

UNION FENOSA
WIND AUSTRALIA

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PALING YARDS WIND FARM

ENVIRONMENTAL ASSESSMENT

January 2014

Prepared by:
Tract Consultants Pty Ltd

on behalf of
Union Fenosa Wind Australia Pty Ltd

In conjunction with:
- AECOM Australia Pty Ltd
- Anderson Environmental Consultants Pty Ltd
- Aviation Projects
- Environmental Resources Management Australia Pty Ltd
- Freehills Pty Ltd
- Garrad Hassan Pacific Pty Ltd
- Green Bean Design
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Quality Assurance - Report Record

Project Name	**Paling Yards Wind Farm**
Document Number	**PR 00**
Revision (see below)	**04**
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Date of Issue	**January 2014**

Revision Status

00	**March 2012**
01	**January 2013**
02	**April 2013**
03	**June 2013**
04	**January 2014**

Author's certification

Nevan Wadeson, Adam Terrill and Rebecca Wardle of Tract Consultants are the primary authors of this document. The report draws on the work of a number of specialists engaged as part of the project team. The information contained in this document is neither false nor misleading.



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Abbreviations

ABS	Australian Bureau of Statistics
AC	Advisory Circular
ACMA	Australian Communications and Media Authority
BOM	Bureau of Meteorology
BVTs	Biometric Vegetation Types
CAP	Catchment Action Plan
CASA	Civil Aviation Safety Authority
CEMP	Construction Environmental Management Plan
CFA	Country Fire Authority
Council	Oberon Shire Council
CSR	Corporate Social Responsibility
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DoPI	Department of Planning & Infrastructure
EA	Environmental Assessment
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPHC	Environment Protection and Heritage Council
EPL	Environment Protection Licence
GWEC	Global Wind Energy Council
LEP	Local Environmental Plan
LRET	Large-scale Renewable Energy Target
MRET	Mandatory Renewable Energy Target
NHMRC	National Health and Medical Research Council
NPW Act	National Parks and Wildlife Act 1974
NRET	NSW Renewable Energy Target
OD	Over Dimensional
POE Act	Protection of the Environment Operations Act 1997
RAAF AIS	Royal Australian Air Force - Aeronautical Information Service
REP	Regional Environmental Plan
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RTA	Road Traffic Authority
SEPP	State Environmental Planning Police
SRET	Small-scale Renewable Energy Scheme

SWMP	Soil and Water Management Plan
TSC Act	Threatened Species Conservation Act 1995
GNF	Gas Natural Fenosa
UFWA	Union Fenosa Wind Australia Pty Ltd
WHO	World Health Organisation
WMA	Water Management Act 2000
WMO	World Meteorological Organisation
WTG	Wind Turbine Generator
WWEA	World Wind Energy Association
ZVI	Zone of Visual Influence

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CHAPTER 1

EXECUTIVE SUMMARY

1 Executive Summary

1.1 Introduction

Union Fenosa Wind Australia (UWFA) (the 'proponent') and its successors and assigns, is seeking project approval for the construction and operation of a wind energy facility known as the Paling Yards Wind Farm (the 'project').

The project is proposed to be located on two land holdings known as 'Mingary Park' and 'Paling Yards' comprising a total of approximately 3,900 hectares (the 'site'). It also includes a transmission line corridor of approximately 9km in length and 70 metres in width across nine land parcels to the north-east of the site. Significantly, there are no non-involved dwellings within 2km of the turbines.

The site is situated approximately 60km south of the township of Oberon and 60km north of the township of Goulburn, in the Central Tablelands of NSW.

This chapter provides a brief overview of the environmental assessment, including the details of the project, the community and stakeholder engagement undertaken, the findings of the specialist assessments, and the impact mitigation measures proposed.

1.2 The Proposal

The Paling Yards Wind Farm project involves the construction, operation and maintenance of up to 55 wind turbines, together with the ancillary infrastructure.

The project comprises a number of elements, including:

- Up to 55 individual wind turbines with a capacity of up to 4.5MW;
- Up to 55 individual kiosks for the housing of transformers and switchgears and associated control systems, to be located in the vicinity of the wind turbine towers (in some turbine models the equipment is integrated within the tower or nacelle);
- Upgrades to local road infrastructure including up to six access points from Abercrombie Road;
- Internal unsealed tracks for vehicle access to turbines and infrastructure;
- An underground electrical and communication cable network linking turbines to each other and the proposed on-site substation;
- Up to three wind monitoring masts fitted with various instruments such as anemometers, wind vanes, temperature gauges and potentially other electrical equipment;
- A temporary batching plant to supply concrete for the foundations of the turbines and other associated structures;
- Obstacle lighting to selected turbines (if deemed necessary);
- Removal of native vegetation (if required);
- Vegetation planting to provide screening;
- Wind farm and substation control room and facilities buildings;
- An on-site electrical substation and approximately 9km of overhead powerline of up to 500kV;
- Grid connection achieved via an off-site 500kV electrical Terminal Station (including control room and other associated facilities) for the grid cut-in to the Mt Piper to Bannaby 500kV transmission line; and

- All associated and ancillary uses and activities.

