0	0	2	0	2	175
Sifton Bush Shrubland	14	15	2	0	30	1,720
Native pasture	2	22	36	0	60	4,374
Exotic/planted	0	0	23	0	23	887
				Total	**235.93**	**14,035.99**

Table 11-6 Estimated TSC Act EEC permanent impact areas by condition class

EEC	Permanent habitat loss within each condition class (ha)			
Box Gum Woodland and Derived Grassland	Good	Moderate	Poor	Unknown
	10	2	28	0
Total area within the site boundary	• **353**	• **27**	• **357**	• **2,331**

11.5.2.1 Impacts to Endangered Ecological Community (Box Gum Woodland EEC/CEEC)

Within the project area few areas were defined as moderate or good condition EEC areas. Good condition areas estimated to be cleared account for approximately 10 ha of the 3,068 ha Box Gum Woodland area assessed. One area in the south of the project area (in the vicinity of RYP_110 and RYP_120 and to the west of these) consists of higher diversity Box Gum woodland and would be directly impacted by the proposal due to the establishment of a 45m wide easement for the 132kV overhead transmission line and some smaller areas for access tracks. Of all the Box Gum Woodland mapped, this area supported the largest patches of this community within the project area and the highest abundance of mature box trees. This area was also identified as important habitat for the Superb Parrot and Painted Honeyeater. These areas have high conservation value and also qualify as the Commonwealth Box Gum Woodland CEEC and have been mapped as a high constraint. Approximately 2 ha of moderate condition Box Gum Woodland would also be permanently cleared by the proposal. Although modified, areas in moderate condition are considered to have potential for recovery and have also been mapped as a high constraint.

The infrastructure layout has been refined to avoid, where possible, Box Gum Woodland habitat, especially moderate to good condition areas. As a result the turbines RYP_14, RYP_108, RYP_111, and RYP_116, were moved out of Box Gum Woodland remnants. In particular, at least 4 km of proposed transmission line has been removed to avoid good condition EEC in the southern section of the project area.

The EEC over the vast majority of the project area is characterised by low diversity native pasture in poor condition. Of the EEC within the project area (3,068 ha), the estimated amount of poor condition EEC to be cleared accounts for 28 ha. Predominately, the areas to be impacted contain a moderate to low tree density with an understorey of native grass dominated pasture with a relatively low native forb and shrub diversity (0 – 11 non-grass species in poor and moderate condition). This structural and understorey configuration is common and widespread in farmland throughout the region, and particularly within high elevation areas on the ridgetops of the project area. The areas of habitat within the site are already fragmented due to previous clearing, grazing pressure, the planting of exotic pastures, the ingress of weeds and the occurrence of other vegetation communities in habitats not suitable for Box Gum Woodland. The long history of grazing, fertiliser use and weed invasion means that the potential for natural regeneration is likely to be very low. Given the low conservation value of this vegetation and the highly localised and limited impacts associated with the proposal, impacts to poor condition Box Gum Woodland are not expected to be significant.

As a precautionary approach, this assessment has considered that the worst case scenario would be the total loss of this vegetation type within the 132 kV transmission line easement; however in reality the vegetation is open woodland meaning that only scattered trees would need to be cleared. The understorey would also be mostly retained excluding small areas required for footings and tracks. It is considered likely that the community would maintain its existing functionality following construction.

Where occurrences of EEC are along established roads or tracks it may be possible to further avoid or minimise impacts in these areas. Impacts to areas in transmission line clearing corridors of the study areas may also have the potential to be avoided or minimised by micrositing infrastructure with input from an ecologist. Where new tracks, turbines or other infrastructure are placed within identified areas of EEC impacts are unavoidable and offsetting these impacts would be required. Higher offset ratios apply to higher value habitat, providing an incentive throughout the construction process to minimise impacts in high value areas.

Offsetting is recommended by this report to maintain or improve the biodiversity values associated with the EEC/CEEC within the proposal site. Large areas potentially exist within the site boundary that if properly managed can assist with the recovery of this community, arresting existing threats and managing the land for biodiversity

outcomes in perpetuity. With the implementation of the controls and recommendations of this report the proposal is considered unlikely to have a significant impact on the Box Gum Woodland EEC/CEEC.

Box Gum Woodland provides habitat for several threatened fauna species, particularly the Superb Parrot, Painted Honeyeater, Golden Sun Moth, and Striped Legless Lizard. These species were detected in this habitat type within the project area.

11.5.2.2 Impacts to threatened flora species

Yass Daisy

The Yass Daisy is a rare perennial herb, 30-60 cm high, inhabiting sclerophyll woodland, forest and roadsides (Harden 1992). It appears to be unaffected by light grazing, with some populations persisting in grazed sites (OEH 2012). In surveys conducted in the Boorowa Shire, all of the occurrences of this species were on land characterised by a light grazing regime. The Yass district is the centre of distribution for this species (Fallding 2002). Most populations occur in the Yass District, at Lake Burrinjuck, Bookham, Rye Park and Dalton. The Yass Daisy has been recorded within 2.5 km west and south-east of the project area. Current threats to the species include agricultural developments, intensification of grazing regimes, invasion of weeds, road works (particularly widening or re-routing) and inappropriate mowing or slashing in cemetery sites (OEH 2012).

Targeted searches were undertaken for this species in higher quality areas of Box Gum Woodland and derived grassland immediately north of RYP_120 and within the proposed overhead transmission line routes to the north-west of RYP_120 and south west of RYP_110. These areas have a long and continuing grazing history. Much of the total area of disturbance would involve tree clearing for a 45m wide easement for the 132kV overhead powerlines. The groundlayer habitat under the powerlines would be largely undisturbed, with the exception of small areas required for pole footings and a maintenance track. In view of the limited extent and pattern of clearing and the low impact on groundlayer vegetation within the transmission line, the works are not expected to add to the existing level of fragmentation or isolation of potential Yass Daisy habitat. The proposal would result in the permanent loss of up to 12 ha of moderate and good condition Box Gum Woodland, which provides potential habitat for the threatened Yass Daisy.

The potential habitat at the subject site is considered unlikely to support the species given the species was not detected during targeted searches; these areas considered as potential habitat are now assessed as low importance for the Yass Daisy. The proposal will not result in significant impact to this species.

11.5.3 Fauna impacts (habitat loss, collision, Alienation)

As a worst-case scenario, the proposal involves the permanent removal of up to approximately 235.93 ha of potential habitat for a variety of species, including 92 ha of forest, 26 ha of woodland, 30 ha of shrubland, 60 ha of native pasture and 23 ha of exotic vegetation. Given the proposal is linear in structure, involves narrow clearance corridors and as such does not result in large consolidated areas of clearing, the proposed habitat removal is unlikely to be considered large with respect to the remaining areas of potential habitat present throughout the project area.

11.5.3.1 Habitat loss (hollow-bearing trees)

Hollow-bearing trees are present across the project area, and may occur in all habitat types and condition classes. Using the estimates above of vegetation community extent and total clearing (Table 11-5), an approximation of the number of hollow-bearing trees that may occur within the project area and the number that may be cleared by the proposal is given in Table 11-7. The average number of hollow-bearing trees per hectare for each vegetation type is derived from hollow-bearing tree data recorded from the 35 plots surveyed.

Table 11-7 Estimates of number of hollow-bearing trees (HBT) in project area (HBT extent) and the number and percentage of total that may be cleared by the proposal

Vegetation	Av. HBT per hectare	Veg extent (ha)	HBT extent	Clearing (ha)	No. HBT cleared	Per centage of total
Forest	13.5	4,654	62,829	53	715.5	1.1%
Woodland	13.5	3,048	41,148	21	283.5	0.7%

Vegetation	Av. HBT per hectare	Veg extent (ha)	HBT extent	Clearing (ha)	No. HBT cleared	Per centage of total
Paddock	1	7,307	7,307	30	30	0.4%
Total worst-case HBT cleared			**111,284**		**1,029**	**0.9%**

Note: Forest amalgamates Argyle Apple, Brittle Gum and Scribbly Gum forest types. Woodland is equivalent to Box Gum Woodland and paddock combines Box-Gum Woodland derived grassland and native pasture.

11.5.3.2 Impacts to threatened or higher risk fauna species

Several fauna species with potential to occur or those recorded during field surveys were assessed in detail within the impact assessment of the BA and are detailed below.

Koala

The main threats to the Koala are the ongoing loss, fragmentation and degradation of habitat, vehicle strike, disease and predation by the domestic dog (SEWPAC 2013). As direct clearance of habitat for the Koala is defined to limited areas the proposal will not increase the main threats of loss of habitat and fragmentation. Furthermore, vehicle strike is not anticipated as the movement of trucks transporting turbines will be temporary and confined to the construction stage; due to steep terrain and land access trucks will be moving at slow speeds within the project area at this time. Vehicle movement will be limited during the operational phase of the project to a single 4WD vehicle for routine maintenance checks. Therefore, the proposal will also not enhance other key threats from indirect impacts of vehicle strike.

Given evidence of the Koala was not detected during the 33 RapSAT surveys, the Koala is not expected to occupy the habitat in high numbers and severity of impact is not considered to be adverse on the Koala (if it were to occur). Additionally, a substantial amount of available habitat will remain within the project area and locality and the proposal will not fragment habitat for this species. Therefore, the proposal is not considered to significantly impact on this species.

Squirrel Glider

Similar to the Koala, construction disturbance and vegetation clearance impacts will occur from the proposal, however these impacts are considered minor due to the nature of clearing and the location of clearing in the context of the available habitat remaining within the landscape. Potential habitat for the Squirrel Glider is limited to a number of proposed turbine sites and the access tracks that will connect these to the main access network (none is present in transmission line easements, the main access track network or proposed substation locations). Within the area of available habitat for this species, clearance for wind turbines will be nil in many locations and minor in other areas, as the main access tracks and turbine sites are predominantly located in cleared or non-forested areas with many tracks already 20m wide due to existing agricultural land practices. The species typically requires sufficient connectivity of tree cover within their maximum gliding distance (70m) (Van der Ree *et al.* 2003) to move through the landscape. The proposal will not fragment existing habitat given the minor amount of clearance and access tracks will be no larger than 70m wide.

In total 90 ha (41 ha of good condition) of Inland Scribbly Gum will be removed for the proposal, with 3,753 ha remaining within the project area. Given the Squirrel Glider was not detected during targeted field survey, clearance impacts are not considered to be adverse on this species, and a substantial amount of available habitat will remain within the project area and locality, the proposal is not considered to significantly impact on this species.

Golden Sun Moth

The Golden Sun Moth was observed at seven of the ten sites surveyed and approximately 200 moths were observed in total. In particular, the southern section of the site appears to support larger numbers of Golden Sun Moth, as well as the area surveyed east of RYP_72. The habitat within these sites was variable and supported a mixture of native grasses and exotic grasses including Weeping Grass, Brush-tail Spear Grass, Wattle Matrush, Wallaby Grasses and localised patches of bracken. Large areas could also be dominated by the annual *Vulpia* spp.

The locations moths were observed are currently impacted by transmission lines, access tracks and substation infrastructure, but no turbines. For these infrastructure types, the proposal has potential to primarily directly impact the emerged phase of the Golden Sun Moth during habitat clearance (i.e. not below ground other than for pole

excavation). However, as the species was detected on site in variable quality habitats it is likely it could occur elsewhere not assessed during the November 2013 survey.

Therefore, as a precautionary measure, the habitat in which the species was located and all contiguous habitat of similar structure and condition has been delineated as potential habitat. This includes all Box Gum Woodland, derived grassland and native pasture habitats across the project area. To determine the extent of impact in this habitat type and specifically quantify habitat for this species within the project area, management measures have been prescribed to undertake further preconstruction surveys of the final infrastructure layout in accordance with the relevant survey guidelines (Significant Impact Guidelines for the critically endangered Golden Sun Moth *Synemon plana;* DEWHA 2009a) for this species. The results of these surveys would be used to minimise impacts and ensure offsetting requirements, where avoidance is not possible. The management protocols for this species would be documented within a management plan, to be implemented as part of the construction process.

However, assuming the Golden Sun Moth occurs in all grassland habitats of the project area, the current total impact for this species is 66 ha. Of these habitat types, 5,887 ha is available within the project area and therefore the ability to offset impact to this species within the immediate area of proposed infrastructure is achievable. Offset sites would target better quality areas of Wallaby Grasses.

Furthermore, there are 15 known populations of the Golden Sun Moth in the general area between Yass and Boorowa, including at Rye Park (DEWHA 2009b) and this species has recently been shown to be more widespread than currently thought, particularly within the Yass Valley region. Recent survey results at another wind farm in the region (Yass Valley Wind Farm) have also shown the species to occur in high numbers (i.e. > 200 individuals). In light of the above, a significant impact to this species is not expected and impacts are considered manageable.

Striped Legless Lizard

One individual of the Striped Legless Lizard was recorded at tile plot 10 (RYP_27) in the northern section of the project area. The species was located on a grazed ridge top supporting a predominantly exotic grassland, with some native species. The Striped Legless Lizard tile surveys sampled areas of potential habitat across the project area to determine presence or absence of the species. The survey was confined to areas where potential habitat was most likely to coincide with areas to be impacted by the proposed development. As the species was detected the habitat in which it was located and all contiguous habitat of similar structure and condition has been assessed as potential habitat for this species.

Assuming the Striped Legless Lizard could occur in all grassland habitats of the project area, the total impact to potential habitat of this species is 66 ha (including Box Gum Woodland Derived grassland and native pasture habitat). Of these habitat types, 5,887 ha is available within the project area and therefore the ability to offset impact to this species within the immediate project area is achievable. To determine the extent of impact, management measures have been developed and are prescribed and include undertaking more detailed microhabitat survey of the site (referencing habitat attributes where the species was located) prior to the end of February 2014 to determine the extent of similar habitat within the project area and quantify the extent of clearance impact. These survey results would be used to minimise impacts and ensure offsetting requirements, where avoidance is not possible.

Woodland Birds

Eight threatened woodland bird species were recorded within the project area during the surveys and are detailed in Table 11-8. Table 11-8 details the amount of habitat present within the project area for these bird species and the amount likely to be impacted by the proposal. Given the habitat present for these species within the project area is substantial in comparison to that to be cleared, it is unlikely that the proposal would result in a significant reduction in habitat for these species. In addition, areas of good quality woodland or forest, including patches comprising movement corridors, have been avoided in the majority of instances. As a result woodland and forest patches would not become fragmented as a result of the proposal.

Collision with turbines is not considered a risk for these species as these species were not recorded within the rotor-swept-area during utilisation data or during general observations. These species were observed to stay below 15 m the majority of the time, with many records observed of these species on, or near the ground.

Table 11-8 Likely habitat loss impacts to threatened woodland birds recorded within the project area

Species	Habitat within project area	Total habitat (ha) within project area	Total habitat to be impacted within project area	% of total habitat to be impacted
Brown Treecreeper	Predominantly Inland Scribbly Gum Forest	3,753	90	2.4%
Diamond Firetail	Box Gum Woodland Native Pasture	7,442	91	1.2 %
Flame Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Hooded Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Scarlet Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Speckled Warbler	Inland Scribbly Gum Forest	3,753	90	2.4 %
Varied Sittella	Inland Scribbly Gum Forest	3,753	90	2.4 %
White-fronted Chat	Native Pasture	4,374	60	1.3 %

Superb Parrot

Superb Parrots were regularly observed during field surveys but results show that the parrot is common to the west of the project area, but is not moving across the ridges proposed for turbines and are not undertaking large-scale movements at higher elevations (i.e. at rotor-swept-area height) and risk of collision impact is low overall. Rather, movement nearby the project area consists of local movements within discrete areas where foraging habitat is available. Superb Parrots generally followed corridors of vegetation and flew below canopy height (i.e. less than 20 m). In particular, Rye Park Road is regularly utilised by the parrot and is considered important roadside vegetation for this species in the locality. The species was recorded in higher abundance along this road than anywhere else within the project area.

Primary flight paths appear to run in a north-south alignment along the western edge of the project area, or from the western edge of the project area further west towards Boorowa (Appendix E.4 of the BA). It is expected that Superb Parrots are moving regularly between the western edge of the project area and Boorowa (a known important breeding area for the species), but are not coming from further east of the project area.

The total clearance impact to Superb Parrot habitat (Box Gum Woodland) would be 25 ha, with 1,555 ha remaining within the project area; however, the greatest impact to this species is considered to occur where the Superb Parrot was observed regularly in one area at the southern end of the project area. This habitat coincides with proposed infrastructure of turbines RYP_106 to RYP_110 and an area proposed for a transmission line. It is possible the parrot is using the Box Gum Woodland that runs in a north to north-east direction as a movement corridor for local movements to forage and breed in this area. This is also the only location parrots were recorded flying at higher elevations (up to 50m).

However, as Superb Parrots are making localised movements in this area and staying within Box Gum Woodland habitat they are considered unlikely to collide with turbines as they are not making long range and large-scale movements. Their foraging movements comprise of tree hopping and rest-stops and it is considered the spacing of turbines at a minimum of 300 m would allow safe passage of this species within the area during these types of movement. The potential collision risk to this species overall is therefore not considered to result in a significant impact to this species, especially as the majority of the population within the locality occurs outside the project area and was observed flying within the tree canopy or below 20 m on most occasions.

Nest trees were identified for this species; however these nests are buffered by at least 600 m to the nearest turbine. Additionally, two potential nest trees were also mapped in the same vicinity. Transmission lines are proposed in the areas of identified nest trees and recommendations to apply a minimum of 100 m buffer to both

known and potential nests trees is prescribed. Tracks and transmission lines will require micro-siting with the aid of an ecologist within these areas. Impacts to known breeding resources of the Superb Parrot will therefore be avoided.

Powerful Owl and Barking Owl

Habitat for threatened large forest owls is marginal within the wind farm site, especially for the Powerful Owl. Several rounds of design layout changes have been undertaken to remove the majority of turbines away from woodland / forest areas. In recent surveys (July 2013), hollow bearing trees were mapped where they occurred within 100m of indicative turbine locations in high quality forest habitat. This survey confirmed one location only (near RYP_104) supports mature eucalypt species with numerous hollows of varying size near a proposed turbine site. This area will not require clearance for this turbine and has been identified as a high constraint area to avoid. The areas where turbines remain are unlikely habitat for these species given the lack of flora diversity and mature woodland / forest. Large hollow-bearing trees and suitable nesting and roost sites are absent in these areas. Foraging resources also appear to occur in low abundance for these owl species. While the Common Brush-tailed Possum occurs within the project area and would be a prey species, results of Koala scat searches suggest the possum does not occur in high densities given scats can be easily identified but were rarely observed within any of the Koala scat search areas. The possum was also not readily detected during 17.25 hours of spotlighting surveys across forested areas of the site.

Based on these factors (paucity of mature habitat, low abundance of prey species), the project area does not support roosting or breeding habitat and is unlikely to provide important foraging habitat, especially for the Powerful Owl. The Barking Owl is more likely to forage through the area than the Powerful Owl but no records are known for this species within at least 40 km of the project area. The proposal is therefore not considered to have a significant impact on these species.

Painted Honeyeater

Approximately 10-12 Painted Honeyeater individuals were observed foraging in Box Gum Woodland in the south of the site on a regular basis in November 2013. Individuals of this species were also observed along Flakney Creek Road (outside the project area) and west of RYP_4, however Box Gum Woodland is not widely available in the north of the site and is reduced to scattered trees, therefore the lower numbers observed at RYP_4 are reflective of the amount of available habitat. The area used by Painted Honeyeaters in the south of the project area also corresponds to the Box Gum Woodland habitat being used by Superb Parrots. As mentioned for Superb Parrots, a transmission line was proposed for this area but has been removed from the layout to avoid the better quality Box Gum Woodland within the site; most of the records observed for this species were in this area and consequently the majority of habitat utilised by this species has been avoided. The remaining Box Gum Woodland habitat will be affected by the existing transmission lines but this area is highly fragmented and trees supporting mistletoe are in lower abundance (i.e. scattered across paddocks). Recommendations have been made to micro-site the transmission line in areas of Yellow Box trees supporting mistletoe in this area to avoid further impact to potential foraging resources for this species. The impact of the proposal to Box Gum Woodland habitat for this species is therefore considered low.

Swift Parrot (Migratory)

The Swift Parrot was not recorded within the project area during targeted field surveys. The species migrates to the Australian south-east mainland between March and October to forage. During the non-breeding season this Swift Parrot feeds extensively on nectar and lerp and other items from eucalypt foliage. Mugga Ironbark (*E. sideroxylon*), Red Ironbark (*E. tricarpa*), Yellow Box (*E. melliodora*), White Box (*E. albens*), Grey Box (*E. macrocarpa*) and Yellow Gum (*E. leucoxylon*) are important sources of nectar in the box-ironbark forests and woodlands of NSW (Kennedy & Tzaros, 2005). Of these feed trees only two are known for the project area, Yellow Box and Mugga Ironbark. Yellow Box is located within Box Gum Woodland habitat as scattered trees. Mugga Ironbark is rare to the project area and was only identified in one location in the north of the site as scattered individuals; this area will not be impacted by the proposal. In general, the areas surveyed are heavily degraded and exist as either open woodland over grassland (with no mid- or understorey stratums) or as derived grassland with scattered trees. The abundance of flowering feed trees within the project area for the Swift Parrot are therefore low in abundance and the species is more likely to use roadside vegetation or larger remnants where greater diversity of feed trees are present.

As impacts to Box Gum Woodland have been largely avoided in the project design and little habitat is present within the project area for the Swift Parrot, apart from those areas targeted for survey in July 2013 in which the species was not detected, the project area is not considered to support an important foraging area for this species.

White-throated Needletail (Migratory)

White-throated Needletail was not recorded during surveys, but based on records in the Atlas of Living Australia there is potential for the species to occur. The species is a seasonal migrant present in Australia outside of breeding season, and may occur in large flocks foraging aerially at heights of up to 1,000 m above the ground (SEWPAC 2012). As the species breeds overseas, the potential for impact would be upon migration resulting in potential collision risk during the operational phase of the wind farm. It appears to collide with wind turbines in some areas and the species has been affected at other wind farms around eastern Australia, with one Bird Monitoring Report recording that "no other non-raptor species had more than four mortality events over the 3 year period" (Roaring 40s Renewable Energy 2010).

Based on the collision data from literature, on average there may be around four collisions of White-throated Needletails per year at Rye Park. Although the species' total population is unknown, it is thought to be abundant in areas where it is found (SEWPAC 2012). Given this species was not detected during surveys, and the huge area of occupancy of this species, the Rye Park wind farm is unlikely to affect an ecologically significant proportion of the population.

Regent Honeyeater (Migratory)

The Regent Honeyeater was not detected during bird surveys of the project area and the project area is not considered to support primary breeding and foraging habitat (i.e. wetter areas supporting Box-ironbark Eucalypt associations or feed trees). Two species of mistletoe were recorded on site, but are not widely distributed and occur in low densities. However, as this species is nomadic and movement patterns are often linked to availability of resources, it can be assumed that they may travel through the project area to other foraging grounds. Therefore it is considered there may be a potential operational risk of blade-strike to this species; however, at the time of survey this species was not observed to utilise the project area.

Records across NSW indicate a strong presence of this species to the south, east and north-east of the project area in better quality habitat (i.e. National Parks) and could be considered an important landscape connection. This area traverses Namadgi NP, Morton NP, Nattai NP and Blue Mountains NP. It is expected the movement of this species would commonly occur through this connection where better quality foraging resources exist.

Given the species was not detected during bird surveys and the species distribution does not show it to commonly occur within the project area, the impact of the proposal to this species is therefore considered low.

Rainbow Bee-eater (Migratory)

The Rainbow Bee-eater inhabits a variety of habitats including open woodlands, it also occurs in riverbanks, sandspits, road cuttings, beaches and golf courses. The species is a summer breeding migrant (Sept-Apr) to south-eastern Australia, but winters in northern Australia, Solomon Islands, PNG and Indonesia, moving in large flocks (SEWPAC 2012). This species was detected outside the project area to the west on Flakney Creek Road. Potential habitat for this species is present on site and this species is considered most at risk from blade-strike during operation. However, as the Rainbow Bee-eater is a common and secure species and widespread within its Australian and global distribution and given the high manoeuvrability of the species it is considered unlikely that the proposal would result in impact such that there would be a population scale effect on the Rainbow Bee-eater.

Wedge-tailed Eagle and Little Eagle

Although Wedge-tailed Eagle (*Aquila audax*) does not have a rating under legislation, it is recognised as an at risk and flagship raptor species in relation to wind farm developments. As mentioned, Wedge-tailed Eagles exhibit a lower collision avoidance rate than other species of birds. Reasons for this including size, manoeuvrability and hunting style are discussed in the literature. If turbines are placed within the core territory of an individual Wedge-tailed Eagle, for example, then the likelihood of a collision is greatly increased for this individual due to the high proportion of flights made within the rotor-swept area by the species and their regular use of updraughts in certain landscape positions (often coinciding with turbine placements). To minimise risk to Wedge-tailed Eagles, proposed turbine locations at Rye Park were classed as high or moderate risk based on landscape position, such as on an

escarpment, at the head of a valley or atop an isolated peak away from other turbines. Turbines in high risk locations have been moved in the design phase of the project (refer to Section 11.7.1).

Little Eagles were not recorded during surveys at Rye Park but are known to occur in the locality. The species it is a medium sized raptor with similar soaring and prospecting foraging behaviour (Aumann 2001) as the Wedge-tailed Eagle and may be similarly at risk from turbines in certain landscape positions. Should a Little Eagle forage or nest in the project area, the proposal has potential to affect the species during the operational phase. As no Little Eagle nests were found within 100 m of surveyed proposed turbine locations, the risk to fledging Little Eagles is considered low. Adult birds, including raptors, have generally shown an ability to habituate to the turbines by taking avoidance action around rotors or by modifying their behaviour (such as approach a root at the head of a gully from below rather than above – EBS Ecology 2012). It therefore appears unlikely that a viable local population of Little Eagle at Rye Park would be placed at risk of extinction from the wind farm proposal.

Eastern Bentwing Bat

The Eastern Bentwing Bat is reported to be a fast and direct flier that forages above the canopy and in open areas and will travel up to several hundred kilometres to over-wintering roosts (Churchill 2008, Lloyd *et al.* 2006), which place it at risk of collisions. Thirty-six calls of the Eastern Benting Bat were recorded within the project area primarily within Inland Scribbly Gum Forest along the ridgeline supporting turbines RYP_80 to RYP_143. This habitat type is considered the most suitable within the project area for temporary roosting sites and a total of 90 ha will be removed, with 3753 ha remaining within the site boundary.

Given the mobility of the species it could forage anywhere within the project area, and the relatively small areas of forest, woodland and grassland habitat to be removed or modified over the project area are not considered to adversely affect the foraging ability of this species. The species is considered more at risk from the proposal from potential collision with operational turbines. The flight height and migratory movements of this species make it potentially vulnerable to blade-strike.

The risk of the proposal impacting on breeding populations (i.e. maternity caves) is low as the nearest maternity cave is 40 km away. There is a staging area and maternity cave in the region (near Bungendore approximately 65 km away and Wee Jasper approximately 40 km away, respectively) for Eastern Bentwing Bat; these are used by a large proportion of the female and juvenile population. It is possible that the local population of Eastern Bentwing Bats may spike slightly when a large proportion of the female and juvenile population migrate to and from the maternity cave (November and February-March); however Anabat results were recorded within November 2011 and 2013 and suggest a relatively low abundance of this species within the project area at this time.

It appears unlikely that the local population would be placed at risk of extinction from the wind farm proposal given that the proposal is not near Wee Jasper or the Bungendore staging area and a relatively low number of calls of this species were detected. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Yellow-bellied Sheathtail Bat

Four calls of the Yellow-bellied Sheathtail-bat were recorded within the project area within one location. Although this species occurs across much of Australia, it is never found in large numbers. The species migrates from northern Australia into south-eastern Australia during the summer months (Churchill 2008), but as it flies predominately above the tree canopy, it is rarely trapped or detected via AnaBat. This species is considered an occasional seasonal visitor that may roost temporarily in tree hollows within the project area. The flight height of this species make it potentially vulnerable to turbine strike, however given it is an infrequent visitor, the overall risk to the species is considered low. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

White-striped Freetail-bat and Gould's Wattled Bat

Although the White-striped Freetail-bat does not have a rating under legislation, it is recognised as an at risk bat species in relation to wind farm developments due to their foraging and flight behaviour. The White-striped Freetail Bat is a relatively large microbat that pursues prey in open air above canopy height (around 50 m above ground – within RSA) at high speed (up to 60 km per hour). Due to speed and wing structure, they are not a highly manoeuvrable bat (Churchill 2008). While White-striped Freetail Bats occupy a wide range of habitats including

woodland, forest, agricultural land and grasslands (Churchill 2008), habitat preferences are correlated with open areas in canopy gaps and along the edge of vegetation and it is more active on upper slopes (Lloyd *et al.* 2006).

Like the White-striped Freetail Bat, the Gould's Wattled Bat does not have a rating under legislation, but it is a relatively large microbat and a fast, high flier with restricted manoeuvrability (Herr 1998) the may put it at higher collision risk. This species hunts most in the sub-canopy and along flyways, particularly on upper slopes (Lloyd *et al.* 2006), so turbines located between closely linked patches of bush or within patches are likely to present the highest risk to Gould's Wattled Bat.

While these species are not threatened they should also be a focal species of an operational Bird and Bat Management Plan. Management measures to reduce risk to common species will also be considered at the operational stage of the proposal.

11.5.4 Fauna alienation or barrier effects

Each bird species and/or individuals response to turbines is likely to differ based on their own sensitivities or tolerances. There have been no published studies of the effects of wind farms on the behaviour of Australian birds, so it is difficult to evaluate the extent to which bird communities will be adversely affected. The distance over which disturbance effects can extend from a wind farm varies considerably. A distance of 600 m is often reported as the zone of disturbance around turbines, however this ranges, e.g. from 80 m (for a grassland songbird), to 800 m (for waterfowl) and 4 km (for seabirds) (Sharp 2010).

The most obvious approach to mitigate the risks posed by a wind farm on bird movements and behaviour would be to space turbines at a distance that allow birds to fly between them. There are no generally accepted minimum separation distances for turbines. The Rye Park layout has two distinct areas of turbines with a spacing of approximately 5 km between them, and in specific areas clusters of turbines are separated by at least 1 km to the next cluster. Spacing between individual turbines within clusters in the current layout is generally around 300 - 500m. There is no evidence to suggest that this spacing is sufficient to manage the risk of potential bird strike, but it is generally considered that the greatest the distance allowed between turbines, the better. For the majority of birds recorded within the project area, such as woodland birds which were not recorded to make large movements above the canopy, the distance between turbine clusters and also the distance between individual turbines is likely to allow for safe bird passage between turbines, without creating a barrier effect. Additionally, the arrangement of turbines into clusters in may better enable birds to use the gaps between turbine clusters when travelling across the landscape.

11.5.5 Indirect and peripheral impacts

As well as direct impacts already discussed, ecological impacts may arise from vehicle access and parking, materials laydown and stockpiles. Peripheral impacts may include:

- smothering of vegetation;
- soil compaction and erosion;
- introduction and spread of weed species;
- pollution associated with the generation of dust and use of concrete, fuels and lubricants and construction chemicals; and
- noise, vibration and activity during construction phase.

With the implementation of specific measures for these peripheral impacts such as weed control, erosion and sediment control, these risks are considered manageable. Further it is noted that indirect impacts are likely to be of low magnitude temporally and spatially, considering the spread out pattern of infrastructure proposed.

11.5.6 Cumulative impacts

There are a number of developments including wind farms in the region and the proposal may contribute to cumulative impacts from vegetation clearing and operational or alienation effects. In terms of operational impact, there are three operating wind farms within approximately 50 km of the project area. These comprise a total of 54

wind turbines (Cullerin Range Wind Farm: 15, Gunning Wind Farm: 31, Crookwell Wind Farm: 8). Several other wind farms are proposed within approximately 60 km of the project area including Rugby Wind Farm, Bango Wind Farm, Conroys Gap Wind Farm, and Yass Valley Wind Farm). The cumulative operational impact of these wind farms is unknown. The difficultly in drawing conclusions about cumulative operational risk is highlighted in a report commissioned by the Commonwealth Department of Environment and Heritage (Biosis 2006), *Wind Farm Collision Risk for Birds: Cumulative Risks for Threatened and Migratory Species* (species considered included Swift Parrot and Tasmanian Wedge-tailed Eagle).

Biological impacts of wind farms can be far-reaching, because of the mobility of migratory, nomadic and territorial fauna species such as bats and birds, with the biggest concern stemming from potential bird and bat collision with operating turbines (Parsons & Battley 2013). The operational and proposed wind farm localities in the district may involve overlapping raptor territories and bird and bat migration routes. However, based on the available habitat which has primarily been cleared in the local area and elsewhere in the district (especially to the west), and the absence of major wetlands, with the closest being Lake Burrinjuck (approximately 47 km to the south-west), the project site is not likely to be located on a major migratory route for wetland birds, seasonally migrating birds or microchiropteran bats. Visits from migratory or nomadic species are expected to be infrequent and sporadic. Additionally, given the low rate of raptor bladestrike recorded at other Australian wind farms, as well as the more recently documented avoidance of turbines by Wedge-tailed Eagles at three wind farm sites in northern Tasmania (Hull & Muir 2013), mortalities are not expected to affect local or regional populations by outstripping the reproductive capacity of any species. The location of the proposed wind farm turbines on largely cleared ridgetop sites already compromised from long-term grazing, coupled with avoidance of clearing good condition woodland, should restrict the potential to affect locally declining woodland or wetland species.

For these reasons, the proposal is not expected to significantly add to the collective impacts of wind farms in the region nor is it expected to significantly affect migratory species such that whole populations would be at risk. However, if the ongoing monitoring and assessment of the operational impacts of all wind farms operating in the region becomes publicly available, the data should be reviewed to ensure cumulative impacts remain within acceptable limits. An adaptive monitoring and management program would be implemented to ensure that any unforeseen impact on bird or bat species are detected and addressed in a timely manner.

11.6 Conclusion of Impact Assessment

Based on the extent of clearance associated with the proposal, impacts arising from the wind farm upon the EEC and species known and likely to occur in the project area are manageable and unlikely to be significant. Further survey is required for the Golden Sun Moth and Striped Legless Lizard to validate this assessment. Further surveys have been prescribed for these species and will ensure that the project is responsive to the results (exclusion zones or management prescriptions, as required). Those species considered to be most affected by the project occur within Box Gum Woodland or grassland habitats. The worst-case scenario for clearing of these habitats is estimated at 66 ha (including poor condition vegetation), with a total of 5,887 ha remaining indicating the ability to offset impact to these species within the immediate project area is achievable. Assessments of Significance are provided in Appendix C of the BA for those species considered most at risk for the proposal to further support the conclusions of the above impact assessment. Assessments of Significance were undertaken for the following species:

- Box Gum Woodland;
- Yass Daisy;
- Golden Sun Moth;
- Striped Legless Lizard;
- Superb Parrot;
- Painted Honeyeater;
- Regent Honeyeater;
- Little Eagle;
- White-throated Needletail;

- Eastern Bentwing-bat; and
- Yellow-bellied Sheathtail-bat.

Impacts have been avoided where possible through design changes based on information and constraints and recommendations have been given to confirm assumptions made in the assessment and further minimise and manage impacts during the final design, construction and operational phases of the wind farm.

Presently, the land in the project area is agricultural utilised for production which has been subject to prior clearing. The management measures and offsets presented in this report provide an opportunity to arrest existing pressures in the project area such as weeds, and conserve a portion of land for biodiversity outcomes resulting in a positive gain.

11.7 Management Measures

11.7.1 Measures to avoid impacts

The proponent has undertaken several reviews of layout revisions to avoid impacts in areas identified as a high constraint in **ngh**environmental (2012) and subsequent correspondence. Design measures to avoid impacts associated with vegetation clearing including loss of Box Gum Woodland EEC and connectivity, are given in Table 11-9. Design measures to avoid blade-strike impacts associated with the operational phase of a wind farm including proximity to nest trees, are given in Table 11-10. These design measures are already part of the proposal. Recommendations given in Section 11.7.2 are supplementary to the design measures incorporated by the proponent.

Table 11-9 Design measures by the proponent to avoid vegetation clearing in areas identified to have a high risk of impact to threatened ecological communities or species

Constraint type	*Design measures to avoid impact*
EEC: Box Gum Woodland	The following turbines moved out of Box Gum Woodland remnants: RYP_14, RYP_111, RYP_116 and RYP_108. At least 4 km of transmission line in the southern section of the project area in the vicinity of RYP_120 removed. Proposed substation in the south-east corner of the site moved.
Fauna habitat: Patch size and integrity	RYP_36, RYP_53 moved to a 50 m buffer from high conservation value fauna habitat
Fauna habitat: Connectivity	RYP_59, RYP_55, RYP_54, RYP_60 removed from layout due to high conservation value fauna habitat. RYP_64, RYP_107 moved to a 50 m buffer from high conservation value fauna habitat.
Fauna habitat: Key features	RYP_96 moved slightly but still within high conservation value fauna habitat.

Table 11-10 Design measures by the proponent to avoid high and moderate operational risks to bird and bat species

Operational constraint types	*Risk description*	*Design measures to avoid impact*
High risk locations		
Proximity to nests	Proximity to Wedge-tailed Eagle nest tree: RYP_91, RYP_92. Proximity to Superb Parrot nest tree: RYP_117, RYP_118.	RYP_91 removed from layout. RYP_92 shifted further south.
Proximity to Superb Parrot, Painted Honeyeater habitat. Potential habitat for Golden Sun Moth and Striped Legless Lizard.	Transmission line in the southern section of the project area in the vicinity of RYP_120 traverses good quality Box Gum Woodland habitat used by these species.	132 kV transmission line in part of this area removed from layout.
Landscape position	RYP_10 was a high risk to all birds that may fly in the rotor sweep area because of isolated position	RYP_10 has been removed from layout and replaced by RYP_16.

Operational constraint types	*Risk description*	*Design measures to avoid impact*
	on a low hill between two much taller ridges.	
Landscape position	These two turbines were outliers from the rest of the layout and were positioned on peaks in a key movement corridor.	Turbines have been relocated to be within the main layout area.
Moderate risk locations		
Landscape position	Turbines in higher risk locations for blade-strike such as along an escarpment or at the head of a valley	RYP_28-30, RYP_32, RYP_36, RYP_41, RYP_52, RYP_56, RYP_83 have been repositioned in line with the recommendation to move turbines back from heads of valleys or escarpments.
Layout position	Turbines in higher risk locations such as isolated (>800 m) from other turbine clusters.	RYP_113 and RYP_115 removed from layout, repositioned to RYP_124 and RYP_145.
Proximity to Bango Nature Reserve	Proximity to Bango Nature Reserve.	Turbines shifted for a 70 m buffer from reserve.

11.7.2 Measures to minimise impacts

Mitigation measures recommended to minimise impacts during the design, construction and operational phase of the wind farm proposal are highlighted in Table 11-11. These measures to minimise impact were developed to ensure potential impacts are minimised at: 1) a broad level in which general management or control measures can be applied to the entire proposal; or 2) at a defined level in which management or control measures can be applied to particular areas, individual species, faunal groups, or a vegetation type.

In particular, a Flora and Fauna Management Plan as well as an adaptive Bird and Bat Management Plan should be prepared prior to construction. These management plans would focus on migratory and at risk bird and bat species, and any threatened species found during further survey work. Particularly, the latter is required to address inherent uncertainty related to bird and bat collision risks at this site. Management strategies for the construction phase of the proposal need to be developed and incorporated into the Flora and Fauna Management Plan. Prescriptions for inclusion in the plan are set out in the tables below. These measures are required to ensure a significant impact is avoided.

The construction footprint should be kept to a minimum for least impact on flora and fauna. The proponent commits to upfront offset ratios before clearing proceeds which is an incentive to achieve 'minimal clearance' during the detailed design and construction phases.

11.7.3 Measures to offset impacts

Measures to offset impacts are provided within Table 11-12 to ensure that an overall 'maintain or improve' outcome is met for the proposal; where impacts cannot be avoided, or sufficiently minimised, the residual impact will be offset in perpetuity. Appendix F of the BA details the biodiversity offset principles developed by the former DECCW (now OEH) and how these guide the identification and management of the offset site. Appendix F of the BA also details how offsets are proposed to be identified, managed, and the offset ratios to be applied. An Offset Plan would be developed with input from OEH and the CMA and finalised prior to any construction impacts.

The Offset Plan would achieve:

- For common vegetation types a ratio of approximately 1:2 (cleared: offset) is proposed. Where vegetation is listed as an endangered community, such as the Box Gum Woodland EEC, a ratio of 1:5 to 1:10 (cleared:offset) is proposed, depending on the quality of habitat.
- Hollows removed would be offset at a ratio of 1:1 (offset site vegetation must contain the same number of hollows, artificial hollows may need to be installed to achieve this ratio).

- The offset site would be protected in perpetuity and appropriate management actions attached to the land title. For example, fencing and signage maintained, minimum biomass to be retained (through controlled grazing if appropriate), regular weed control and pest fauna management.

11.7.4 Decommissioning Phase

A flora and fauna management plan would be developed prior to decommissioning to manage decommissioning impacts on biodiversity values. Biodiversity investigations would be required prior to decommissioning, to update the knowledge of site attributes and evaluate specific impact types (given the life span of the proposal is in the order of 30 years) and to minimise biodiversity impacts related to the removal of infrastructure. New measures to avoid and mitigate impacts may be required depending on: 1) the results of the investigation; and 2) outcomes of the monitoring programs implemented during the operational phase of the proposal. Any implementation of a rehabilitation plan would consider the implemented plans and the environment at the time of decommissioning.