The specialist consultants' assessments were based on a layout of up to 59 turbines, which was the number of turbines previously under consideration. However, the results of the final flora and fauna assessment have prompted the removal of three turbines (P2, P6 and P7) due to the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth government's Environmental Stewardship program.

As part of the adequacy review of this EA, discussions between DoPI and the flora and fauna specialist have prompted the removal of another turbine (P11). The proponent has agreed to the removal of this turbine in order to reduce vegetation clearing for the project.

Therefore, the proponent seeks approval for up to 55 turbines.

As the specialist assessments of the project have been based on a layout of 59 turbines, the findings present 'worst-case' scenario impacts and can be considered conservative in nature.

1.3 Project Justification

The primary objective of the Paling Yards Wind Farm is to produce renewable energy. This form of energy meets Federal, State and Local Government objectives of reducing greenhouse emissions and the adverse impacts of climate change.

The project would bring environmental, social and economic benefits to the Paling Yards locality, the wider region, and the State of NSW.

Environmentally, the wind farm would displace up to approximately 535,961 tonnes of greenhouse gases and in doing so assist in attempts to reduce the impacts of climate change. It would provide up to 550,833 Megawatt hours (MWh) of renewable energy per year and power the equivalent of up to 85,344 households per year and supply the equivalent of up to 221,895 people. This equates to approximately two-thirds of Canberra's population (350,000) or more than ten times the size of Goulburn (20,127).

Economically, the wind farm would invest approximately $287 million into the economy and create 65 full-time equivalent jobs in construction and 11 full-time equivalent jobs during operation. In addition, up to 10 additional contractors could be working on the site once every 10 to 15 years as part of scheduled major site overhauls.

Socially, the wind farm would fund upgrades to local roads, assist in addressing the population decline of the region, and position the area as a leader in renewable energy industries. Furthermore, UFWA is exploring options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations.

1.4 Project Background

The project is a transitional Part 3A project under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and, as such Part 3A continues to apply to the project despite its repeal. The project is also a Critical Infrastructure Project under Part 3A of the EP&A Act as it is a renewable energy project with a peak generating capacity of between 112 to 200 Megawatts (MW).

A Preliminary Environmental Assessment was lodged by Tract Consultants on behalf of the proponent with the NSW Department of Planning and Infrastructure (DoPI) (formerly the Department of Planning) on 12 April 2010. DGRs were subsequently issued for the project on 6 May 2010 and the supplementary DGRs were issued on 16

August 2011. This Environmental Assessment (EA) has been prepared to address the DGRs.

The NSW Government released the *Draft NSW Wind Farm Planning Guidelines* (Draft Guidelines) for exhibition on 23 December 2011. DoPI wrote to all proponents of wind farms in NSW on 18 April 2012 regarding the Draft Guidelines and enclosed a checklist highlighting the key provisions of the guidelines which should be adopted for all applications yet to be exhibited.

Whilst the Draft Guidelines are yet to be finalised and further supplementary DGRs have not been issued requiring consideration of the Draft Guidelines in this EA, this EA considers the Draft Guidelines and demonstrates that the project is generally in accordance with the Draft Guidelines. A checklist for the Draft Guidelines is provided in **Appendix 1**.

1.5 Community engagement and support

The proponent understands the need to effectively communicate with local residents and all relevant stakeholders through a program of community consultation. UFWA has developed a community consultation and engagement program aimed at providing the community and stakeholders with factual information about the project and gathering feedback about their concerns and interests, which can be subsequently addressed in the approvals process and influence the project design.

In order to meet the information needs of the community, a range of consultation strategies were adopted and undertaken, including:

- Consultation with government departments and agencies, non-government agencies, community groups and individuals.
- Direct contact with identified community groups.
- Door-knock consultations undertaken within 5km of the site and along the corridor of the proposed transmission line routes.
- Community newsletter distributed to the local area and to anyone registering interest in the project.

A key step in the stakeholder identification process and community consultation was undertaken through the door-knock consultation and surveys carried out by UFWA representatives on 30 and 31 May and 1 June 2011 and again on 5 and 6 July 2011.

A community information session will be held during the public exhibition of the wind farm and advertised through a newsletter and local press.