Table 11-11 Design measure to avoid and minimise impacts for Rye Park Wind Farm

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
Design Phase						
General measures	Project area	N/A	Ensure all infrastructure will be sited entirely within the areas assessed in the Biodiversity Assessment.	After final alignments / development envelopes confirmed	• If infrastructure is required outside of the areas surveyed in this biodiversity assessment, more survey and assessment in this area will be required.	Avoid
General Measures	Project area	High risk birds and bats	Turbine infrastructure design to minimise operational impacts on birds and bats.	Prior to operation	• If possible, red flashing lights[3] should be fitted to turbine towers to reduce insect attraction and potentially night-flying birds. • No guy lines to be fitted to turbine towers. • Flags and/or marker balls to be fitted to wind monitoring mast guy lines • Turbines (e.g. nacelles) should minimise perching opportunities.	Minimise
Striped Legless Lizard habitat	Identified areas of potential habitat for the Striped Legless Lizard (i.e. all grassland habitats)	Striped Legless Lizard	Further targeted survey in all grassland habitat of the project area to avoid and minimise impacts.	Prior to construction (February 2014)	• Undertake more detailed micro-habitat survey of the site (referencing habitat attributes where the species was located) prior to the end of February 2014. • Use survey results to minimise impacts and ensure offsetting requirements, where avoidance is not possible. • Document management protocols for this species within a management plan, to be implemented as part of the construction process.	Avoid, minimise, offset
Superb Parrot nest trees and impacts to breeding, Painted	Where all nests trees and Painted Honeyeater records identified in	Superb Parrot	Avoid impact to known and potential nests trees and construction impacts during	Prior to construction (for avoidance of nests trees); During construction	• Maintain a 100 m buffer around identified and potential Superb Parrot nest trees (refer Appendix E.4 of the BA) in the southern section of the project area. • Micro-site all transmission lines and access tracks near	Avoid, minimise

[3] Although lighting effects are poorly understood at this time, migrating birds and bats appear to be attracted to steady burning lights and red flashing lights are said to decrease insect activity and reduce bird and bat activity at turbines.

Item	*Area*	*Target Species*	*Objective*	*Timing*	*Proponent Commitment*	*Avoid or Minimise Impact*
Honeyeater foraging habitat	Appendix E.4 of the BA.		breeding period for the Superb Parrot. Avoid impacts to foraging habitat (Yellow Box) for the Pained Honeyeater.	(for no clearance near nests trees during this time)	known nest trees and Yellow Box trees between RYP_110 and RYP_120.	
Raptor nest trees	Where all nests trees identified in Appendix E.4 of the BA.	Wedge-tailed Eagle, Nankeen Kestrel	Avoid impact to known nests trees.	Prior to construction	• Maintain a 100 m buffer around identified nest trees.	Avoid
Good condition fauna habitat	Project area	All species, primarily threatened woodland birds	Avoid impact to woodland and forest habitat.	Prior to construction	• Maintain a 70 m buffer around turbines in good condition fauna habitat, especially turbines RYP_17 in the north of the project and turbines near Bango NR (RYP_123 & RYP_126).	Avoid
Construction Phase						
Golden Sun Moth habitat	Identified areas of potential habitat for the Golden Sun Moth (i.e. all grassland habitats)	Golden Sun Moth	Further targeted survey in all grassland habitat of the project area avoid and minimise impacts.	Prior to construction	• Undertake preconstruction surveys of the final infrastructure layout in accordance with the relevant survey guidelines (Significant Impact Guidelines for the critically endangered Golden Sun Moth *Synemon plana;* DEWHA 2009). • Results of these surveys used to minimise impacts and ensure offsetting requirements, where avoidance is not possible. • Document management protocols for this species within a management plan, to be implemented as part of the construction process.	Avoid, minimise, offset
Box Gum Woodland and Good quality fauna habitat	Project area, particularly good condition EEC/CEEC between RYP_110 and RYP 120 and within transmission line south of RYP_110	Box Gum Woodland areas and threatened species	Prevent unauthorised clearance. Minimise track and transmission line impacts in areas of high conservation value.	During construction	• Clearly define works areas nearby or within Box Gum Woodland areas to strictly defined permitted clearance zone. • Minimise track width, where possible, to the minimum required for safe access and operation. • Install the 33kV powerlines (co-aligned with roads) as underground, where possible. • Removal of topsoil and subsoil for trenching to be	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
					replaced and revegetate disturbed areas with local native grasses (i.e. Kangaroo Grass, Wallaby Grass or Spear Grass).	
Woodland bird habitat	Around the transmission line and turbines near RYP_102-110	Brown Treecreeper, Diamond Firetail, Flame Robin, Hooded Robin, Scarlet Robin and Speckled Warbler	Minimise track and transmission line impacts in areas of high conservation value for these species.	During construction	• Clearly define works areas nearby this area. • Micro-site all infrastructure in this location with the input from an ecologist.	Minimise
Hollow-bearing Trees	Project area where targeted hollow-bearing tree survey not previously undertaken	Threatened hollow dependent fauna	Targeted hollow-bearing trees survey to accurately record the number of hollows to be cleared to ensure impacts are offset.	After final alignments / development envelopes confirmed	• Pre-clearance survey within final development envelope and alignment for hollow-bearing trees. • Infrastructure micro-sited to avoid hollow-bearing trees, where possible. • For hollow-bearing trees to be cleared a management plan should be prepared by an ecologist detailing: procedures to minimise impacts to, and relocate resident fauna; timing of works to avoid breeding periods, where possible; number and type of hollow-bearing trees to be removed and offset (to be included in Flora & Fauna Management Plan). • Where hollow-bearing trees are to be cleared a standard pre-clearance survey, such as that described in *Biodiversity Guidelines* (**ngh**environmental / RTA 2011), should be undertaken and details of hollow-bearing trees cleared including number and size of hollows and number of hollow-bearing trees recorded.	Minimise
Reptile Species habitat	Project area	All reptiles, primarily Pink-tailed Worm-lizard	Pre-clearance surveys in Box Gum Woodland and native pasture to identify rocky outcrops for avoidance, where possible.	During construction and as required	• Turbines and infrastructure would be micro-sited to avoid rocky outcrops in this habitat, where possible. • Where rocky outcrops cannot be avoided, replace rock in nearby areas in consultation with an ecologist. • Fallen timber > 50cm to be left in place or moved to a nearby area to retain fauna habitat.	Minimise
General Measures	Project area	All species and vegetation communities	Minimise clearance and disturbance.	During construction and as required	• Clearly define works areas and restricting impacts to these. Including vehicle and equipment parking and access routes. • Co-locating underground and overhead 33kV powerlines	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
					with the track network to minimise additional impact area, where possible. • Establish construction compound in a disturbed area. • Use disturbed areas for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and deposition and retrieval of spoil, wherever practicable. • Fill in trenches as soon as possible. Trenches left open overnight to be inspected at first light for trapped fauna. Trapped fauna to be released appropriately in a nearby location. • Hollow-bearing trees and sensitive features to be retained to be communicated to staff via inductions and other methods.	
Riparian Area Management	Project area	All species and vegetation communities	Minimise clearance and disturbance.	During construction	• Creek crossing to be designed in accordance with: NSW Fisheries Policy and Guidelines for Fish Friendly Waterway Crossings (2003). • Creek works not to be undertaken when heavy rain is forecast and should be avoided when there is flow. • Implement sedimentation and erosion controls in accordance with best practice guidelines.	Minimise
Weed Management	Project area	All species and vegetation communities	Pre-construction inspection for noxious weeds within project area. Prevention of spread of weeds and pathogens. Weed monitoring.	Before commencement of works and as required Monitoring – late spring / early summer after construction	• Control noxious weeds in works area according to plans and control measures of the LGAs. • Minimise use and adhere to best practice guidelines for herbicide treatment in environmentally sensitive areas (i.e. Box Gum Woodland). • Establish a machinery hygiene plan to ensure vehicle and machinery is absent of organic matter pre- and post-site access. • Sign environmentally sensitive areas (i.e. CEEC areas) and designate clean-down area for entry / exit points into these areas. • Monitoring and weed control in areas of known noxious or invasive species. • Understorey vegetation in easements should be managed to maintain composition and quality to prevent	Minimise

Item	*Area*	*Target Species*	*Objective*	*Timing*	*Proponent Commitment*	*Avoid or Minimise Impact*
					weed invasion	
Pollution Prevention	Project area	All species and vegetation communities	Prevention of contaminants and erosion outside works zones.	As required	• Establish a spill plan to prevent chemicals or pollutants from having an adverse effect on the environment. • Backfill cable trench where cement is used; at least 20 cm of cement free topsoil to be replaced as the top layer in the back fill. • Establish an erosion and sediment control plan so appropriate controls are in place prior to commencement of works.	Minimise
Site Management	Project area	All species and vegetation communities	Stabilisation of soil, rehabilitation and revegetation to be undertaken progressively to re-establish ground cover.	As required	• Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by exotic groundcover species. Sow with an appropriate cover crop in consultation with land owners. • Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by native grasses using local provenance species. • Fertiliser should not be used to promote revegetation in areas dominated by native grasses.	Minimise
Operational Phase						
Flora & Fauna Management Plan	Project area	All species and vegetation communities	To avoid significant impact to flora and fauna outside of the accepted clearance boundaries and prevent 'unassessed' impacts occurring.	Implement prior to construction	• An ecological professional to develop and implement a Flora and Fauna Management Plan to report on and manage impacts. • The management plan should highlight ecological important areas (vegetation communities and threatened fauna species habitat) and their management. • Specific areas requiring monitoring or management should be highlighted as well as timing for monitoring. • Weed species should be highlighted along with prescriptions for their management.	Minimise
Adaptive Bird & Bat Management Plan	Project area	Superb Parrot, Painted Honeyeater, Regent Honeyeater, Wedge-tailed Eagle, Little Eagle, Eastern	Development of an 'insurance' monitoring program to address uncertainty inherent in the assessment.	Implement prior to construction. Survey and monitor during 'high risk' periods, when species may be	• An ecological professional to develop and implement a Bird and Bat Monitoring Program to report on, and manage impacts with potential to be significant. • Monitoring surveys should include an understanding of breeding activity (i.e. nest locations) and foraging	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
		Bent-wing Bat, Yellow-bellied Sheathtail-bat, Gould's Wattled Bat and White-striped Freetail Bat.		moving through or foraging in the area	movements. • Baseline (pre-construction) and operational collision and abundance data would be collected, focused on higher risk species and higher risk locations in order that actions can be taken to address unforseen impacts, should they occur. • Management Plan methods would utilise AusWEA (2006) best practice guidelines. • Management Plan should include management response options (i.e. restriction of lambing on ridges with high raptor activity to reduce collision risks) to be implemented where significant impacts are anticipated.	
Habitat Connectivity	Transmission Line Easement	All common species, as well as threatened fauna, particularly threatened parrots, gliders and bats	Minimise fragmentation of landscape connectivity.	After construction	• Promote growth of vegetation under the transmission line to the maximum allowable height to maintain fauna habitat connectivity. • Understorey vegetation in easements should be managed to maintain composition and quality to prevent weed invasion. • Near areas of intact woodland or forest a spacing of 600m should be considered for turbines.	Minimise

Table 11-12 Offset measures to maintain or improve biodiversity for Rye Park Wind Farm

Item	Area	Target Species	Objective	Timing	Proponent Commitment
Construction Phase					
Development of offset strategy and offset plan	Project Area	Box Gum Woodland, Hollow-bearing trees, Threatened species habitat	Proponent will develop an offset plan to offset all permanent native vegetation removal to maintain or improve biodiversity in the longer term.	Prior to construction	• Develop an offset strategy and finalise prior to any construction impacts an ecological professional, in accordance with Appendix F of the BA. • Develop an offset plan prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site. • Ensure the offset strategy complies with the *Principles for the use of biodiversity offsets in NSW* guidance document. • The offset ratio will be determined with reference to: the conservation status of the vegetation, the condition of the vegetation, and the actual threatened species habitat value lost (i.e. known threatened species habitat, not potential habitat). • Where vegetation is listed as an EEC, a ratio of 1:5 to 1:10 is proposed, depending on quality of habitat. • Where non-threatened vegetation is cleared an offset ratio to be applied at 1:2. • Where hollow-bearing trees are to be cleared and cannot be avoided an offset ratio to be applied at 1:1 and is supplementary to other areas offset. • Include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.

12 Aboriginal and European Heritage

12.1 Overview

New South Wales Archaeology Pty Ltd has conducted an Aboriginal and European cultural heritage assessment of the proposed Rye Park Wind Farm.

The assessment has been conducted in accordance with the Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC, 2005), the NSW Office of Environment and Heritage's Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH, 2011a) and Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010b).

The study has sought to identify and record Aboriginal cultural areas, objects or places, assess the archaeological potential of the proposal areas, and formulate management recommendations based on the results of the community consultation, background research, field survey and a significance assessment.

12.2 Aboriginal Consultation

A process of Aboriginal community consultation has been undertaken in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW DEC July 2005) and OEH's *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a).

The registered Aboriginal parties for this project are:

- Buru Ngunawal Aboriginal Corporation
- Gundungurra Aboriginal Heritage Association Inc
- Carl and Tina Brown
- Gunjeewong Cultural Heritage Aboriginal Corporation
- Onerwal Local Aboriginal Land Council

An outline of the scope of the project, the proposed cultural heritage assessment process and the heritage assessment methodology was forwarded to the registered parties following receipt of their registration of interest. No responses were received from registered parties in regard to the consultation process and methodology. However, Wally Bell, Buru Ngunawal Aboriginal Corporation, provided valuable information in regard to the archaeological sensitivity and potential of the study area. Sharyn Halls, Gundungurra Aboriginal Heritage Association, discussed her ancestors' connections to Blakney Creek, located in the local area.

For review and comment, a copy of the draft cultural heritage report was forwarded to the registered parties; no responses were received at the time of submitting this EA.

12.3 Results

A search of the NSW OEH Aboriginal Heritage Management Information System (AHIMS) has been conducted for this project on the 11 April 2012 (Client Service ID: 67566). The search area measured 756 km² and encompassed the area between eastings 672000 – 690000, and northings 6147000 – 6189000.

Three Aboriginal object sites, none of which are in the proposed impact area, are recorded on AHIMS as present in the search area. The most common Aboriginal object recordings in the region are distributions of stone artefacts. Rare site types include rock shelters, scarred trees, quarry and procurement sites, burials, stone arrangements, contact sites, carved trees and traditional story or other ceremonial places. Searches have been conducted of the NSW State Heritage Inventory and the Australian Heritage database. No Aboriginal heritage sites are listed on these as being in the proposed activity area.

One previously recorded Aboriginal site, AHIMS #51-4-0058 is located along Flakney Creek Road near to the project boundary. The original recording indicates artefacts on the road, spread over a distance of 181 metres (x 5m wide). This site was inspected during the current study. Artefacts were found distributed along the edge of the road. No exposures were present off road, however, artefacts would be present across the broader toeslope landform in low

density and a relatively undisturbed context. It is possible that this site could sustain impacts if the road were to be upgraded for site access during construction of the wind farm.

Thirteen Aboriginal object locales were recorded during the field survey, 10 of which are single stone artefacts. Undetected or subsurface stone artefacts are predicted to be present in extremely low density. In addition, three quartz outcrops have been recorded which may have been used as stone procurement areas (SPAs) by Aboriginal people. Establishing the artifactual status of these has not been possible based on a visual assessment alone. However, as a precautionary measure it is recommended that they be avoided during construction by implementing a strategy of micro-siting of turbines, roads etc. Three European heritage items have been recorded, and while these do not warrant heritage listing, it is recommended that they also be avoided by micro-siting the relevant components during construction.

The Effective Survey Coverage achieved during the survey is considered to have been sufficient to characterise the nature of artefact distribution. The survey results are therefore assessed to be a relatively accurate reflection of the archaeological status and artefact density in the proposal area. Accordingly, based on the relevant predictive model of site distribution and the results of the field survey, the proposal area is assessed to be of generally low cultural and archaeological potential and significance. This assessment forms the basis for the formulation of recommendations relating to the proposal.

12.4 Conclusions and recommendations

The 13 Aboriginal sites identified in the subject area are assessed to be representative of extremely low density artefact distribution. Their cultural and archaeological heritage value is low. The AHIMS site #51-4-0058 is likewise assessed to be of low archaeological heritage significance. The archaeological status of the three SPAs is uncertain, and accordingly, their cultural and archaeological values are unknown.

The Aboriginal object locales comprised of stone artefacts (and any undetected and subsurface artefacts) do not surpass archaeological and cultural significance thresholds which would act to preclude the construction of the proposed wind farm.

Based on a consideration of the predictive model applicable to the environmental context in which impacts are proposed, and the results of the study, it is concluded that the proposed impact areas do not warrant further investigation such as subsurface test excavation.

The following recommendations are made:

- The 13 recorded Aboriginal object locales are assessed to be representative of a very low density distribution of stone artefacts. The cultural and archaeological heritage significance of these locales is assessed to be low. Accordingly, unmitigated impact is considered to be appropriate. A management strategy of impact avoidance is not warranted, except in respect of the three quartz outcrops. It is recommended also, that the three European heritage items are avoided during construction.
- There are no identified Aboriginal archaeological and cultural constraints relating to the proposal.
- It is recommended that additional archaeological assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant Aboriginal objects can occur anywhere in the landscape and, accordingly, they need to be identified and impact mitigation strategies implemented prior to impacts.
- The proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Plan. The development of an appropriate Cultural Heritage Management Plan should be undertaken in consultation the registered Aboriginal parties and the NSW Office of Environment and Heritage.
- The Cultural Heritage Management Plan would set out procedures relating to the conduct of additional archaeological assessment, if required, and the management of any Aboriginal cultural heritage values which may be identified.
- Personnel involved in the construction and management phases of the project should be trained in procedures to implement recommendations relating to cultural heritage, as necessary.
- Cultural heritage should be included within any environmental audit of impacts proposed to be undertaken during the construction phase of the development.

13 Traffic and Transport

13.1 Approach

A Traffic Impact Study was prepared by Epuron. A full copy of the study is presented in Appendix E. The assessment considered the potential impacts of the proposed wind farm and provides mitigation measures to minimising potential traffic impacts associated with the project. The Traffic Impact Study was prepared in consultation with and considering the relevant local council traffic road policies, and is primarily focused on the construction phase as it is considered that the construction phase would generate the greatest volume of traffic.

The methodology adopted for the assessment included:

- reviewing the RMS checklist for preparing traffic impact studies;
- mapping of the proposed wind farm site and surrounding area;
- review of planning documentation for other wind farm developments in the area;
- roads were inspected and photographed;
- RMS data was reviewed to establish traffic volumes on the main roads;
- personal communication with the RMS;
- consultation with Boorowa, Upper Lachlan and Yass Valley Councils;
- considering relevant local council traffic and road policies;
    - Yass Valley
        - Property Vehicular Access
        - Roadside Clearing and Trees Planting
        - Road Naming
        - Unsealed Rural Roads
        - Road Standards
        - Stock Grazing and Movement on Council Roads
    - Boorowa
        - Road Naming
        - Approved B Double Route for Boorowa LGA
        - Road Closure
        - Road and Street Planting
    - Upper Lachlan
        - Road Management
        - Roads – Permission to Use
        - Street and Road Naming
- information on road conditions from property owners at the Information Day on 26/07/2012; and
- information from turbine suppliers on access track requirements and turbine component transport.

13.1.1 Existing Environment

The roads in the vicinity of the project area are generally classified as follows:

- State Highway – Hume Highway is owned and maintained by the RMS.

- Regional Roads – Part funded by a grant agreement administered by the local RMS.
- Local Roads – All other roads that are owned by the council.

The southern end of the wind farm site is located 10 km north north-east of Yass, a significant country town and service centre. The Hume Highway provides a safe, dual carriage way connection with up to 110 km/h travel speed.

Access requirements for the proposed wind farm can be separated into the following categories:

- Standard road vehicles ranging from 2 wheel drive cars to B-Double trucks. These vehicles are required to access the site as far as the construction compound and associated equipment storage area. They represent the largest portion of vehicles. It would be anticipated that light vehicles would be the source of transport within the construction area of the site.
- 4 wheel drive vehicles may be required for most transport to the turbine locations and would provide ongoing maintenance.
- Specialist vehicles may include off-road construction vehicles, for example vehicles with nonstandard axle combinations. These may include tracked vehicles and reconfigured trailers used to tow components into position. This type of vehicle would not generally be able to be used on sealed local roads
- Over-dimension vehicles transporting turbine components and oversize construction machinery. These vehicles would generally be wider and longer but weights of loads would not be excessive (generally up to 70 tonnes carried over 7 axles).
- Over-mass and over-dimensional vehicles transporting electrical transformers of up to 200 tonnes. These vehicles would possibly require the strengthening of bridges and drainage structures because of the close spacing of axles. Only a small number of these vehicles are anticipated during construction.

Expected Construction Access

The Hume Highway is the major inland highway that links Sydney and Melbourne and has sufficient capacity to handle the delivery of imported turbine components. The route north from Port Kembla through Wollongong and on to the Hume Highway is the preferred route for the proposal.

Two primary routes for accessing the Rye Park Wind Farm from the Hume Highway are being proposed. The majority of the site will be accessed from the Hume Highway at the western end of the Yass Valley Way, before continuing along the Yass Valley Way, Faulder Avenue, Cooks Hill Road and the Rye Park – Dalton Road. The primary route to access the southern end of the site will use the Jerrawa Road exit from the Hume Highway and continue along Coolalie Road and Bush's Road as seen in Figure 13-1.

A secondary access route to the southern end of the site is proposed from the Yass Valley Way exit as described above. However, the secondary route will continue past the Faulder Avenue turn and continue on the Yass Valley Way before turning into Pollux Street and Coolalie Road on the outskirts of Yass.

An alternative access route to the site for oversize vehicles is being considered to the west of the Yass Valley Way exit via the Lachlan Valley Way, around the outskirts of Boorowa before entering Rye Park from the Boorowa Road. This route includes several 90° corners that will be difficult for the delivery of the major turbine components and is therefore only considered an alternative option.

Figure 13-2 shows the proposed haulage routes from Port Kembla and the Port of Newcastle to the project site.

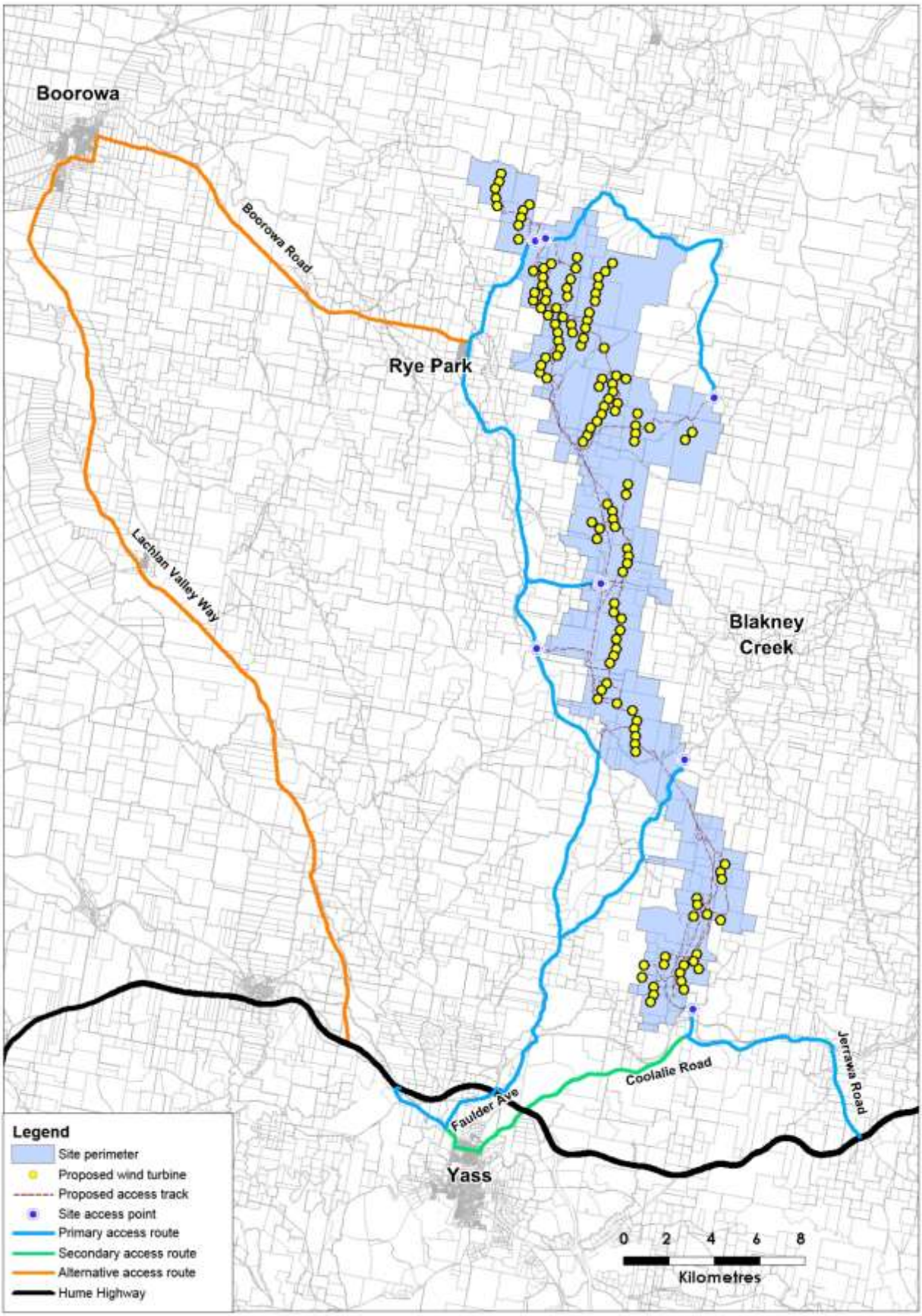


Figure 13-1 Main access from Hume Highway along Yass Valley Way, Faulder Avenue, Cooks Hill Road and Rye Park – Dalton Road

Figure 13-2 Proposed haulage access routes from the arrival port to the project site

13.2 Assessment

Construction and decommissioning phase

Table 13-1 Approximate dimensions and weights of the components of a typical wind turbine

Wind Turbine Component	*No. of parts per turbine*	*Total number of parts for 126 turbines*	*Approximate component weight (tonnes)*
Towers	3 - 5	378 - 630	Up to 60
Nacelle	1	126	Up to 80
Hub	1	126	Up to 23
Blades	3	378	Up to 12

Over-mass and over dimension vehicles

The larger vehicles would occupy most of the width of the roadway at many locations thereby requiring traffic control procedures to ensure safe passage for local road users. For nearby property owners, there is likely to be an increase in traffic noise and dust nuisance in addition to the need to control stock from straying on the roads which are not fenced. Dust generated on unsealed roads could impact visibility and result in the loss of pavement materials. Gravel road surfaces would deteriorate and potholes would form under the increased traffic loads, particularly during wet weather when water ponds or drains across a road. Structural damage may occur to some of the culverts, concrete causeway crossings, stock grids and traffic islands. The location of trees and other roadside objects have the potential to obstruct the passage of long wide loads and high loads. Lack of roadside delineation in some locations may impact traffic safety during periods of poor visibility. Some intersections have inadequate pavement width to safely accommodate the turning manoeuvres of the over-size vehicles.

It is considered that these impacts would be temporary, as the equipment haulage is not a continuous program. Most of the heavy haulage would be in the form of convoys and would be managed through a number of specific mitigation measures developed and implemented in conjunction with RMS and Boorowa, Upper Lachlan and Yass Councils. These measures usually include escort vehicles.

Decisions on the final routes for these vehicles would be the subject of negotiations between the haulage contractor and the road authorities.

Construction Traffic

Construction traffic will be generated by the delivery of equipment and materials to site including the construction work force travelling to and from the site on a daily basis.

The vehicles delivering the main crane, wind turbine components and transformer components will be oversize, over-mass or both. These vehicles will require special operating permits to allow them to travel on public roads and the appropriately licensed haulage contractor will complete a detailed assessment for approval by the Roads and Maritime Services (RMS, formally the Roads and Traffic Authority) and Councils prior to construction. As the surrounding local access roads are generally of a high quality, it is expected there will be no difficulty in obtaining the necessary approval.

Oversize vehicles are those over 19 m in length, 2.5 m in width and 4.3 m high and may require one or more escort vehicles to accompany them.

Over-mass vehicles are those with a gross mass in excess of 42.5 tonnes and will require a permit to use public roads.

On-site access tracks will generally be around 5-6 m wide, but will need to be wider at bends and intersections for turning. During construction access tracks in some areas may be up to 10 m wide for crane access, but 5-6 m during operations. The longest vehicles will be those delivering blades. Typically two blades are delivered in one load, and oversized vehicles used to deliver turbine blades can be up to 41m long.

There are no turning bays required on public roads, though turning bays may be required within the project site. Placement of turning bays, if needed, will likely be at the end of dead-end on site access roads, and will be organised in consultation with the relevant landowner.

Table 13-2 Estimate of peak daily traffic volume

Construction Activities (Many occur concurrently)	*Approximate Duration (Months)*	*Maximum number of trips per day*	*Comments*
Construction staff and management	24	60	Assumes 3 employees per vehicle
Site establishment	1	10	
Internal access track construction	10	22	
Foundation excavation and construction	12	102	Based on off-site concrete delivery
Dust suppression	16	12	
Substation construction and commissioning	4	26	Includes up to 4 over-mass vehicles
Cabling	10	6	
Turbine erection	12	58	Includes up to 50 over-dimensioned vehicles
Maximum Construction Duration	**24**		
	Total maximum trips per day	**296**	

Table 13-2 presents a prediction of the maximum daily traffic volumes, expressed as one way vehicle movements, of approximately 300 vehicles per day. In reality this overstates the likely trip numbers as these activities will be spread across the construction schedule and are unlikely to occur simultaneously. It also conservatively assumes that the concrete for the turbine foundations will be delivered to site rather than sourced from on-site batching plants.

Traffic impacts at specific location

Hume Highway

The route from Port Kembla to Yass via Wollongong provides a safe, dual carriage highway for the vast majority of the distance from port to destination. During the construction phase there would be an increase in traffic travelling along this route including standard road vehicles, B-Double trucks and over dimension vehicles transporting turbine equipment.

Impacts on access route roads

There is potential to impact Yass Valley Way, Faulder Avenue, Cooks Hill Road, Rye Park – Dalton Road, Pollux Street, Coolalie Road and Bush's Road. The routes through Yass identified in Figure 13-3 will experience an increase in traffic through the construction phase of the wind farm including standard road vehicles, B-Double trucks and over dimension vehicles transporting turbine equipment. The delivery of equipment along these roads would be done as per the TMP. This increase in traffic volume would require improvements to ensure the safety of road users particularly in relation to conflicts between vehicles and stock.

Isolated curves and crests on looser gravel surfaces could result in drivers losing control. Several drainage structures may need to be upgraded to ensure continued wet weather access.

Several mitigation measures have been developed to manage traffic impacts during the construction phase; key areas are highlighted in Section 13.3. These centre on the development of a TMP, consultation with roads authorities and affected members of the community, to finalise the routes and ensure that safety and protection of assets is managed effectively.

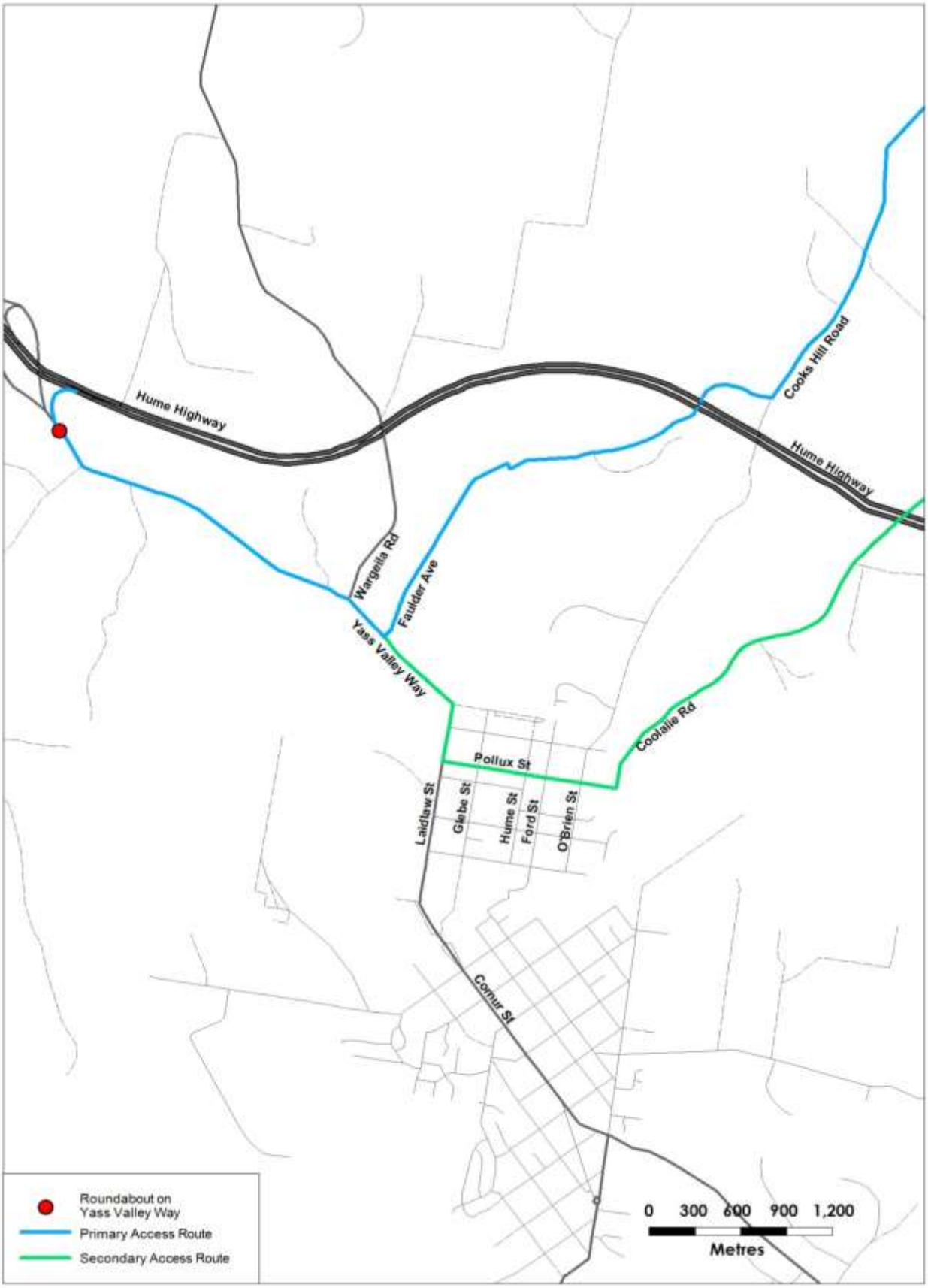


Figure 13-3 Access route through Yass for wind farm infrastructure

Operational phase

Once operational, the wind farm would be managed and maintained by several crews of technicians, likely to be based at Yass or Canberra. The proposed wind farm may generate interest as a visual feature in the locality however, it is considered that this would not significantly increase the number of tourists visiting Rye Park and therefore the increase in traffic volumes and subsequent impacts are likely to be low. No specific mitigation measures are considered warranted to manage operational traffic impacts.

On-site access roads would only require minimal operational maintenance as only light vehicles would require access during the operational phase. Significant maintenance of on-site tracks would only be required for major wind turbine maintenance or decommissioning.

13.3 Mitigation Measures

The following measures would be adopted to minimise the impacts from construction traffic:

- Development of a Traffic Management Plan that will identify detail actions such as scheduling of deliveries, managing timing of transport near major centres (Yass) and local towns (Rye Park) to avoid peak times (beginning / end of school), consultation activities during haulage activities, designing and implementing modifications to intersections and street furniture and managing the haulage process.
- Use of a licensed and experienced haulage contractor, to be responsible for obtaining all necessary permits and approvals from the RMS and Councils and for complying with conditions of consents.
- Escorts for oversize and over-mass vehicles will be provided in accordance with RMS requirements.
- The Traffic Management Plan will establish a procedure to monitor traffic impacts during construction such as noise, dust nuisance and travel timings so adjustments can be made to minimise impacts.
- Re-instating pre-existing conditions after temporary modifications, if required.
- Providing a 24hr telephone contact during construction to enable any issue or concern to be rapidly identified and addressed.
- Consult with the local Councils prior to construction and agree any road upgrade or rehabilitation responsibilities and requirements including potential contribution towards road maintenance funding.
- In consultation with local Councils and RMS the proponent will prepare road dilapidation reports prior to the commencement of construction and following completion of construction to determine any damage attributable to the project.

Should deterioration of roads occur during construction activities, an inspection and maintenance program would be established, if required by the Council.

14 Hazards and Risks

14.1 Aviation

14.1.1 Background

The proposed development of the Rye Park Wind Farm would involve the construction of wind turbines with a maximum height of up to 157 meters to the blade tip. Due to the height of the wind turbines, potential impacts to the safety of aviation activities have been assessed. This includes:

- identifying nearby aerodromes and landing strips;
- consultation with aviation authorities and associations; and
- assessing the risk to aerial agricultural activities.

14.1.2 Existing Environment

Aerodromes

The closest Civil Aviation Safety Authority (CASA) certified and registered aerodromes to the proposed wind farm site are Canberra and Goulburn airports, approximately 70 km to the south-southeast and 80 km to the east of the site respectively.

CASA uses a term called Obstacle Limitation Surfaces (OLS) to manage the area around an aerodrome. An OLS is a series of surfaces that define the limits to which objects may project into the airspace, and above which, become obstacles to aircraft operations and must be reported to CASA. An assessment of these aerodromes will not occur as the DGRs required an assessment of aerodromes within 30 km to the development. The location of these airports in relation to the project is presented in Figure 14-1.

Landing Strips

Eleven private landing strips (known as Aircraft Landing Areas or ALAs) have been identified on private properties within 5km of the project, which have historically been used for aerial agriculture. The majority of these landing strips are on properties associated with the project. ALAs are not registered or regulated by CASA. Locations of the landing strips are shown in Table 14-1 and Figure 14-2.

Table 14-1 Location of existing landing strips

Ref	Runway Orientation	Location		Distance from nearest wind turbine (metres)
		Easting	Northing	
1	NE-SW	678,539	6,150,198	4,190
2	E-W	681,384	6,147,889	3,170
3	NE-SW	688,203	6,148,492	4,550
4	NE-SW	688,733	6,160,911	4,660
5	NNE-SSW	686,548	6,162,351	4,060
6	NW-SE	678,807	6,166,860	2,470
7	NW-SE	680,385	6,172,950	810
8	NW-SE	677,118	6,175,747	2,360
9	NE-SW	685,087	6,176,086	570
10	NW-SE	685,418	6,178,714	3,260
11	NNW-SSE	685,140	6,181,224	3,910

Figure 14-1 Aerodromes within vicinity of the proposed wind farm

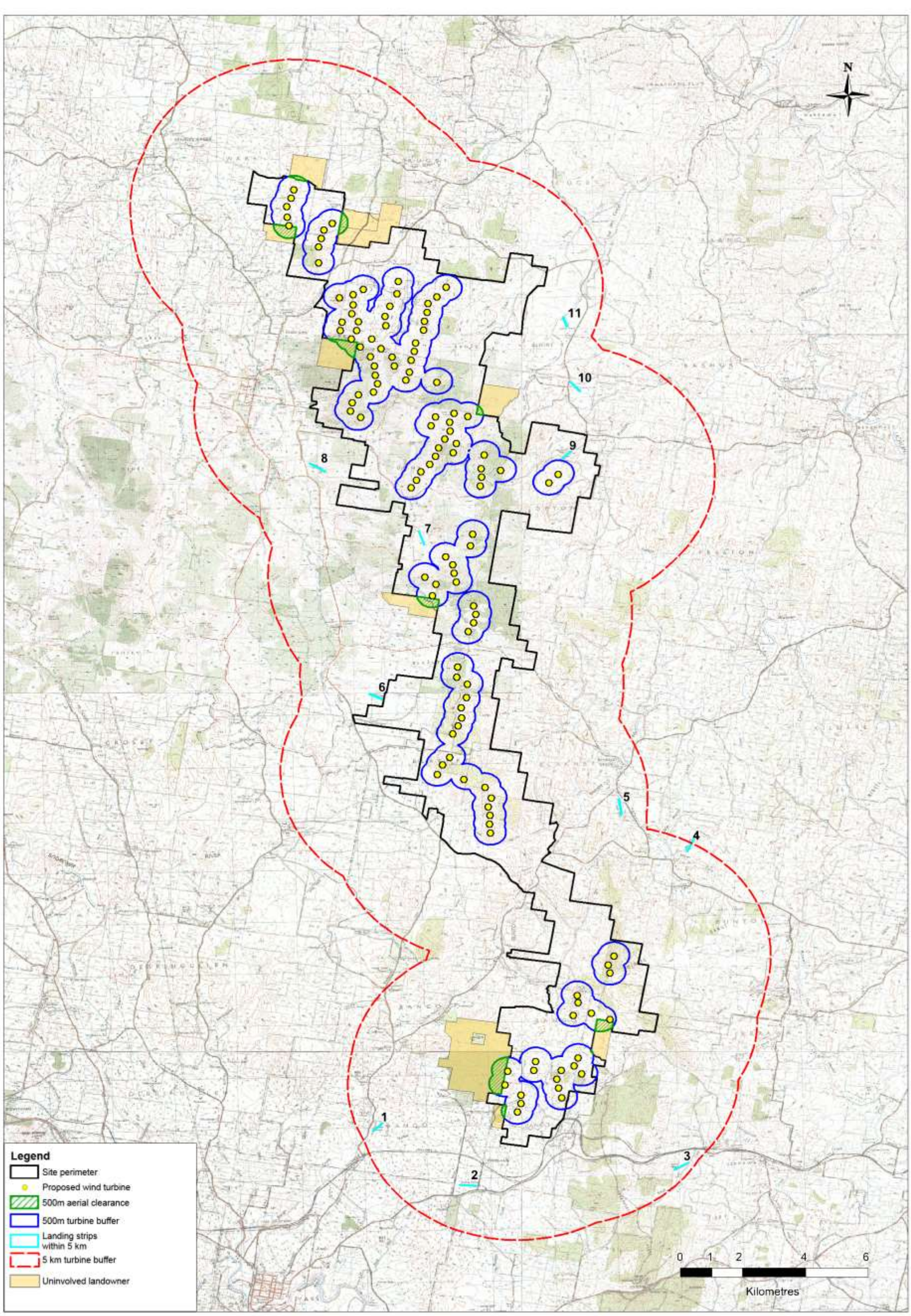


Figure 14-2 Landing strips within 5km of a turbine

14.1.3 Consultation

Epuron has consulted with the Yass Valley Council, Upper Lachlan Shire Council, Boorowa Council, CASA, Airservices Australia (ASA), Aerial Agricultural Association of Australia (AAAA) and the Department of Defence in relation to the project. This consultation included written correspondence and follow up discussions as necessary.