The site is in a generally isolated location and there are no non-project involved, identified dwellings within 2km of any of the proposed wind turbines. Therefore, no neighbour agreements are required for the project. However, the consultation with surrounding residents and stakeholders to date has revealed a diversity of views on the project in the vicinity of the wind farm, which are addressed in this EA and the socio-economic impact assessment at **Appendix 5**.

The key issues identified relate to:

- the impacts of the transmission lines,
- the visual impact of the wind farm,
- reduction in land values,
- noise arising from the turbines,

- fire hazards,
- impacts to flora and fauna,
- impacts to the ability to carry out aerial agriculture,
- electromagnetic interference, and
- shadow flicker.

These issues and are discussed in **Chapter 22** as well as in the full socio-economic report found at **Appendix 5** and the other specialist reports.

UFWA's response and approach to all the issues raised through consultation includes a commitment to implement the impact mitigation measures recommended under each chapter of this EA.

The consultation activities commenced many years ago at the beginning of the project and are proposed to continue throughout the various phases of the project, including after construction. The consultation timeline will be dynamic and will be updated as required to suit the planning process and feedback from key stakeholders.

Since 2010, a number of revisions to the site plan and turbine layout have been specifically influenced by stakeholder input, as well as by the specialists studies completed, including:

- Selection of the northern transmission line as the least impact option;
- Removal of the southern substation;
- Removal of turbine P26 in response to the findings of the noise assessment to reduce potential noise impact for the project involved landowners;
- Removal of turbines P2, P6, and P7 in response to the findings of the flora and fauna assessment and the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth Government's Environmental Stewardship program;
- Removal of turbine P11;
    - removal of associated crane pad from the remnant area; and
    - removal of associated 1,184m of access track of which 353m were in the remnant area.
- Relocation of turbine P10 to 184m south of original location;
    - removal of 184m of access track from the remnant area.
- Relocation of turbine P13 to 70m south-east of original location;
    - removal of 77m of access track from the remnant area; and
    - turbine and crane pad will be located in a more cleared area, hence reducing the vegetation clearing by approximately 50% for this location.
- Relocation of turbine P14 to 86m south-east of original location;
    - removal of 101m of access track from the remnant area; and
    - turbine and crane pad will be located closer to the edge of the remnant area, hence reducing the vegetation clearing by approximately 20% for this location.

- Micrositing of the turbines to minimise local impacts;
- Changes to the location of:
    - several access tracks to further utilise the existing farm tracks and reduce the infrastructure footprint;
    - underground cabling to provide more efficient transfer of electricity and reduce the infrastructure footprint;
    - an access road to separate the wind farm construction vehicle traffic from the access used by the project involved landowners;
    - selecting a smaller wind turbine envelope size for specific locations to reduce potential noise and shadow flicker impact for the project involved landowners;
    - substations to reduce length of overhead powerlines; and
    - powerline poles for the northern transmission line route to minimise and avoid where possible the removal of native vegetation.

In relation to community attitudes to wind farms in Australia, in 2010, the NSW Government commissioned AMR Interactive to undertake a study of community perceptions towards wind farms in NSW. AMR Interactive surveyed over 2,000 residents and 300 businesses in regional NSW.

The results showed that a significant majority (85%) of surveyed respondents indicated that they would support wind farms being built both in NSW as well as in their local region (80%). Over three quarters of the respondents (79%) were supportive of wind farms being built within 10km from their residence, and more than half of the respondents (60%) supported them at 1-2km.

More recently, the CSIRO recently conducted an investigation, *Exploring Community Acceptance to Rural Wind Farms in Australia: a snapshot*, (2012) that sought to improve understanding of community acceptance of rural wind farms. The study found that *"community acceptance of wind farms could be increased by developers intentionally adopting frameworks for transparent and well structured community engagement"*.

In accordance with these findings and recommendations, a detailed and thorough community consultation program has been designed for direct community consultation and to have stakeholders' views heard and responded to. The proponent has already taken steps in the process to proactively engage the local community and stakeholders in the project.

Community input has influenced the design of the wind farm and any concerns will continue to be addressed.

The proponent seeks to minimise or eliminate where possible any potential adverse impact from the construction, operation and decommission of the project upon the community and the environment.

1.6 Assessment findings and impact mitigation measures

The EA has found that the project would have a range of positive and negative impacts on the site and region. However, it was found that the benefits of the wind farm would outweigh the undesirable impacts, and with appropriate conditions and mitigation measures detailed, the impacts can be minimised.

Most notably, the project would make a small but important contribution to reducing the adverse impacts of anthropogenic climate change, such as droughts, floods, extreme weather events and sea level rise.

The project is rare in that it is located in an isolated location that is further than 2km from a non–project involved, identified dwelling. As a result, the typical impacts associated with wind farms in proximity to dwellings, such as noise, visual impact, and shadow flicker, are less for this project than most comparable Australian wind farms.