On the 2nd of November 2012 Epuron wrote to the Department of Defence in relation to the project. The Department of Defence is responsible for ensuring that new developments would not conflict with existing military aircraft operations, radio communications and the operation of navigational aids and radars. No concerns have thus far been raised by the Department of Defence in relation to the project.

On the 2nd of November 2012 Epuron wrote to CASA in relation to the project. CASA is an independent statutory authority whose primary function is to conduct the safety regulation of civil air operations in Australia. Due to the height of the proposed turbines (greater than 110m), notification to CASA is required in accordance with the Civil Aviation Safety Regulations 1998 (CASR) Part 139, Subpart 139E Obstacles and hazards. CASA previously recommended that obstacle lighting be provided as per section 5.5 of Advisory Circular 139-18(0) - Obstacle Marking and Lighting of Wind Farms, however this Advisory Circular was withdrawn in September 2008. The withdrawn Circular defined the interval between turbines and obstacle beacons should not exceed 900m. Since the withdrawal of the Advisory Circular in 2008 there have been no updated recommendations and as such there are currently no CASA guidelines to conform to in relation to obstacle marking of wind farms. CASA has indicated that they are reviewing their position and it appears that CASA may align their advice with international guidelines and not require obstacle lighting.

Epuron provided Airservices Australia (ASA) with details of the project on the 2nd of November 2012. ASA is responsible for air traffic management and has the expertise to assess the potential impacts of wind farm proposals on precision / non precision navigational aids, HF/VHF communications, radar and satellite links in the area. ASA is also able to provide advice on whether the project would impact Lowest Safe Altitudes (LSALTs). On the 21st of November 2012 ASA advised Epuron that they would be sending information including instructions for performing a detailed assessment. Epuron will continue to work with ASA to ensure the project will not adversely impact on existing services.

The AAAAs formal policy position on all wind farm developments and wind monitoring towers is to automatically oppose such developments, unless the developer is able to clearly demonstrate they have openly and honestly consulted local aerial operators, sought independent expert opinion, ensured no long or short term effect on safety standards and provided a legally binding agreement for compensation for loss of income (AAAA, 2011).

14.1.4 Assessment

Aerodromes

After consultation with CASA regarding regulated aerodromes, the proposed wind farm site is considered to be a sufficient distance away from these airfields (aerodromes) as all proposed turbine locations are outside of the maximum distance (15 km) of any existing OLS. Consequently it would not affect their operations and no further assessment is considered necessary in relation to these regulated aerodromes.

Landing Strips

Eleven landing strips have been identified within 5 kilometres of the proposed development, two of which are within 2 km. These strips are classed as “Aeroplane Landing Areas” by CASA in accordance with Civil Aviation Safety Regulations Part 139.

CASA guidelines for these landing strips are contained in their *Civil Aviation Advisory Publication 92-1 (1) - Guidelines for Aeroplane Landing Areas* (Madders and Whitfield, 2006). The publication contains physical characteristics that define the ‘surfaces’ which should be clear from obstacles around the runway approaches. These characteristics are shown in Figure 14-3 for day operations.

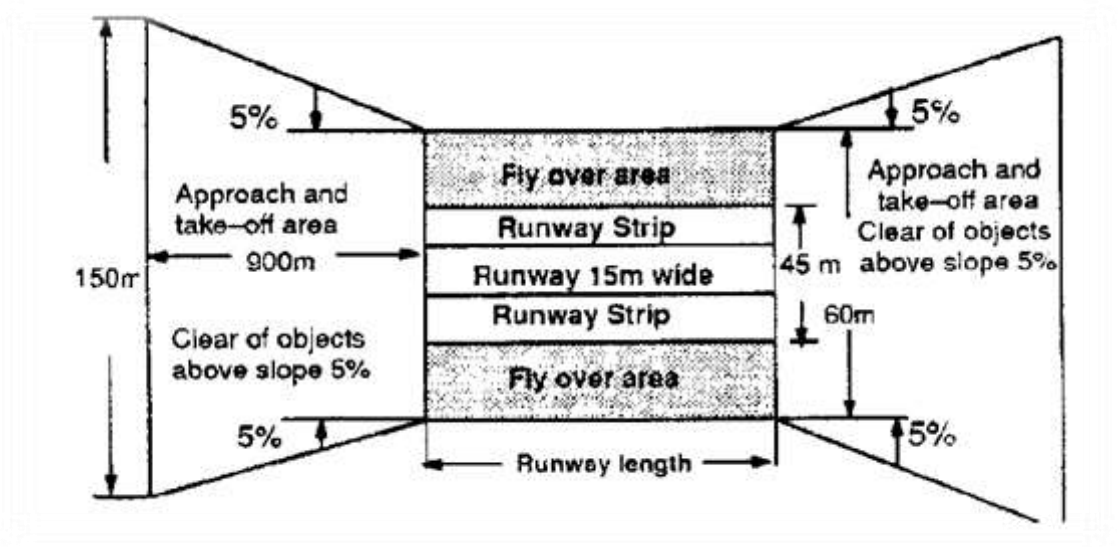


Figure 14-3 CASA's guideline for characteristics of an Aeroplane Landing Area (Madders and Whitfield, 2006)

For this assessment a worst case scenario basis had been chosen and all landing strips will be assessed as if they were for Single engine and Centre-Line Thrust Aeroplanes not exceeding 2000 kg maximum take-off weight (MTOW) for day time operations. By using this definition of aeroplane landing areas, it increases the clearance required between wind turbines and the approach and take-off areas and will ensure greater safety for both pilots and the wind farm.

A zone extending 900 metres from the approach and take off area is required to be free from obstacles at an angle of 5% extending out from the end of the runway.

The project does not encroach on any of the existing landing areas with the closest turbine being 570 m from landing strip No. 9. Figure 14-4 demonstrates that the clearances are in excess of the CASA guidelines for landing strip No. 9.

As these private airstrips rely on visual rather than instrument based landing techniques, and as the turbines are highly visible, it is unlikely that the proposed development would pose any additional hazard to users of these airstrips. It is expected that pilots will continue to use the local landing strips.

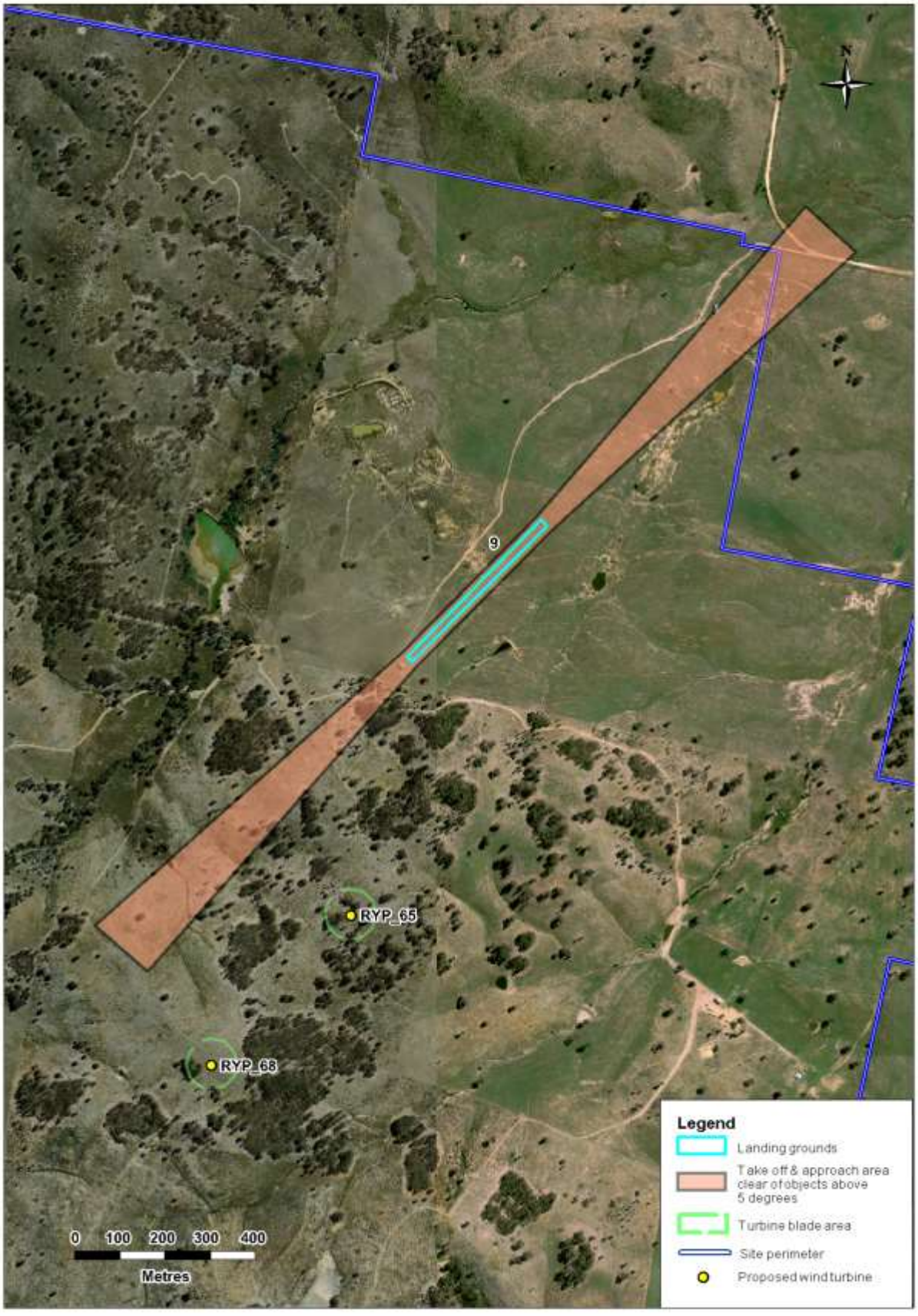


Figure 14-4 CASA guidelines for local landing strip No. 9

Aerial Agriculture

The Proponent acknowledges that the wind farm will likely impact aerial spraying in the area immediately adjacent to the turbine locations. Accordingly, should spaying or spreading of fertilisers be required in this vicinity, ground based methods will need to be considered.

A report conducted by the Ambidji Group Pty Ltd for the Berrybank Wind Farm concluded that a buffer zone of 500 m should be applied when planning aerial spreading in the close proximity to an installed wind farm (Smales, 2006). This would mean that more time would be required in the pre-planning process as the approach may need to be varied to avoid turbines. The report states:

> *"A standard agricultural aircraft loaded to maximum capacity takes approximately 500 metres to complete this turn. This would have an impact on the direction at which some of the spraying operations would need to be conducted. A distance of 500 metres from the nearest turbines would be required as a buffer zone for this operation."*

This report therefore assumes that aerial spreading would impact the area within 500m from a constructed turbine.

Figure 14-2 shows a 500 m buffer from the currently proposed turbines in relation to non-involved properties surrounding the site. The total affected area, as a result of this buffer zone, is confined to the ridge tops mostly and in some case covers areas that are heavily vegetated and would not be suitable for aerial agriculture.

Although the project will have some impact on the operations of aerial agriculture on these properties, alternate spreading methods are available.

Lighting

Due to the significant physical separation between the wind farm and the closest airports, the fact that the overall wind turbine height will be below the lowest safe altitude for aviation and consideration of general community views on turbine obstacle lighting at night being visually intrusive, it is not considered appropriate to install obstacle lighting on turbines at the Rye Park Wind Farm site. The use of private landing strips is restricted to daytime operation and hence there would be no reason to install obstacle lighting for private aviation purposes.

Accordingly, the Proponent would only install obstacle lighting if required to do so by CASA, and to the extent required by CASA.

It should also be noted that the night time lighting installed on the Cullerin Wind Farm has been decommissioned by Origin Energy following a risk based aviation assessment. A number of recent wind farm developments in New South Wales have been approved without requirement for night time lighting, including the Gullen Range and Glen Innes wind farms.

14.1.5 Mitigation Measures

- Liaise with all relevant authorities (CASA, Airservices, and Department of Defence) as well as the operators of local airports and airstrips, and local aerial agriculture contractors and the AAAA, and supply location and height details once the final details of the wind turbines have been determined and before construction commences.
- Comply with any requirements of CASA in relation to obstacle marking of wind turbines, and would not otherwise install obstacle beacons on any wind turbine.

14.2 Communications Impacts

14.2.1 Background

Wind turbines have the potential to interfere with television and radio broadcasting, mobile phone reception, microwave links and other radio links such as mobile and CB radio. There are three mechanisms by which wind turbines may cause interference: reflection, diffraction and near field effects.

Reflection or scattering occurs when a signal becomes obstructed between the transmitter and a receiver, this could be due to a tower or moving blade component as shown in Figure 14-5.

Diffraction occurs when a signal is both absorbed and reflected by an object in the signal path.

Near field effects are caused by electromagnetic fields. This is no longer an issue due to advances in wind turbine technology and compliance with Electromagnetic Emission Standards.

A communication impact assessment report was prepared by Epuron for the Project. The objectives of this investigation were to identify the potential for impacts from the proposed Rye Park Wind Farm on existing telecommunications services in the vicinity of the project, and to identify appropriate mitigation strategies for potential impacts. The full investigation including a glossary of acronyms used in the investigation, maps, footnotes and references is presented in Appendix F.

The following approach was adopted to identify the potential impact of the project on telecommunications:

- Identify holders of telecommunications licenses (under the Radiocommunications Act 1992) within a 25km radius of the project, as well as point-to-point links in the vicinity of the project, using information provided on the Australian Communications and Media Authority (ACMA) RADCOM database.
- Provide written notification of the project and seek comments from each license holder identified via the ACMA RADCOM database search.
- Record and review all responses received to identify any issues raised by license holders.
- Discuss issues raised with relevant license holders with the aim to resolve or identify mitigation options.
- Carry out an assessment of the “Fresnel zone” associated with each fixed point-to-point communications link in the vicinity of the project.
- Determine appropriate ‘exclusion zones’ for the proposed turbine layout based on these calculations and advice from license holders.
- Confirm that all turbines (including blades) are located outside the ‘exclusion zone’.
- Determine appropriate additional mitigation measures which may be required.

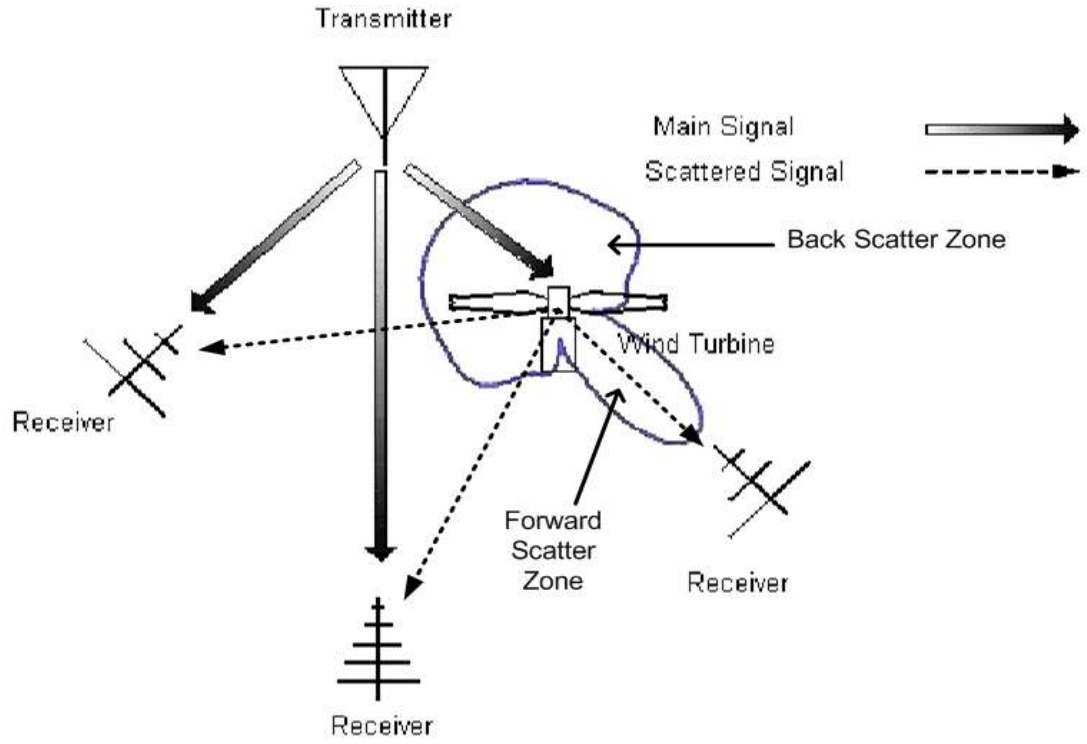


Figure 14-5 Scattering of a signal from a wind turbine

14.2.2 Existing Environment

The potential impacts of the proposed Rye Park Wind Farm on the four most commonly used telecommunications services have been investigated separately and are summarised below.

These services include:

- television broadcast services;
- radio broadcast services;
- mobile phone services; and
- radio communication services.

Television Broadcast

The ACMA RADCOM database lists the following broadcasters for television under postcode 2586, Rye Park, NSW.

- Southern New South Wales TV1: ABC, CBN, CTC, WIN and SBS

The closest transmitter of television programs is at Reservoir Hill, Young located about 60 kilometres North West of Rye Park.

Television Interference (TVI) is dependent on a range of factors including: existing environment factors (topography, direct signal strength, transmitter type, and receiver type) and wind farm design factors (turbine elevation, rotor size and orientation, speed of rotation, blade material and pitch). Due to the variability of local conditions and the characteristics of antennae used in particular installations, there is a degree of uncertainty regarding predicted levels of interference.

A Kordia report commissioned by the Long Gully Wind Farm in New Zealand stated that analogue television would be the most likely transmission service to experience interference from a wind farm development, although only within a limited distance. Very High Frequency (VHF) TV reception at dwellings within approximately 1 km of an installed wind turbines would have some probability of noticeable “ghosting” at times (Kordia, 2009).

However, as analogue television signals have been 'switched off' and replaced with digital signals in the Rye Park area in June 2012, this is no longer an issue as digital TV is not susceptible to visible "ghosting" degradation (Kordia, 2009).

Satellite based television or internet services may also be received at various locations throughout the area. These services are not subject to the same topographic screening that can affect the land based TV transmissions. Due to the distance of residences from the wind farm it is very unlikely that satellite based television services would be subject to interference due to the wind farm's operation as the wind turbine would have to be within the line of sight from the antenna to the satellite.

Radio Broadcast

The ACMA RADCOM database lists the following broadcasters for radio under postcode 2586, Rye Park, NSW.

- Young RA1: 2ABCCRN, 2LF, 2LFF, 2RVR

The level of radio broadcast interference experienced can be influenced by a variety of factors including abnormal weather conditions, multi-path distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.), overloading (when an FM receiver receives too strong a signal) and electrical interference.

Potential wind farm impacts on FM radio are highly unlikely and therefore the stations serving the area have not been listed.

License holders have been contacted regarding possible impacts to television or radio broadcasting services. The Proponent will work with organisations to resolve issues, should any be identified.

Mobile phone services

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2 - 10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells.

Mobile phone coverage is available in much of the area around Rye Park but is patchy further away from Rye Park and the main highways and where topography limits coverage. Mobile phone coverage is particularly poor in rural locations not far from the Rye Park Wind Farm site.

Due to the separation distance between base antennas for providing mobile phone services and turbine structures due to the wind farm location, transmission of mobile phone signals is not expected to be affected by the wind farm.

Radio Communications

The ACMA issues radio communications licenses in accordance with Part 3.5 of the Commonwealth Radiocommunications Act 1992. The ACMA issues licenses to use specific segments of the radio broadcasting frequency spectrum for different purposes and maintains a register (the ACMA RADCOM Database) of all the licenses issued.

The register allows the ACMA to create a 'density' classification of areas across Australia as high, medium or low depending on the number of licenses in operation in a particular area. According to the ACMA RADCOM database, the area in the vicinity of the proposed wind farm is classified as a "Low Density Area".

License holders operate a range of radio communications services, including fixed link microwave communication and mobile communication systems within a 25km radius of the proposed wind farm. Multiple license holders use some sites, while sole users employ others. Radio communications site licence holders within a 25km radius are listed below.

Each license holder has been contacted and asked to provide independent comment on the wind farm development with respect to possible impacts to communication links. The Proponent will work with organisations to resolve issues, should any be identified.

Table 14-2 - Radio communication license holders within 25km of the Rye Park wind farm site

ACMA Licence Holder	ACMA Site ID No.
2KY Broadcasters Pty Ltd	151009
Airservices Australia	9530, 49366
Ambulance Service of NSW	9530, 9547, 204072
Australian Rail Track Corporation Limited	40012, 202399
Boorowa Council	9547
Chris Despotakis	139907
Concrite Pty Ltd	36172
Department of Finance and Services	55602, 9006930, 9013320
Dianne Maree Nacson	9504, 9530, 55601, 100903, 137000
Essential Energy	9530, 9547, 36146, 36149, 404038, 9000026
Fire and Rescue NSW	9529, 9547, 34798, 100903
NSW Police Force	9547, 55601, 55602
NSW Rural Fire Service	9547, 34887, 34888, 201543, 9013320
Optus Mobile Pty Limited	9525, 9546, 55601, 55602, 202115, 370254
RBA Holdings Pty Ltd	9504
Robinvale District Health Services	304511
Singtel Optus Pty Limited	9525, 9546, 55601, 55602, 370254
Soul Pattinson Telecommunications Pty Limited	55602, 100785, 204072
State Emergency Service (NSW)	9504, 9530, 201458, 9009594, 9009595
Stephen Cusack	138528
Telstra Corporation Limited	9531, 9546, 9547, 39130, 55601, 100722, 100785, 130627, 132565, 370254
Transgrid	204072, 9006930
Upper Lachlan Shire Council	9504
Vodafone Australia Pty Limited	9529, 55602, 370254, 9013911
Vodafone Hutchison Australia Pty Limited	9529, 370254
Wendy Blackmore	199282
Yass Community Radio Association Inc.	9529, 39129, 151009
Yass Valley Council	9529

14.2.3 Consultation

License holders identified via the ACMA RADCOM database within a 25 km radius of the wind farm were notified in writing of the project in relation to potential impacts and asked to provide comments and included a follow up telephone discussion where necessary.

Table 14-3 summarises the organisations that were consulted and their comments received or discussed.

Table 14-3 Consultation with license holders

Organisation	*Response*	*Comment*
2KY Broadcasters Pty Ltd	No Response	
Airservices Australia	No Response	
Ambulance Service of NSW	No Concern	
Australian Rail Track Corporation Limited	No Concern	Requested more information regarding rail crossings
Boorowa Council	No Response	
Chris Despotakis	Concerns Raised	Discussion with organisation ongoing
Concrite Pty Ltd	No Response	
Department of Defence	No Concern	
Department of Finance and Services	No Response	
Dianne Maree Nacson	No Response	
Essential Energy	No Response	
Fire and Rescue NSW	No Response	
NSW Police Force	No Concern	
NSW Rural Fire Service	No Response	
Optus Mobile Pty Limited	No Concern	
RBA Holdings Pty Ltd	No Response	
Robinvale District Health Services	No Response	
Singtel Optus Pty Limited	No Concern	
Soul Pattinson Telecommunications Pty Limited	No Response	
State Emergency Service (NSW)	No Response	
Stephen Cusack (Yass Taxis)	No Response	
Telstra Corporation Limited (Telstra Wireless Network Engineering 15)	No Concern	
Transgrid	No Response	
Upper Lachlan Shire Council	No Response	
Vodafone Australia Pty Limited	No Response	
Vodafone Hutchison Australia Pty Limited	No Response	
Wendy Blackmore	No Response	
Yass Community Radio Association Inc.	No Response	
Yass Valley Council	No Response	

14.2.4 Assessment

Television and radio broadcast services

In the event that Television Interference (TVI) is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference would be investigated by the Proponent using a before and after approach as detailed in the mitigation measures.

Should investigations determine that the cause of the interference can be reasonably attributable to the wind farm; the Proponent would put in place mitigation measures at each of the affected receivers in consultation and agreement with the landowners.

Radio communications services

A fixed link radio transmission is a point to point transmission path typically between two elevated topographical features. Radio links could make use of a number of transmission frequencies including UHF, VHF or microwave. The transmission path may become compromised if a wind farm is located within the direct line of sight or what is known as the 'Fresnel Zone' around the line of sight between the sending and receiving antennae.

The potential impact zone will vary with the distance between the transmitter and receiver, frequency of transmission and the location of any particular point along its path. The maximum extent of the Fresnel zone occurs at the midpoint along the path of the microwave link as shown in Figure 14-6. Communications are only likely to be affected if a wind farm is in the line of sight between two sending and receiving antennae or within a zone of the line of sight of these antennae. In general, microwave links (which have very narrow Fresnel zones) are more liable to interference as a greater portion of the Fresnel zone can be impacted by the wind turbine.

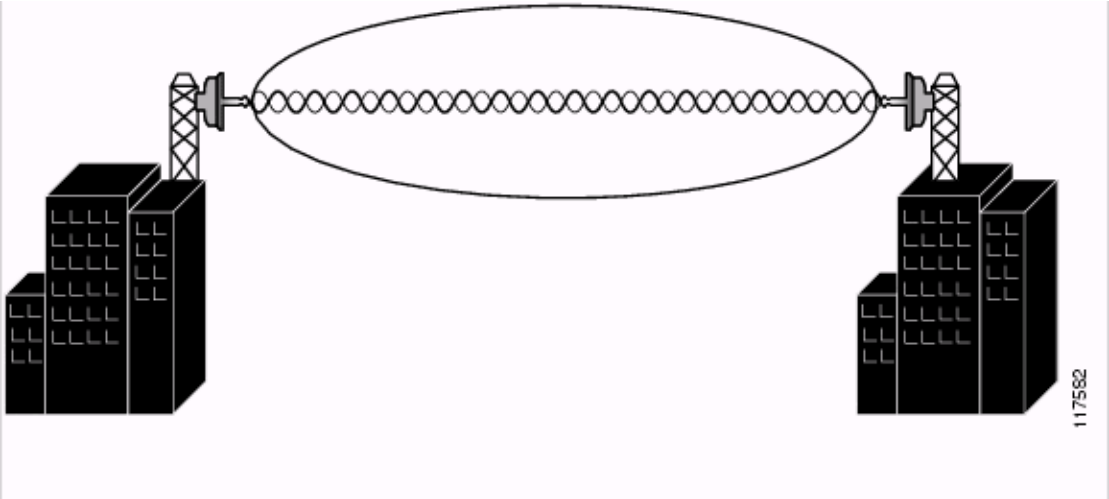


Figure 14-6 The Fresnel zone between a transmitter and a receiver

In order to ensure that obstruction to the signal transmission path does not occur; calculations of the 2nd Fresnel zone of the point to point communications links crossing the site were undertaken.

It is suggested that beyond the 2nd Fresnel zone, the power of a scattered signal from a structure such as a wind turbine would be small enough such that it would not result in significant interference at the receiver.[4].

Completion of this Fresnel analysis showed that a number of turbines were to be located within the 2nd Fresnel zone or close to the direct line of sight path of the point to point link crossing the site, and therefore these

4 D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

turbines were moved outside of these areas. This mitigated all impacts to six out of the seven radio communication links within the site perimeter.

The seventh radio communication link on site is a VHF link registered to the Department of Defence. Research of recent literature suggests that interference to VHF links (i.e. in the 30MHz - 300MHz frequency range) by wind turbines is not likely. The Department of Defence link crossing the site operates with a frequency of 30.7MHz and so falls within this range.

> *Auswind best practice guidelines states: "The communications systems most likely to be affected (by wind turbines) are those which operate at super high frequencies (particularly microwave systems operating at frequencies above 300MHz)"*
>
> *Garrad Hassan's "Assessment of Electromagnetic Issues for the proposed Berrybank Wind Farm", insists that only frequencies greater than UHF range (300MHZ - 3GHz) may potentially experience interference from wind turbines.*[5]

The same view was also taken by Energreen Wind Pty Ltd in their Black Springs Wind Farm EMI assessment dated 26-7-2006:

> *"UHF and VHF voice services have been found not to be affected by wind turbines unless the turbines are in the immediate vicinity of an antenna such that "near field" issues occur. The Blayney wind farm, south west of Sydney, NSW lies directly in the path of a VHF link and there has reportedly been no discernible interference as a result of the development."*[6]

The Department of Defence was contacted in regards to this communications link and the Rye Park Wind Farm and the correspondence is quoted below.

> *"Defence has assessed the proposal for any impacts to operations in the area. This includes safety of low flying military aircraft, as well as affects to Defence communications, and surveillance radars. Defence advises that the Rye Park wind farm* ***would not*** *adversely affect military aircraft operations or interfere with Defence communications and radar."*

Therefore, based on:

- The results of the above literature research,
- Relocation of turbine layout to avoid 2nd order Fresnel zones of UHF links,
- The frequency of the Department of Defence link being in the low VHF range (30MHz - 300MHz) and
- The fact that the wind farm is not in the vicinity of an antenna,

Interference to the existing point to point communication links from the Rye Park wind farm is not expected.

14.2.5 Mitigation Measures

As a result of the exclusion zones established in planning the wind farm, the possibility of impacts to existing point to point communication links is reduced. However, in the unlikely event that interference is observed, the proponent is confident that impacts will be able to be mitigated using the following techniques:

- Modifications to or relocation of the existing antennae
- Installation of a directional antennae to reroute the existing signal
- Installation of an amplifier to boost the signal and/or
- Utilisation of onsite optical cable to reroute the original signal.

5 http://www.unionfenosa.com.au/BB_Application_Report/BB_Appendix_9_Telecommunications_Assessment.pdf (page 3/23)

6 http://majorprojects.planning.nsw.gov.au/files/1887/Appendix%20G%20Electromagnetic%20interference%20study.pdf

The Proponent will ensure final design and construction of the project is carried out in consultation with the registered communication licensees (including emergency services) to ensure that risks to these services are minimised as far as reasonable and feasible. In the event that any disruptions to these services occur as a result of the project, the Proponent will undertake appropriate remedial measures in consultation with the relevant licensees to rectify the issue as soon as possible. Such measures may include modification to or relocation of the existing antennae or relocation of the services.

14.3 Electromagnetic Fields

14.3.1 Background

Electromagnetic fields (EMF) (having both electric and magnetic components) are generated by all electrical devices including household appliances (televisions, lights, electric blankets etc.), powerlines, substations and wind turbines. Generally, scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields from these sources are a hazard to human health. Current science would suggest that if any risk exists, it is small (ARPANSA, 2011a).

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has produced fact sheets which state that studies to date have consistently shown that there is no evidence that exposure to low level electric fields (such as those found in the home or in most workplaces) are a health hazard. In the same text, it states the possibility remains that intense and prolonged exposure of magnetic fields may increase health risks (ARPANSA, 2011a).

In relation to EMF, the issues associated with wind farms are no different to the issues associated with the electricity industry in general and the use of industry best practice (and in particular the appropriate location of associated powerlines and related easements) should ensure EMF risk is adequately managed.

ARPANSA was formed in 1998 as a Federal Government agency charged with the responsibility of protecting the health and safety of people and the environment, from the harmful effects of ionising and non-ionising radiation. ARPANSA is currently developing guidelines on exposure limits to EMFs but in the meantime they still refer to the National Health and Medical Research Council Interim Guidelines (ARPANSA, 2011b).

The *National Health and Medical Research Council Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields* recommend a limit for 24 hour exposure of 1000 mG for magnetic fields and 5 kV/m for continuous public exposure to electrical fields (NHMRC, 1989). These values are consistent with the 50 Hz values of the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998). They note that research suggests that health effects are associated with prolonged exposure; measurements at one point in time do not accurately reflect prolonged exposure levels. As an update in 2009, the ICNIRP stated that based on the latest scientific literature, these recommended limits above remain in place.

Electric fields can be reduced both by shielding and with distance from operating electrical equipment. Magnetic fields are reduced more effectively with distance from the equipment.

Potential for EMF impacts occurs only during the operational phase of the wind farm when electrical infrastructure is capable of generating electromagnetic fields. The electromagnetic fields produced by the wind farm infrastructure would vary at different locations onsite, as discussed below. No impact mitigation is considered to be required for the construction and decommissioning phases.

14.3.2 Assessment

Powerlines

The maximum voltage of the underground and overhead powerline cables connecting turbines to the collection substations within the site would be either 22 kV or 33 kV. At the collection substations, the voltage would be stepped up to a maximum 330 kV, and transmitted along 330 kV overhead powerlines to a connection substation will be connected to a new adjacent TransGrid connection switchyard, also adjacent to the existing TransGrid transmission network, where it would connect into the existing Yass to Bannaby 330 kV powerline.

The magnetic fields associated with a powerline at any moment in time depend on a range of factors, including the amount of current flowing in the line and the distance of the measurement point from the conductors. The electric field strength created by powerlines is dependent upon the height of the wires above the ground and their geometric arrangement. Table 14-4 shows maximum electrical and magnetic field strengths for the various types of powerlines expected to be used in the project (National Grid, 2011):

Table 14-4 Maximum electrical and magnetic field strength of various powerlines

Voltage and Type	Maximum electrical field strength under powerline (or over cable) (kV/m)	Maximum magnetic field strength directly under line (over cable) (mG)
33 kV overhead powerline	0.897	257
33 kV underground cable	--	10
330 kV overhead powerline	3.6	304

Note that underground cables do not produce any external electric fields.

All these values are well within the limits of 5 kV/m and 1000 mG recommended for 24 hour exposure mentioned previously (NHMRC, 1989). These values are maximum values and those measured in the project are expected to be less. Furthermore, the strength of both electric and magnetic fields falls away rapidly with distance from the line (National Grid, 2011)

Any off-site electricity lines will be located and designed in accordance with Essential Energy's Easement Requirements (Essential Energy, 2012). This guideline provides requirements for how powerline easements are to be constructed, when they are required and how they are obtained in New South Wales. The electricity cables will be located away from residences, where practical, to minimise magnetic fields from any off-site powerlines.

Substations

Electricity substations are a source of electric fields, although those encountered at the boundary of substations are usually very weak due to effective screening. They are certainly no more than a few hundred volts per meter near the largest installations, well below the 5 kV/m limit.

Magnetic fields from substations occur at their maximum opposite feed pillars, transformers and switching units (Maslanyj, 1996). Fencing around the substations and the location of the substations and control buildings would ensure that the magnetic field exposure to receivers including the public, property owners and workers are well below the 1,000 mG levels determined to be the maximum to safeguard for public health.

Wind Turbines

The areas proposed for the installation of wind farm infrastructure with potential EMI would have limited public access. Access to these areas by the general public would be restricted, with periodic access by appropriately trained and qualified maintenance staff only. Property owners accessing the sites would have no reason to spend extended periods near the infrastructure, which is not located near frequent use areas such as sheds, yards and residences. Should property owners require access to control buildings or other wind farm infrastructure, they would be accompanied by an appropriately trained and qualified maintenance staff member.

A report investigated the expected magnetic field for proposed wind turbines for Windrush Energy in 2004 (Iravani et al., 2004). The study was based on research and measurements of an existing wind turbine. The measured flux density at the door of the existing turbine was 0.4 mG and the typical value around the wind turbine was 0.04 mG. The acceptable level as stated by the International Commission on Non-Ionizing Radiation Protection (at 60 Hz in this case) is 833 mG (ICNIRP, 1998). The results also concluded that no measurable magnetic field would be expected at a distance of eight metres from the 1,650 kW wind turbine, and hence the magnetic fields produced by generation of electricity from turbines would not pose a threat to public health.

14.3.3 Mitigation

Overhead powerlines and underground cables would generally be located as far as practical from residences and in accordance with the minimum distances set in Essential Energy's Procedural Guideline – Easement Requirements.

14.4 Shadow Flicker

14.4.1 Introduction

Due to their height, wind turbines can cast shadows on the areas around them. Coupled with this, the moving blades create moving shadows. When viewed from a stationary position, when the turbine is between the viewer and the sun, the moving shadows appear as a flicker giving rise to the phenomenon of 'shadow flicker'. This is similar to the strobe effect often experienced when driving through scattered trees on a rural highway.

For a particular position, shadow flicker will only occur during periods when the sun's rays pass directly through the swept area of the turbine blades to the viewpoint. The extent of the shadow flicker is dependent on the time of day, geographical location, meteorological conditions of the site and local vegetation.

There are a number of factors influencing the effect and duration of shadow flicker including:

- position of the sun in relation to the turbine;
- time of year (season) and time of day;
- turbine height and rotor diameter;
- viewer's distance from turbine;
- topography of the area;
- vegetation cover;
- weather patterns, number of cloudy days per year; and
- airborne particles, haze

The effect of 'chopping the light' attenuates with distance and is not considered by modellers of shadow flicker to be noticed beyond 500-1000 m from a turbine (Osten and Pahlke, 1998).

In NSW there are currently no guidelines on which to assess shadow flicker generated by wind turbines. The Victorian Planning Guidelines limit the duration of shadow flicker to a maximum of 30 hours per year (SEAV, 2003). The South Australian Planning Bulletin suggests that shadow flicker is insignificant once a separation of 500m between the turbine and house is exceeded.

14.4.2 Background

Shadow flicker is usually an amenity issue rather than a health risk. Given it is a daytime event; it does not interrupt sleep patterns. However, two issues have been raised as potential health concerns in relation to shadow flicker:

Flicker vertigo

Flicker vertigo is an imbalance in brain cell activity caused by exposure to low frequency flickering or flashing of a light or sunlight seen through a rotating propeller (Rash, 2004). It can result in nausea, dizziness, headache, panic, confusion and – in rare cases – loss of consciousness. Flicker vertigo is usually associated with a light flashing sequence, or flicker frequency, of between approximately 4 hertz (cycles per second) and 20 Hz (NASA, 2001; Rash, 2004).

Photosensitive Epilepsy

Flicker from turbines that interrupt or reflect sunlight at frequencies greater than 3 Hz poses a potential risk of inducing photosensitive seizures. At 3 hertz and below the cumulative risk of inducing a seizure should be 1.7 per 100,000 of the photosensitive population. The risk is maintained over considerable distances from the turbine. It is therefore important to keep rotation speeds to a minimum, and in the case of turbines with three blades ensure that the maximum speed of rotation does not exceed 60 rpm, which is well above the normal practice for wind farms. The layout of wind farms should ensure that shadows cast by one turbine upon another should not be readily visible to the general public or fall upon nearby homes (Harding et al., 2008).

In both cases, the cause of the health effect is a flashing of light with the flash frequency in the range of 3 – 30 hertz. Therefore, wind turbines would only provide a health risk of the shadow flicker created was within this range.

14.4.3 Assessment

A detailed analysis of the potential for shadow flicker and blade glint to affect dwellings has been carried out by Epuron. Modelling of the shadow flicker was conducted using specialist industry software, assessing the largest turbine (maximum tip height) proposed for the project to represent the worst case impact scenario. The maximum number of annual hours at each of the nearby houses where shadow flicker may be experienced was calculated using this model.

The number of annual hours of shadow flicker at a given location can be calculated using simple geometrical models incorporating data such as the sun path, the topographic variation and wind turbine details such as rotor diameter and hub height. In such models, the wind turbine rotor is modelled as a disc and assumed to be in the worst case (i.e. perpendicular) to sun-turbine vector. Furthermore, the sun is assumed to be a point light source.

Shadow flicker calculated in this manner overestimates the number of annual hours of shadow flicker experienced at a specified location due to several reasons.

- The occurrence of cloud cover has the potential to significantly reduce the number of hours of shadow flicker.
- The probability of wind turbines consistently yawing to the 'worst case' scenario where the wind turbine is facing into or away from the sun- wind turbine vector is less than 1 (i.e. less than 100% of the time).
- The amount of aerosols in the atmosphere has the ability to influence shadows cast due to the following reasons.
    - Firstly, the distance from a wind turbine that a shadow can be cast is dependent on the degree to which direct sunlight is diffused, which is in turn dependent on the amount of dispersants (humidity, smoke and other aerosols) in the path between the light source (sun) and the receiver [2].
    - Secondly, the quantity of aerosols in the air is known to vary with time and it has the potential to vary the air density, thereby affecting the refraction of light. This in turn affects the intensity of direct light to cause shadows.
- The modelling of the wind turbine blades as discs to determine shadow path overestimates the shadow flicker effect.
- The blades are of non-uniform width with the thickest viewable blade width (maximum chord) occurring closer to the hub and the thinnest being located at the tip of the blade. As outlined above, the direct sunlight is diffused resulting in a maximum distance from the wind turbine that a shadow can be cast. This maximum distance is dependent on the human threshold which variation in light intensity can be perceived [2]. When the blade tip causes shadow, the diffusion of direct sunlight means that the light variation threshold occurs closer to the wind turbine than when a shadow is caused by the maximum chord. That is, the maximum shadow length cast by the blade tip is less than by the maximum chord.
- Modelling the sun as a point light source rather than a disc has an effect similar to that described above.
    - Firstly, situations arise where the light rays from different portions of the sun disc superimpose around a shadow resulting in light intensity variations less than human perception.
    - Secondly, when the sun is positioned directly behind the wind turbine hub, there is no variation in light intensity at the receiver location and therefore no shadow flicker. However, when the sun is modelled as a point source, shadow flicker still arises.
- The presence of vegetation shields incidences of shadow flicker.