The key matters assessed in this EA in relation to the potential positive and negative impacts of the project include:

- Economic and social impacts,
- Landscape and visual impacts,
- Noise impacts,
- Health impacts,
- Flora and fauna impacts,
- Aeronautical impacts,
- Transport impacts,
- Electromagnetic interference impacts,
- Fire hazard impacts,
- Shadow flicker impacts,
- Heritage impacts,
- Geotechnical impacts,
- Hydrological impacts,
- Cumulative impacts, and
- Community consultation.

The above matters are addressed in this EA under individual chapters.

The assessment of potential negative impacts arising from the project found that the wind farm has the potential to have a low to moderate impact on landscape values, a limited impact on local communications facilities, an increase in noise for some residents, and result in the clearing of non-significant vegetation. Mitigation strategies have been developed and incorporated in the planning and design of the project and in the draft Statement of Commitments made by the proponent and outlined in this EA.

The impacts of the project would be minimised by the extensive range of management plans that would be prepared before construction and ongoing monitoring of the compliance of the wind farm post-construction with the established standards. These commitments are detailed in this report in **Chapter 24**.

No impacts were identified which, after these mitigation strategies have been implemented, are considered unacceptable. The environmental, social and economic benefits of the project are considered to outweigh the mitigated impacts identified.

In relation to noise impacts, the assessment found that all non-project involved residential receivers were found to be below the relevant noise criteria. Some project involved receivers are predicted to slightly exceed the WHO noise criteria, however it is noted that these conservative assumptions would potentially overestimate noise levels as the noise standards may not reflect the circumstances of the project. The noise impact assessment made important recommendations such as the verification of noise levels at commissioning and extensive monitoring throughout the project, in order for standards to be met.

The NSW Government has recognised the wind energy potential of the region by identifying Paling Yards one of six designated renewable energy precincts, called the NSW/ACT Border Region. The renewable energy precincts have been established as locations for the State's future wind power investment due to their suitability for the technology. The precincts are a community partnership initiative in areas where significant future renewable energy development is expected (especially wind farms), designed to give local communities a voice and a stake in renewable energy development.

Associated with this designation is the presence of a number of wind farms in the wider region, with six other wind farms approved or existing within a 50km radius of the site. The cumulative impact of the project was assessed in relation to surrounding projects, and found that there is unlikely to be a significant increase in visual impact. The closest wind farm is the proposed Golspie Wind Farm, which is located approximately 25km to the south/south-west.

1.7 Conclusion

The EA found that in relation to the positive impacts, the EA found that if approved the wind farm would:

- generate 65 full time positions during construction, and 11 full time ongoing positions during the operation;
- invest $287 million in the economy;
- generate up to 550,833 Megawatt hours (MWh) of clean, renewable energy per year, enough to power up to 85,344 households;
- displace 535,961 tonnes of greenhouse gases or the equivalent of taking 123,778 cars off the road; and
- make a small but important contribution to reducing the dangerous impacts of climate change.

In relation to the negative impacts, the EA found that the wind farm has the potential to have a low to moderate impact on landscape values, have a limited impact on local communications facilities, increase noise for some receivers, and result in the clearing of non-significant vegetation. These risks are proposed to be minimised by the extensive range of mitigation measures and management plans detailed in **Chapter 24 – Statement of Commitments**.

The EA found that the project is compatible with the existing land uses of the area and complies with relevant planning and environmental controls applicable to the site.

As a result, it is regarded that the project is in the public interest.

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CHAPTER 2

INTRODUCTION

2 Introduction

2.1 Introduction

Union Fenosa Wind Australia (UFWA) (the 'proponent') and its successors and assigns, is seeking project approval for the construction and operation of a wind energy facility known as the Paling Yards Wind Farm (the 'project'). The Paling Yards Wind Farm project is a major project aimed at providing renewable energy.

Renewable energy, such as wind generated electricity, meets the Federal, State and Local Government objectives of reducing greenhouse emissions and the dangerous impacts of climate change.

The site of the project ('the site') includes two land holdings over approximately 3,900 hectares known as 'Mingary Park' and 'Paling Yards'. There are two homesteads on these properties. The majority of the site has been cleared of native vegetation, although scattered trees are common within the site and thicker vegetation exists near the site's boundary. The site is bordered by the Abercrombie National Park on the western boundary and forested land to the south-east, all of which are heavily vegetated.

The project is a transitional Part 3A project to which Part 3A of the *Environmental Planning and Assessment Act (1979)* (EP&A Act) continues to apply despite its repeal.

A Preliminary Environmental Assessment (PEA) was lodged by Tract Consultants on behalf of the proponent with the NSW Department of Planning and Infrastructure (DoPI) (formerly the Department of Planning) on 12 April 2010. This Environmental Assessment (EA) has been prepared to address the Director-General requirements (DGRs) issued by the Director General of Planning for the project under Part 3A of the EP&A Act which were provided by DoPI on 6 May 2010 and the supplementary DGRs which were provided by DoPI on 16 August 2011.

This EA has also been prepared to address the *Draft NSW Wind Farm Planning Guidelines* (Draft Guidelines), which were released for public exhibition on 23 December 2011, as required by a letter from DoPI dated 18 April 2012. The letter dated 18 April 2012 from DoPI, as well as the 'checklist for applications yet to be exhibited' can be found at **Appendix 1** of this report. Brief comments on how each item on the checklist has been addressed, and which chapter of this report to refer to, are also provided in **Appendix 1**.

The EA was lodged to DOPI on 30 January 2013, and has been subsequently updated to reflect the review by DoPI,

2.2 Project History

The project was originally proposed by TME Australia Pty Ltd in 2002, at which time wind monitoring masts were placed on site to determine the suitability of the wind resource.

Once a suitable wind resource was confirmed, the project progressed through a joint venture with Gamesa Energy Australia Pty Ltd and a consultant team was established in 2004 to prepare an Environmental Impact Statement (EIS) and EPBC referral for a project of approximately 46 turbines of 67 – 78 metres to hub height. The rapid changes in technology in the wind farm industry have now allowed for consideration of an increased number of turbines of increased size.

The project was referred to the then Minister for Environment and Heritage (now the Minister for Sustainability, Environment, Water, Population and Communities) under the *Environmental Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) in

2005. The Minister determined that the project was not a controlled action which required approval under the EPBC Act.

A planning focus meeting was held in February 2005 to provide DoPI with a formal brief of the project and to inform the preparation of the DGRs. However, due to an uncertain investment environment for renewable energy projects, an application was not lodged at that time.

On 29 October 2009, the Deputy Director General, Development Assessment for the Department of Planning, under delegation for the Minister for Planning, determined that the project was a project to which Part 3A of the EP&A Act applied. A Part 3A application was subsequently lodged for the project on 9 April 2010.

Since lodgement of the PEA for the project in April 2010, the proponent has engaged specialist consultants to investigate and assess the site and the project. The ongoing assessments carried out by these consultants have been used in the planning and design of the wind farm and to inform this EA. The consultants' work has been guided by the DGRs and the Draft Guidelines.

A key element of the investigations undertaken in relation to the project was the face to face consultation (door-knock) carried out with surrounding land owners, which took place from 30 May 2011 to 1 June 2011. The results of the door-knock, combined with a second round of consultation with key stakeholders, and additional consultant studies, resulted in a number of changes being made to the project to address some of the major issues raised. Changes to the project since its recommencement in 2010 have included:

- The selection of the northern transmission line as the least impact option;
- Selection of the northern transmission line as the least impact option;
- Removal of the southern substation;
- Removal of turbine P26 in response to the findings of the noise assessment to reduce potential noise impact for the project involved landowners;
- Removal of turbines P2, P6, and P7 in response to the findings of the flora and fauna assessment and the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth Government's Environmental Stewardship program;
- Removal of turbine P11;
    - removal of associated crane pad from the remnant area; and
    - removal of associated 1,184m of access track of which 353m were in the remnant area.
- Relocation of turbine P10 to 184m south of original location;
    - removal of 184m of access track from the remnant area.
- Relocation of turbine P13 to 70m south-east of original location;
    - removal of 77m of access track from the remnant area; and
    - turbine and crane pad will be located in a more cleared area, hence reducing the vegetation clearing by approximately 50% for this location.
- Relocation of turbine P14 to 86m south-east of original location;
    - removal of 101m of access track from the remnant area; and

- turbine and crane pad will be located closer to the edge of the remnant area, hence reducing the vegetation clearing by approximately 20% for this location.

- Micrositing of the turbines to minimise local impacts;
- Changes to the location of:
    - several access tracks to further utilise the existing farm tracks and reduce the infrastructure footprint;
    - underground cabling to provide more efficient transfer of electricity and reduce the infrastructure footprint;
    - an access road to separate the wind farm construction vehicle traffic from the access used by the project involved landowners;
    - selecting a smaller wind turbine envelope size for specific locations to reduce potential noise and shadow flicker impact for the project involved landowners;
    - substations to reduce length of overhead powerlines; and
    - powerline poles for the northern transmission line route to minimise and avoid where possible the removal of native vegetation.