- Periods where the wind turbine is not in operation due to low winds, high winds or operational and maintenance reasons.

Taking the above issues into account, the modelling of shadow flicker has been conducted using simple geometric analyses. The wind turbine has been modelled assuming all wind turbines are disc objects positioned in the worst case with respect to shadow flicker. The sun has been assumed to be a point light source.

To carry out the shadow flicker assessment, the Victorian Planning Guidelines and the South Australian Planning Bulletin discussed earlier were used to determine the inputs to the model. They were:

- a maximum duration of shadow flicker at any residence of 30 hours per year; and
- a conservative assessment distance of 1 km (twice the distance suggested to be affected by shadow flicker).

Therefore, the modelling conducted here represents a very conservative scenario and is intended to overestimate the actual annual hours of shadow flicker experienced at a location.

14.4.4 Actual Conditions at Rye Park

When the actual conditions of the Liverpool Range site are taken into consideration, the number of hours of shadow flicker should be reduced. The major consideration in this respect is the weather patterns and particularly the number of cloudy days experienced that result in no shadow flicker.

Based on 35 years (1971 – 2010) of daily weather observations in Goulburn (Goulburn Tafe, Bureau of Meteorology), the nearest source of data, the average number of cloudy days experienced is 132.2 days/year. The average number of clear days experienced is 88.4/year. These are based on observations at 9am and 3pm each day.

Accordingly based on 132.2 days/year of cloud the number of shadow flicker hours should be reduced by 36.1%. Further reductions for vegetation screening should be considered and applied where appropriate on a case by case basis.

14.4.5 Results

The shadow flicker modelling has calculated the number of annual hours at each of the nearby houses and the results are presented in Table 14-5. The second column represents the theoretical maximum hours of shadow flicker, as discussed above. This approach is based upon the assumption that the wind turbine is yawed to the worst case position of facing into or away from the sun. Using onsite wind rose measurements, the probability of occurrence of various wind directions can be incorporated in the assessment to increase the accuracy. The results are shown in the third column. Additionally a reduction of the theoretical maximum number of hours can be assumed based on the long term observation of cloudy days shown in the fourth column.

Table 14-5 Result of shadow flicker assessment

Residence ID	Theoretical maximum shadow flicker (hrs/yr)	Reduced due to turbine orientation (hrs/yr)	Reduced due to cloud cover (hrs/yr)
R16	24	15	10
R14	1	0	0
R2	0	0	0
R13	0	0	0
R11	0	0	0
R32	62	51	33
R34	0	0	0
R41	0	0	0

Residence ID	Theoretical maximum shadow flicker (hrs/yr)	Reduced due to turbine orientation (hrs/yr)	Reduced due to cloud cover (hrs/yr)
R46	35	24	15
R30	49	35	23
R33	59	42	27
R35	0	0	0

The results show compliance with the Victorian Guidelines of 30 hrs/year at all nearby residences except one (R32). Dwelling R32 is not anticipated to receive the calculated level of shadow flicker due to screening. This is based on extensive vegetation on the south and south-eastern perimeter as seen in Figure 14-7. This vegetation is situated between the dwelling and 3 out of 5 turbines within 1 km of the dwelling, shown in in Figure 14-8.

In addition, the dwelling is used occasionally as a weekender a few times a year and the dwelling owner is a project stakeholder who understands the potential impacts of shadow flicker.

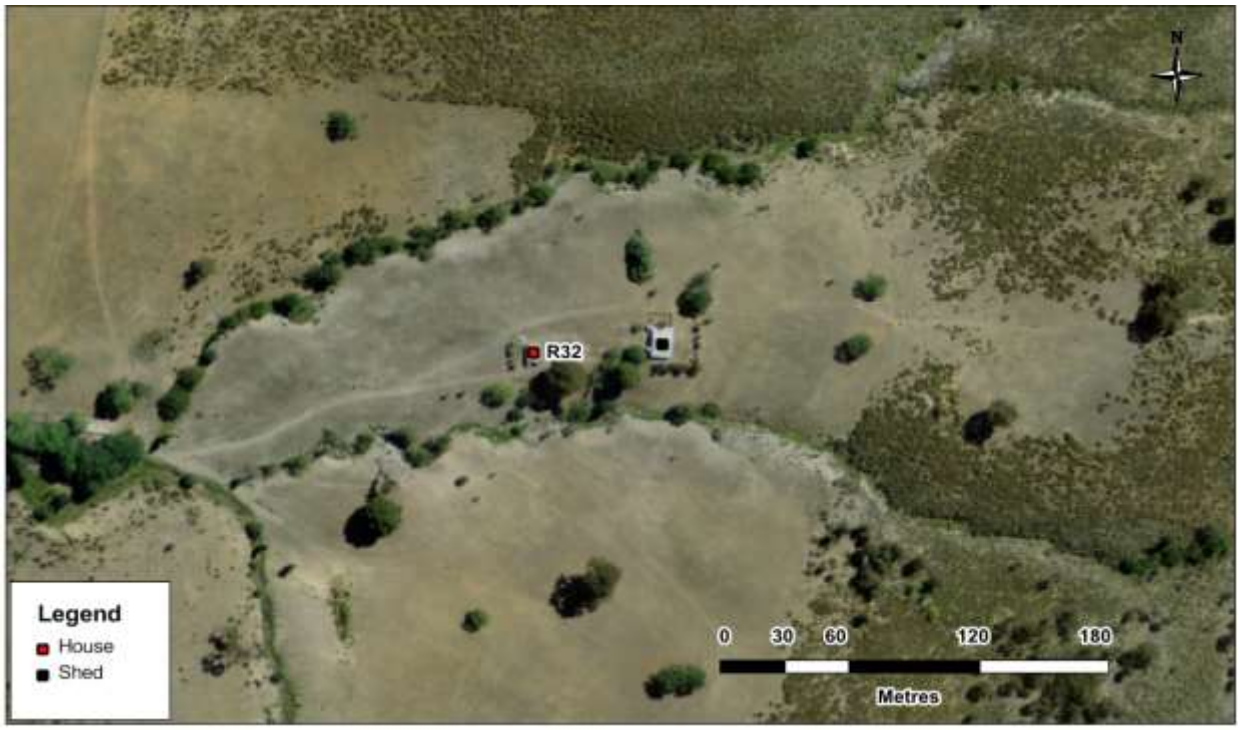


Figure 14-7 Aerial imagery of dwelling R32

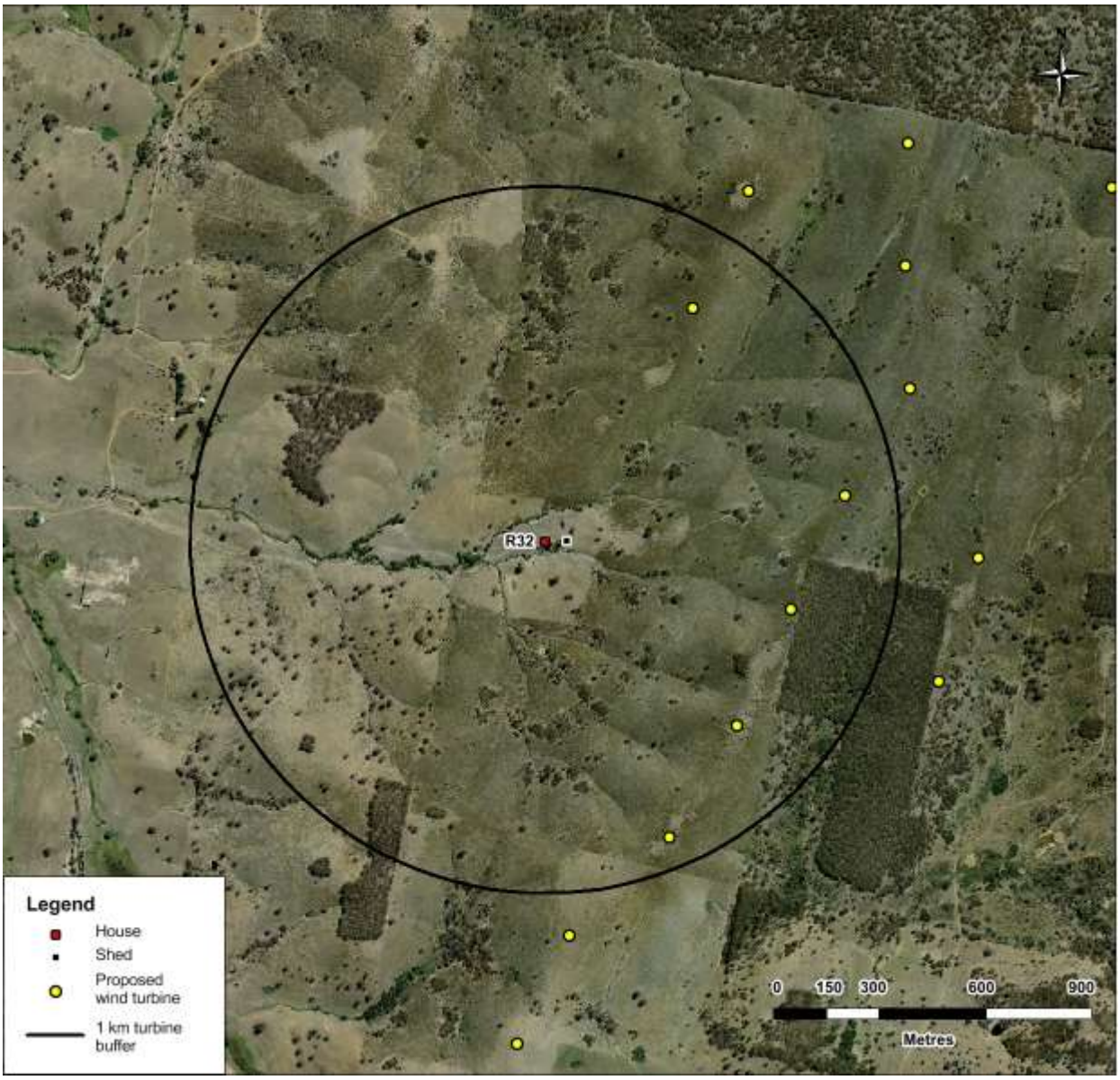


Figure 14-8 Proposed turbines relative to dwelling R32

14.4.6 Health effects from shadow flicker

Flicker frequency of rotating propellers, including wind farm rotors, is derived by multiplying the hub rotation frequency by the number of blades. Based on the rotation speed of the 3 bladed wind turbines proposed for the project, the maximum shadow flicker frequency would be 1 cycle per second (1 Hz), well outside the frequency range associated with flicker vertigo or photosensitive epilepsy.

The operational wind turbines are not anticipated to produce a flicker frequency high enough to pose a health risk. Comparable turbines have been rated 0.45 to 0.95 Hz, significantly below critical levels of 3-30 Hz for public health. The project is therefore unlikely to represent a health risk to local residents in relation to flicker vertigo or photosensitive epilepsy.

This sentiment is also reflected in a recent public statement by the National Health and Medical Research Council titled 'Wind Turbines and Health' which has stated that the evidence on shadow flicker does not support a health concern (NHMRC, 2010).

14.4.7 Blade Glint

Blade glint occurs when sunlight is reflected off turbine blades. The concern is that this may affect some motorists or cause annoyance at dwellings.

Turbine manufacturers have acknowledged the possibility of blade glint and use a low reflectivity gel finish to reduce any reflectivity. The turbines proposed for this project would be finished in a matte, non-reflective finish to ensure blade glint impacts do not occur.

14.4.8 Conclusion

The worst case predicted shadow flicker at each dwelling within 1km of the proposed wind turbines is shown in Table 14-5. Additionally an assessment has been made on the level of conservatism associated with the worst case results by reduction in shadow flicker due to turbine orientation based on wind direction occurrences measured on site and cloud cover. The adjusted results are shown in the table and indicate that only one location exceeds the accepted limit of 30 hours per year.

The dwelling where exceedance occurs is R32. Given the dwelling is surrounding by vegetation on the south and south-eastern sides and turbines causing shadow flicker are situated in this direction it can be expected that this will further reduce the shadow flicker. Additionally the owner is a project involved stakeholder and understands the associated impacts of shadow flicker.

14.4.8.1 Mitigation Measures

- If shadow flicker is found to be a nuisance at a particular residence at a known location a physical screen can be placed between the location and the wind turbines. Additional trees or other vegetation can be used to accomplish this.
- Appropriate mitigation measures will be negotiated and implemented, where necessary, including potential limiting hours of operation on selected turbines or pre-programming the control system of individual wind turbines to automatically shut down while these conditions are present.
- Shadow flicker effects on motorists would be monitored following commissioning and any remedial measures to address concerns would be developed in consultation with the RMS and the Department of Planning.

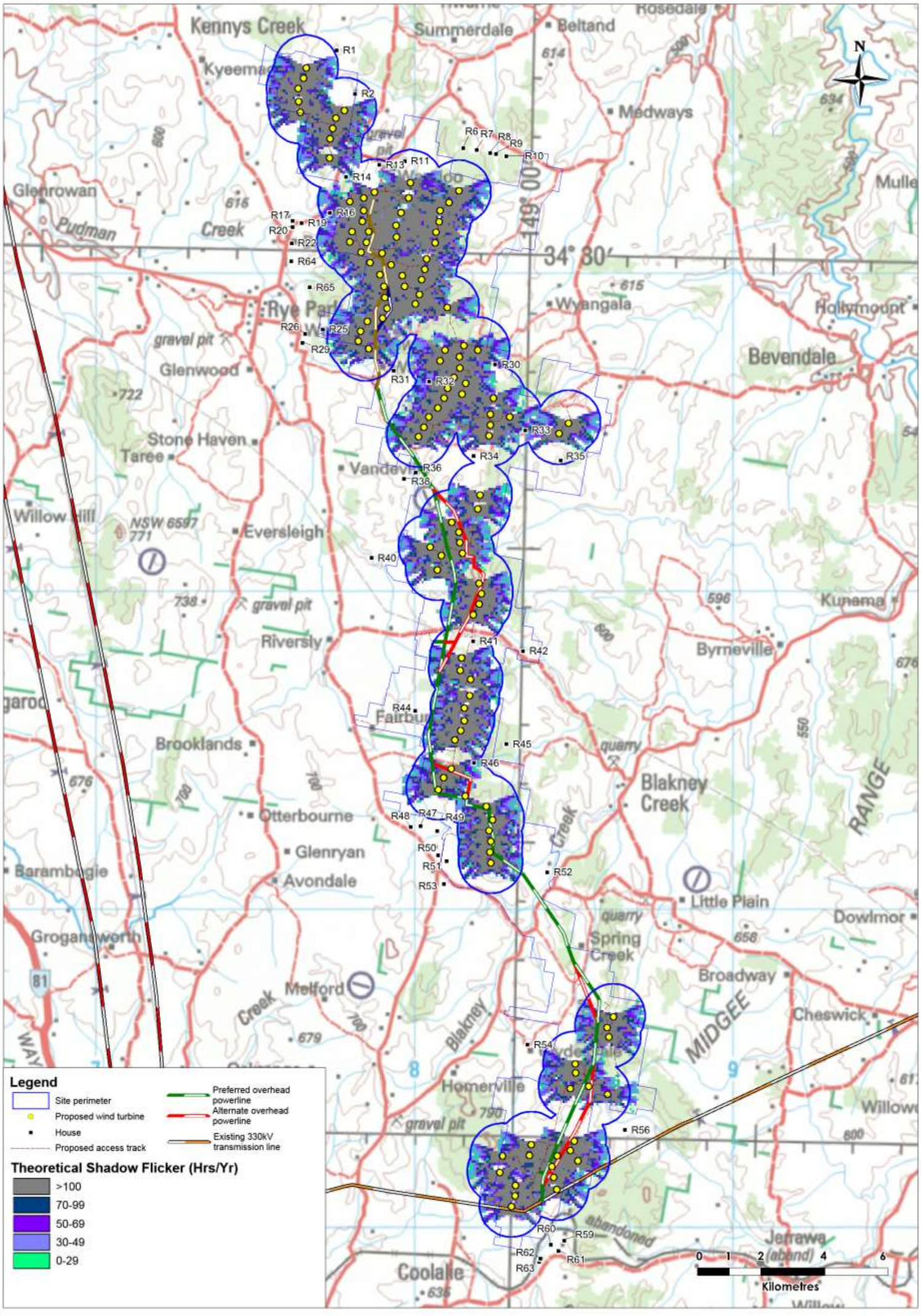


Figure 14-9 Areas potentially affected by shadow flicker

14.5 Fire and Bushfire Risks

14.5.1 Background

A bushfire management plan would be prepared prior to construction and included within the Construction and Operational Environmental Management Plans. Bushfire safety Issues that are associated with wind farms include:

- the potential for wind farm infrastructure to cause a fire that may or may not result in a bush fire;
- the potential for the wind farm to be affected by a passing bush fire and the impact the existence of turbines may have on fire management; and,
- the presence of additional ignition sources as a result of the construction, operation or decommissioning of the wind farm.

14.5.2 Existing environment

The development envelope for the project is predominately pasture with patches of remnant Box Gum Woodlands also present.

The bushfire danger period stated by the NSW Rural Fire Service (RFS) is generally between 1st October and 31st March, but can vary subject to local conditions. Summer conditions in these LGAs can be dry and hot with high wind speeds. Existing ignition sources include farm machinery and vehicles, hay storage, vehicles stopping in long grass on road verges, cigarette butts thrown from car windows and lightning strikes. The elevated position of the sites may increase the frequency of lightning strike. The steep topography and absence of built areas or natural fire breaks such as large water bodies may assist the rate of spread of wildfires. The RFS Fire Prone Land proximate to the Project site can be seen in Figure 14-10.

Factors mitigating fire risks within the site include the sparse and fragmented nature of woodland and forest remnants flanking the development envelope and the continued grazing regimes, which acts to reduce fuel loads. However grass fires can spread rapidly and threaten life and property.

The NSW Fire Brigade has the authority to attend, combat and render safe any land-based or inland waterway spillage of hazardous materials within the State. The NSW Fire Brigade defines hazardous materials as (F&R NSW, 2007):

> *"anything that, when produced, stored, moved, used or otherwise dealt with without adequate safeguards to prevent it from escaping, may cause injury or death or damage to life, property or the environment".*

The fuels and lubricants required to construct and operate the wind farm constitute hazardous materials under this definition, and any fire at the wind farm would come under the management of the NSW Fire Brigade supported by the RFS.

All NSW Fire Brigade fire stations are equipped with trained personnel and resources for dealing with hazmat incidents. The closest NSW fire brigades to the site are Boorowa Fire Station (20 km from the site) and Yass Fire Station (43km from centre of the site – 15 km from the southern boundary), in addition to a RFS brigade in Rye Park.

The Hazardous Materials Response Unit has a 24 hour phone contact (Tel: 02 9742 7155). Intermediate hazardous materials response is delivered by 20 strategically located units, each unit is equipped with detection equipment and has the capability to access chemical databases with information on chemical, biological, radiological and toxic industrial chemical substances.

14.5.3 Assessment

Construction Activities

Flammable materials and ignition sources brought onto the site, such as fuels, would increase the risk of fire during the construction period. Correct handling and storage procedures would mitigate against the risk of ignition. Appropriate fire fighting equipment would need to be held on site when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use.

The RFS would need to be consulted in regard to the adequacy of bushfire prevention procedures to be implemented on site during construction, operation and decommissioning. These procedures would in particular cover hot-work procedures and response measures to control any incident.

Operational Activities

Being electrical equipment and containing petrochemicals, there is potential for the wind turbines, substations, control buildings and powerlines to start or influence the spread of fire. For the wind turbines themselves, the risk of fire can be associated with malfunctioning turbine bearings, inadequate crankcase lubrication, electrical distribution facilities, electrical shorting or arcing occurring in transmission and cable damage during rotation (AusWEA, 2001).

The ready visibility of the turbines and local presence of RFS equipment and personnel would assist detection, response time and control. In addition, shut down mechanisms are installed in the wind turbines, and remote alarming and maintenance procedures would also be used to minimise risks.

Lightning conductors are installed in turbines to ground lightning strikes in order to minimise risk of damage to the turbines and risk of ignition of a wildfire. Relatively minor damage to turbines may occur from lightning strike. At the existing Crookwell I site, a direct strike resulted in damage to one of the turbine blades, which was repaired onsite. No wildfire resulted. The risk of turbine ignition is considered to be low, based on the low likelihood of electrical failure or over-heating and a range of factors mitigating the fire hazard.

Transmission and powerlines would be installed to connect the wind farm to the electricity grid. The powerlines are underground across most of the site and overhead to connect strings of turbines to the substation. The overhead lines have been routed to avoid trees and forest fragments where possible, reducing the need for clearing and eliminating ongoing fire risks from tree growth and in the event of a line breakage. Cable routes would be periodically inspected to monitor any regrowth.