The initial proposal included options for 30 and 50 wind turbines, each with a power output of two megawatts and a collective capacity to produce 60 to 100 megawatts (MW) of renewable energy. The type of wind turbine initially proposed had a maximum rotor radius of 45 metres and a hub height of 67 - 78 metres. The combined height of the tower and the rotor in a vertical position was a maximum of 125 meters.

Due to technological advancements in wind turbine design, the project was enlarged to include up to 60 turbines. However, the results of the preliminary assessment recommended the removal of one turbine (P26).

Following this, the project included up to 59 turbines. The specialist consultants' assessments and the consultation with the community and stakeholders were based on this layout of up to 59 turbines.

However, the results of the final flora and fauna assessment have prompted the removal of three turbines (P2, P6 and P7) due to the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth government's Environmental Stewardship program. Additionally, as part of the adequacy review of this EA, discussions between DoPI and the flora and fauna specialist have prompted the removal of another turbine (P11). The proponent has agreed to remove this turbine in order to reduce vegetation clearing for the project.

Therefore, the project seeks approval for up to 55 turbines.

As the technical assessments of the project have been based on a layout of 59 turbines, the findings therefore present 'worst-case' scenario impacts and can be considered conservative in nature.

The proponent is considering a number of alternative wind turbine models and therefore has adopted a theoretical wind turbine with a capacity of up to 4.5 MW, a hub height of up to 119 metres, a rotor radius of up to 68 metres and a total tip height of up to 175 metres. This represents a combination of the maximum elements of a range of turbines under consideration. As new turbines are frequently released to the market; it is possible that minor variations to these dimensions could occur prior to the final turbine selection. Based on the maximum number of turbines now proposed, the potential capacity across the entire project is up to 178 MW of renewable energy.

2.3 The Proponent

2.3.1 Overview

Union Fenosa Wind Australia Pty Ltd (UFWA) is the proponent of the Paling Yards Wind Farm project. UWFA is a subsidiary of a Spanish Energy Utility called Gas Natural Fenosa.

The Gas Natural Fenosa group is one of the leading multinational companies in the gas and electricity sector, operating in 25 countries and employing around 20,000 staff with 15.4 GW of installed power and nearly 20 million customers.

UFWA remains a separate entity and has eight wind farm projects (in development, approved and early construction stages) across NSW and Victoria. This portfolio represents a potential investment of approximately $2 billion in renewable wind energy generation. Once complete, the portfolio would increase Australia's present wind generation capacity by over 1,000 MW. In addition, it will result in the creation of several hundred jobs in the construction and operational phases.

Refer to **Figure 1 – Gas Natural Fenosa International Projects** and **Figure 2 – UFWA Projects**.

Following the acquisition of the electricity company Unión Fenosa, Gas Natural Fenosa has achieved its objective of integrating the gas and electricity businesses in a single company with extensive experience in the energy sector, capable of competing efficiently in markets subject to a process of increasing integration, globalisation and levels of competition.

Gas Natural Fenosa is the largest integrated gas and electricity company in Spain and Latin America, leading the natural gas sales market in the Iberian Peninsula, and it is the biggest distributor of natural gas in Latin America. With a fleet of 11 LNG tankers, it is a company of reference for LNG/NG in the Atlantic and Mediterranean basins.

Gas Natural Fenosa has a strong commitment to social and environmental issues throughout all aspects of its business. Gas Natural Fenosa's goal is to achieve sustainable growth and its electricity and gas production, transport, distribution and marketing activities focus on protecting the environment and quality of life. Gas Natural Fenosa's efforts in this regard have been acknowledged and the group has received numerous awards and public acknowledgements in 2011 for its contributions to social responsibility, sustainability and environmental protection, in addition to its strict financial control.

In 2012 Gas Natural Fenosa's sustainability strategy earned it a place on the Dow Jones Sustainability Index and DJSI Europe. This is the eighth year that Gas Natural Fenosa has earned a place in DJSI Europe (2005-2012). Likewise, for the tenth year running, it was included in the FTSE4Good sustainability indices.

Gas Natural Fenosa is committed to the community in which it operates, where it generates value through community investment. Gas Natural Fenosa received the 2011 Platts Global Energy Award in New York for the most outstanding community