The transformers located in the substation facilities would contain transformer oil for the purpose of cooling and insulation. These facilities would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire and would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). Transformer oil would be changed regularly at appropriate intervals by qualified staff to minimise the potential for fire caused by contaminated oil. The oil would be removed from the site and disposed of appropriately.

The substations would be surrounded by a gravel and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation areas would also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. An asset protection zone would be maintained around the control room and substation buildings, compliant with the RFS Planning for Bushfire Protection guidelines. Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.

Impacts on fire-fighting operations

Wind farms have been found to influence temperature and wind speed around turbines and have the potential to influence bushfire behaviour. A distance of up to 1.25km around each wind turbine is likely to experience warmer night temperatures and faster wind speeds on average, although this attenuates rapidly with distance from the turbine (SEDA, 2002). While the amount of increase is small (approximately 0.7^{o}C increase and approximately 0.6 metres/second increase at ground level; (Baidya Roy et al., 2004)) these factors may enhance bushfire conditions, slightly increasing the intensity or rate of spread of a bushfire at the site. This minor increase in fire intensity is not considered likely to noticeably affect the rate of spread or controllability of wildfires. In the event of a fire, the turbines would be shut down.

The turbines have the potential to present a hazard to fire fighting helicopters and planes, however, the access tracks installed to build and maintain the wind farm would increase the accessibility onsite and would therefore have a positive impact on the response time and ability to fight fires onsite or on neighbouring properties.

The RFS have participated in the environmental assessment process of several wind farms in NSW. Representatives of the RFS have stated that, due to the hazardous materials stored onsite (hydrocarbons within turbines and the substation), the local RFS would only ever act in a support capacity to the NSW Fire Brigade, in the event of an infrastructure related fire onsite. The RFS and NSW Fire Brigade would be consulted regarding safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, and also in the event of an external wildfire threatening the wind farm. They have also stated that wind farm infrastructure is not different with regard to bush fire risk than similar large scale infrastructure developments.

While the risk of bushfires would be increased by the construction and operational activities of the wind farm, the cleared nature of the land and the improvements to site access would aid fire fighters on site.

14.5.4 Mitigation

- Ensure that all project components on the site are designed, constructed and operated to minimise ignition risks, provide for asset protection consistent with relevant RFS design guidelines (NSW RFS, 2006; NSW RFS, 2010) and provide for necessary emergency management including appropriate fire-fighting equipment and water supplies on site to respond to a bush fire.
- Regularly consult with the local RFS to ensure familiarity with the project, including the construction timetable and the final location of the entire infrastructure on the site. The Proponent will comply with any reasonable requests of the local RFS to reduce the risk of bushfire and to enable fast access in emergencies.
- Prepare a Bushfire Management Plan as part of the Construction Environmental Management plan. The RFS and NSW Fire Brigade would be consulted in regards to its adequacy to manage bushfire risks during construction, operation and decommissioning. As a minimum the plan would establish hot-work procedures, asset protection zones, safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure. All flammable materials and ignition sources brought onto the site, such as hydrocarbons, would be handled and stored as per manufacturer's instructions
- During the construction phase, appropriate fire fighting equipment would be held on site when the fire danger is very high to catastrophic, and training would be provided as necessary in its use. Fire extinguishers would be stored onsite in the control building and within any substations.
- Substations would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facilities would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bundled area is clear (including removing any rainwater).
- Shut down of turbine components would commence if the components reach critical temperatures or if directed by the RFS in the case of a nearby wildfire being declared (all hours contact points would be available to the RFS during the bushfire period. Remote alarming and maintenance procedures would also minimise the risk. Overhead transmission easements would be periodically inspected to monitor regrowth of encroaching vegetation.

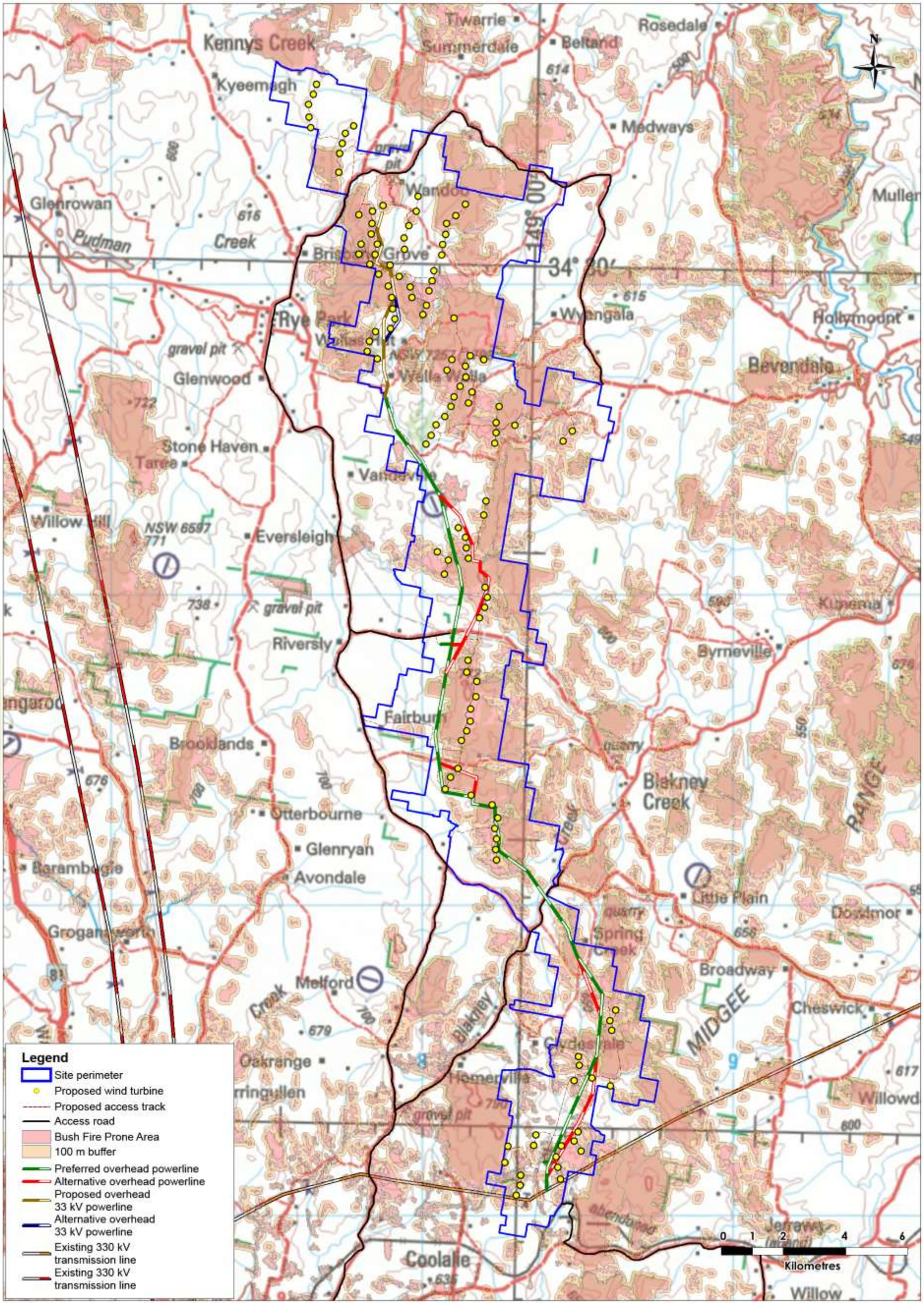


Figure 14-10 Bush fire prone areas near the Rye Park Wind Farm

14.6 Blade Throw

Blade throw refers to the event in which ice or a turbine blade itself becomes separated from the nacelle into the surrounding environment. On the occasions where part of the blade has become separated from the tower, the most common causes are lightning strikes, storms, material fatigue or poor operation and maintenance practices. Wind turbines manufacturers have been implementing new design features to reduce the risk of these events occurring even further. Some of these advances include increasing lightning protection along the blades to reduce the damage from strikes and developing greater control systems to monitor any decrease in structural integrity and implement an automatic shutdown. Furthermore, modern turbines have an automatic braking system when wind speeds exceed a set value. For the case of the Vestas V112 as proposed in this environmental assessment, the cut-out speed for high winds is 25 m/s (90 km/h).

Ice throw occurs when the surrounding environment drops below freezing temperature and ice develops on the turbine blade. The ice is then dislodged when the turbine blade begins to rotate or the surrounding temperature increases. Rye Park and the surrounding regions have been known to regularly have sub-zero nights throughout winter and therefore this must be considered as a low possibility for the winter months.

While there is a possibility of these events occurring, the likelihood of a landowner being near a turbine during storms or freezing conditions is considered low; however, land owners will be advised to avoid turbines during these conditions.

14.7 Health

Some areas of the community, particularly those proximate to proposed or operating wind farms, have raised concerns for the potential impacts of wind turbine noise on human health. These concerns appear to relate to emissions from either low frequency noise or infrasound which is the two areas generally raised regarding potential health impacts from wind farm noise. Both these potential noise related impacts are addressed in further detail in Section 10 of this EA.

Other areas of concerns for human health related impacts from wind farms include electromagnetic radiation, shadow flicker and blade glint produced by wind turbines. While a range of effects such as annoyance, anxiety, hearing loss, and interference with sleep, speech and learning have been reported anecdotally, there is no published scientific evidence to support adverse effects of wind turbines on human health. There have been a number of studies into the perceived health impacts to humans from wind farms over the last few years and an outline of the key points from some of these studies include:

Environmental Protection Authority of South Australia

In January 2013, the South Australian Environmental Protection Authority (EPA) released findings of a study into the level of infrasound within typical environments in South Australia, with a particular focus on comparing wind farm environments to urban and rural environments away from wind farms.

The study concluded that the level of infrasound at houses near the wind turbines assessed is no greater than that experienced in other urban and rural environments, and that the contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment.

National Health and Medical Research Council

In 2010, Australia's peak body for undertaking health and medical research, the National Health and Medical Research Council (NHMRC), undertook a study of available literature on the potential impacts of wind turbines on human health. The objective of the study was to ascertain if the following statement could be supported by the evidence: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.

The study findings noted that: Based on current evidence, it can be concluded that wind turbines do not pose a threat to health if planning guidelines are followed, and concluded by stating that: The health effects of many forms of renewable energy generation, such as wind farms, have not been assessed to the same extent as those from traditional sources. However, renewable energy generation is associated with few adverse health effects compared with the well-documented health burdens of polluting forms of electricity generation. This review of

the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.

The NHMRC public statement accompanying the study also concluded that: It is recommended that relevant authorities take a precautionary approach and continue to monitor research outcomes. Complying with standards relating to wind turbine design, manufacture, and site evaluation will minimise any potential impacts of wind turbines on surrounding areas.

World Health Organisation

The World Health Organisation (WHO) has developed guideline exposure values for various types of community noise emissions. These noise values are designed to avoid long term deterioration in physical or psychological functioning. The guideline of most relevance to the potential impacts of wind farm noise is that for sleep disturbance. The WHO considers that night-time noise levels at the outside façade of a dwelling should not exceed 45dBA with open windows. The noise assessment using different wind turbine models indicates that residences at the project would experience night time noise levels that are unlikely to exceed the WHO recommended levels.

NSW Parliament Inquiry

In 2009 the NSW Parliament conducted an inquiry into rural wind farms in 2009, which included consideration of the potential health impacts of wind farms. The inquiry report (New South Wales Parliament Legislative Council General Purpose Standing Committee No. 5, 2009) noted that "…the health effects associated with wind farm noise appear to be the most common concern…" and observed that "…it was clear that some people are significantly affected by their experience of wind farms, both existing and proposed". However, the inquiry report concluded that "…many purported impacts have created little more than unfounded fear in local communities, for example vibroacoustic disease, wind turbine safety, shadow flicker and 'Wind Turbine Syndrome'" and that "…the level of concern for many impacts is not supported by evidence" with "…such impacts being promoted to support arguments against wind power in general, rather than being used to highlight fundamental problems with wind farms." Notwithstanding that current research has been unable to establish a direct relationship between wind farm noise emissions and health, the NHMRC review (citing Chapman, 2010), note that:

> *"It has been suggested that if people are worried about their health they may become anxious, causing stress related illnesses. These are genuine health effects arising from their worry, which arises from the wind turbine, even though the turbine may not objectively be a risk to health."*

The Proponent will establish a complaints management system to be implemented prior to the construction phase and maintained throughout the operation phase of the development to register noise and other health complaints and concerns about the Proposal from the community.

15 Water Supply, Water Quality and Hydrology

15.1 Catchment Management Regions

The Rye Park Wind Farm is located across two Catchment Management Authority (CMA) regions. The majority of the wind farm is located within the Lachlan CMA region, with a small portion of the south-west corner of the project located in the Murrumbidgee CMA region. Figure 15-1 highlights the location of the wind farm in relation to the surrounding CMA regions.

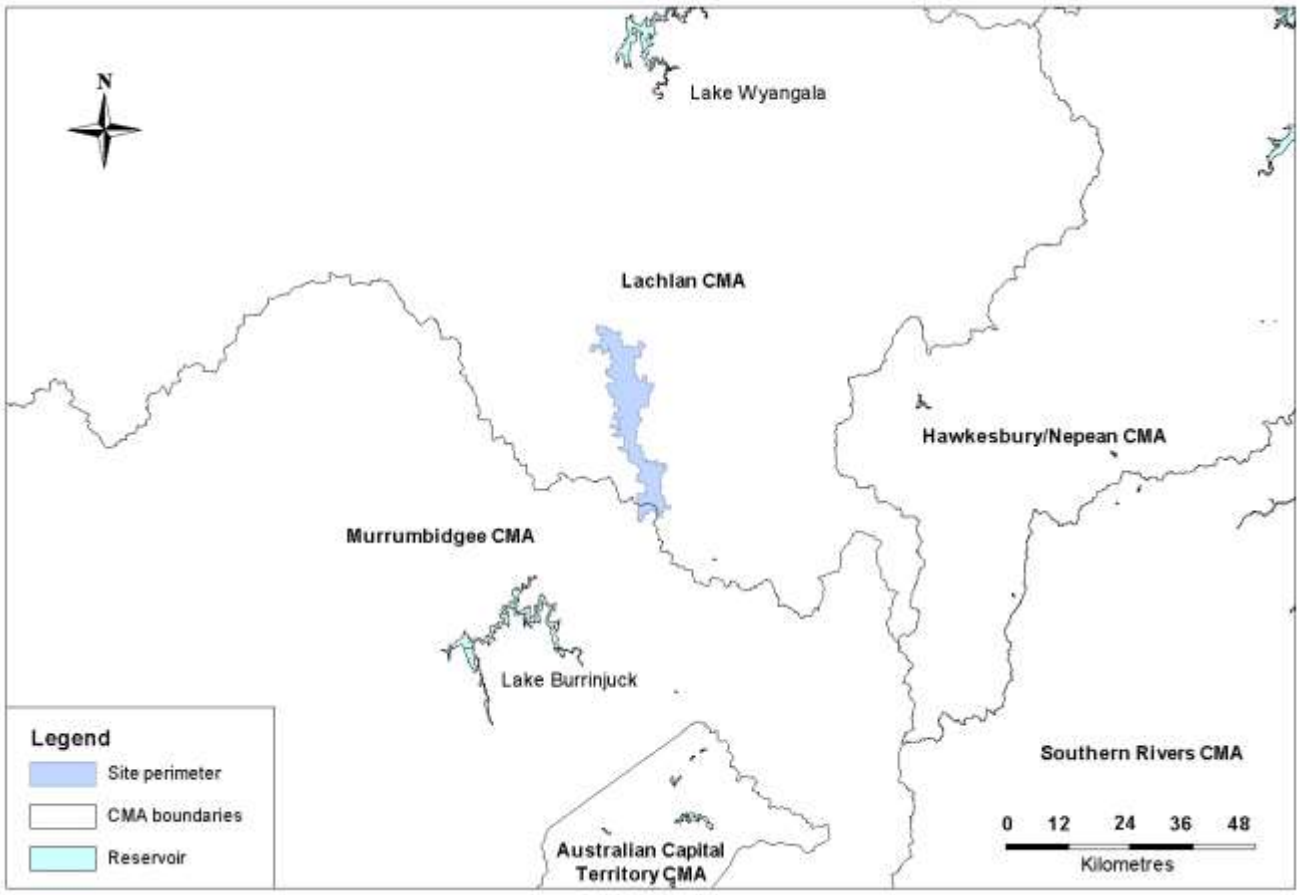


Figure 15-1 Surrounding Catchment Management Authority regions

15.1.1 Lachlan Catchment Management Authority

The Lachlan catchment covers an area of approximately 84,700 km^2 and has a population greater than 100,000 people and produces 14% of NSW agricultural production. The catchment encompasses 24 local government areas and is located in central western New South Wales, flanked by the Macquarie and Bogan catchments to the north and Darling to the west, Murrumbidgee to the south and the Sydney/Shoalhaven Basin to the east (LCMA, 2007).

The main dam regulating flows in the Lachlan River is Wyangala Dam, which has a capacity of 1,220,000 megalitres (ML) and is located at the junction of the Lachlan and Abercrombie Rivers. The Belubula River is regulated by Carcoar Dam, has a capacity 36,000 ML and is located about 10 km downstream of Blayney (LCMA, 2007).

15.1.2 Murrumbidgee Catchment Management Authority

The Murrumbidgee catchment has one of the most diverse climates in NSW, ranging from the alpine areas of Kosciuszko National Park and the Monaro plains, through to the rich grazing and grain belts of the South West Slopes and Plains and the shrublands and grasslands of the semi-arid western Riverina. It covers an area of 84 000 km^2, the Murrumbidgee catchment is home to more than 500,000 people. Canberra and Wagga are both situated within the catchment (MCMA, 2012).

The closest major catchment to the proposed wind farm is Lake Burrinjuck, 50 km to the south-west of the project boundary. It has a catchment area of 12,953 km^2, a storage capacity of 1,028,000 ML and supplies water for towns, river flows, stock and domestic requirements, irrigated agriculture, industry, flood mitigation and environmental flows (State Water, 2009).

15.2 Local Water Supplies

15.2.1 Regional Water Sources

The project is situated on the boarder of the Lachlan and Murrumbidgee Catchment areas, with the principle water courses being the Lachlan River 16 km to the east, Boorowa River 20 km to the west, the Yass River 10 km to the south and the Murrumbidgee River 50 km to the south-west.

Watercourses in the catchment area generally flow in a westerly direction until they form with the principle rivers in the catchment. In the western section of the catchments the Lachlan River and Murrumbidgee River combine and form part of the Murray Darling Basin.

The closest major reservoirs to the site are:

- Burrinjuck Dam — 50 km to the south-west
- Pejar Dam — 55 km to the east
- Lake Wyangala — 60 km to the north
- Cotter Dam — 60 km to the south

Yass Dam, on the Yass River, supplies water to the town of Yass and the villages of Bowning and Binalong. The Murrumbateman bore supplies the village of Murrumbateman. All other areas of the Yass Valley LGA rely on onsite water collection and storage. Residents in non-urban zones are required to have tanks for rainwater collection as a condition of development consent; this is also to assist bushfire-fighting services.

The town of Rye Park is dependent on sourcing its own water through the use of their own tanks, as there is no town water supply from Yass or Boorowa. Additional water is also pumped from Pudman Creek for use in the town under domestic water licences.

15.2.2 Site Surface Water

The use of aerial photographs, topographical and surface water overlays for any creeks, watercourses and wetland areas were utilised to identify any significant watercourses, standing water bodies, lakes and wetland areas within the study area. No significant water bodies or wetlands have been identified within or near the wind farm site. Some small stock dams are interspersed across the site area.

The watercourses on site have been assessed based on their stream order. The order of streams was determined based on the Strahler method of stream ordering classification. This method of stream ordering involves labelling all upper tributaries as first order streams, which when two first order streams converge they combine to form a second order stream. Consequently where two second order streams converge they form a third order stream. When a stream of lower order joins a stream of higher order the downstream section of the stream will retain the order of the higher order upstream section (Yang and Kwan, 2001).

The site contains a number of watercourses which are predominantly first order streams with some second order streams. The turbines are generally located on the higher ground and the access tracks and underground cabling generally follow the higher ground locations. The layout of the wind turbines, the access tracks and underground

cabling has been designed to avoid crossing known third order watercourses where possible on the site. However, there will be a requirement to upgrade an existing access track which crosses a third order stream (Blakney Creek) at the eastern boundary of the site, adjoining Blakney Creek North Road. This existing watercourse crossing will be upgraded and managed to be consistent with the 'Guidelines for Controlled Activities on Waterfront Land' as specified by the NSW Office of Water[7]. The NSW Office of Water has been consulted regarding the project. The watercourses through the site and the access track layout are illustrated in Figure 15-2.

The location of the substations and switchyard are also positioned away from any watercourses. Overhead powerlines are proposed to interconnect different segments of the project. The use of overhead powerlines will also be used to avoid the requirement to place underground cables through existing watercourses.

[7] Water NSW. Can be accessed via 'www.water.nsw.gov.auM/ater.Licensing/Approvals/Controlled-activities/default.aspx'