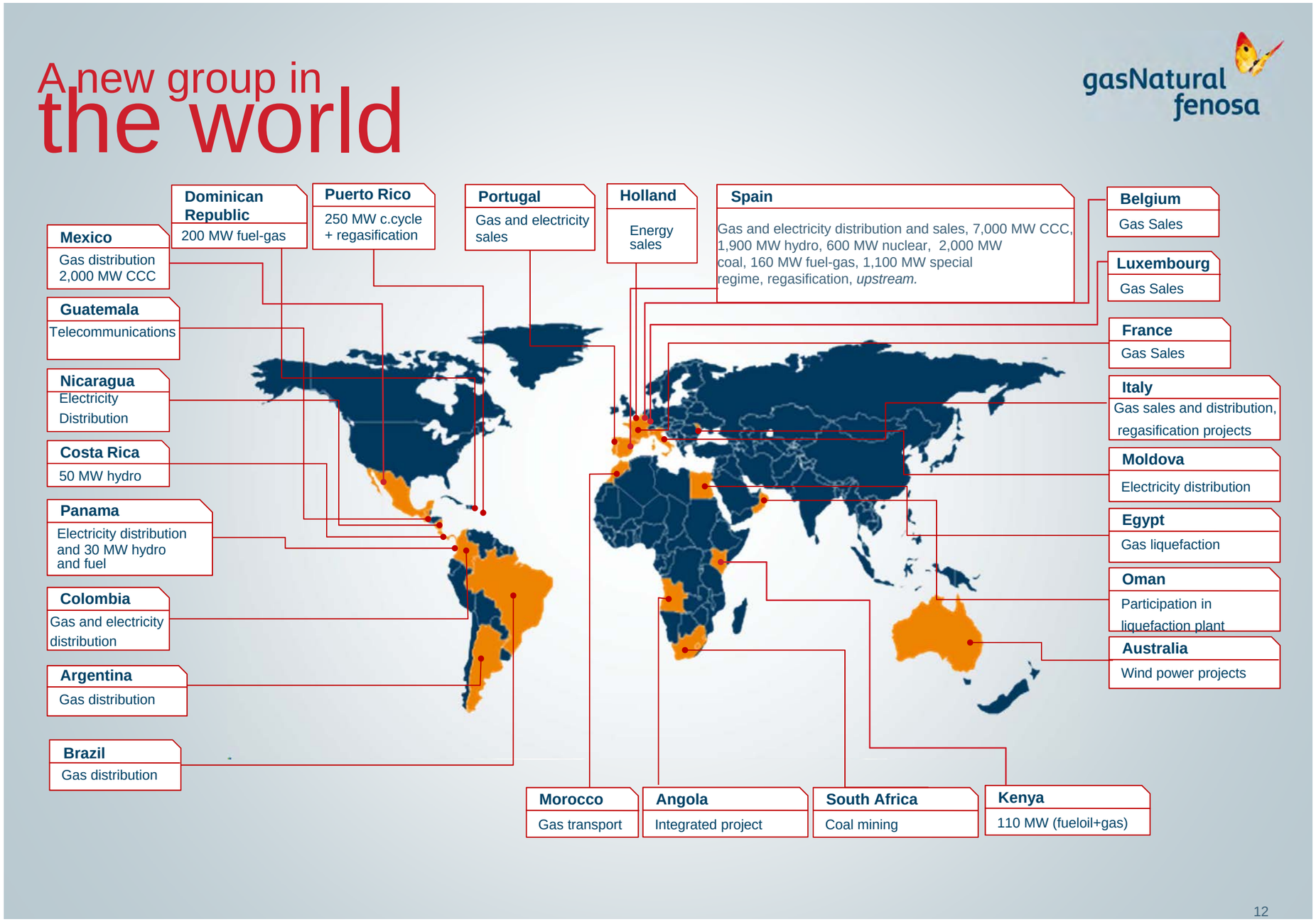


Figure 1 Gas Natural Fenosa International Projects

Source: UFWA

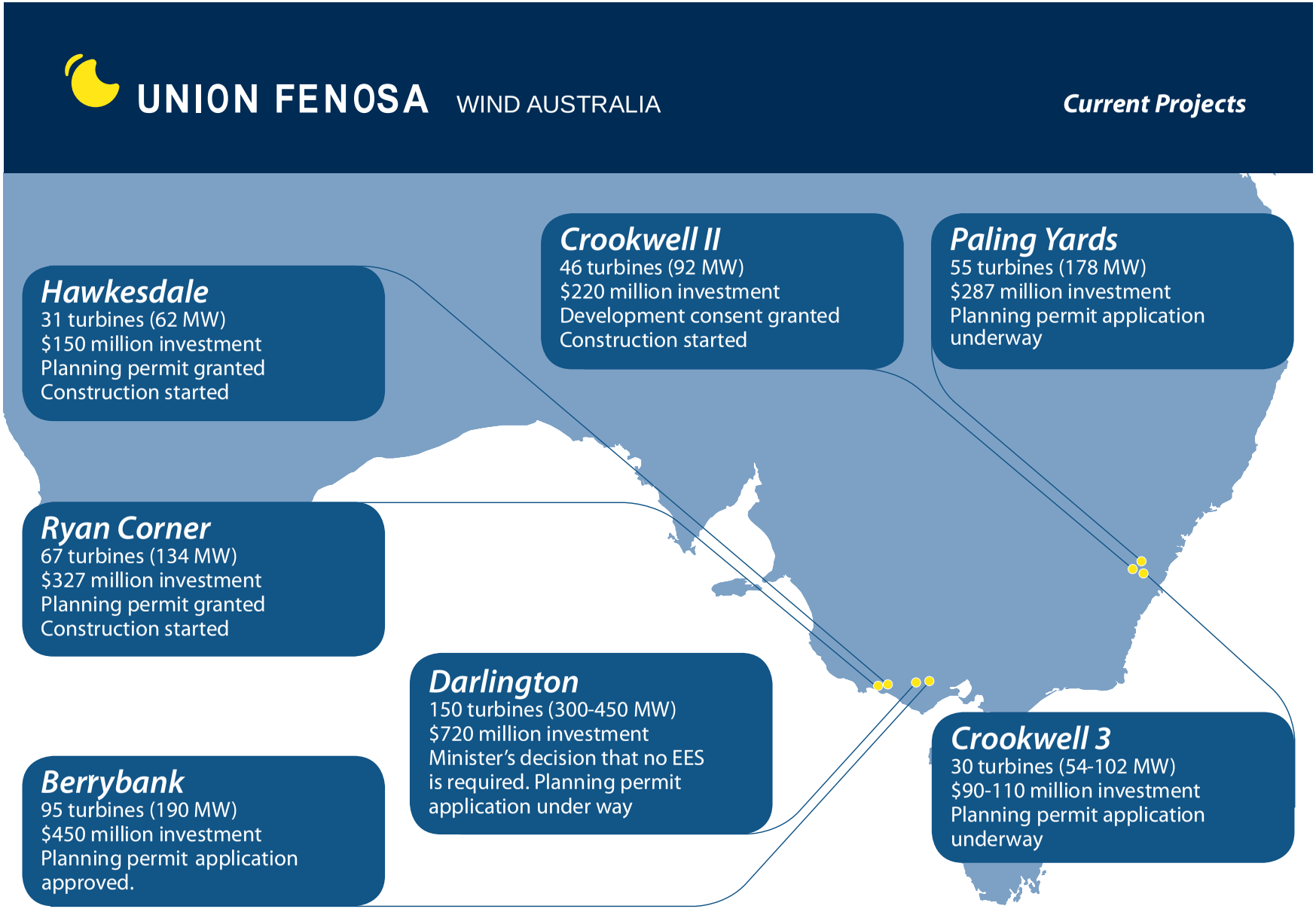


Figure 2 UFWA Projects

Source: UFWA

development programme for its Cuartel V gasification project in Buenos Aires, Argentina. The award winning initiative works to improve access to public services for the neediest groups and to contribute in this way to reducing poverty in local communities where the company operates.

The company has a Corporate Social Responsibility (CSR) policy that is implemented rigorously across all of its projects in all countries. The fundamental aim of this CSR is to share the benefits with the communities in which they operate to ensure that Gas Natural Fenosa forms an important component within the community. In previous projects, this has translated to direct investment in local projects to assist communities, such as sponsoring organic farmer markets (Columbia), bringing technology and computers to schools (Guatemala), and running educational programs for the unemployed (Spain).

2.4 Structure of the report

This document is an Environmental Assessment (EA) presented on behalf of UFWA. It has been prepared by Tract Consultants with the assistance of specialist consultants. The aims of this EA are to:

- Describe and detail the subject site and its context, the project and design response;
- Provide a strategic justification which details the site selection process, renewable energy benefits, wind power in the international, Australian and regional context, and the community and environmental benefits of the project;
- Provide an assessment of the project against all relevant Federal, State and Local policies and guidelines;
- Assess the likely economic, social, environmental and cumulative impacts of the project;
- Describe and provide recommendations on stakeholder and community consultation; and
- Identify, and outline management or mitigation options for any negative impacts arising out of the project.

This EA draws on the expert knowledge and investigations of a wide range of specialist assessments that are summarised within this EA, with the full reports attached as appendices. The project team comprises:

- Tract Consultants Pty Ltd – Environmental Planning
- AECOM Australia Pty Ltd – Decommissioning
- Anderson Environmental Consultants Pty Ltd – Flora and Fauna, and Indigenous and Non-Indigenous Archaeological Heritage
- Aviation Projects Pty Ltd – Aeronautical Safety and Obstacle Night Lighting
- Environmental Resources Management Australia Pty Ltd – Socio-Economic and Landholder Consultation, Flora and Fauna, Indigenous and Non-Indigenous Archaeological Heritage and Hydrology
- Garrad Hassan Pacific Pty Ltd – Electromagnetic Interference and Shadow Flicker
- Green Bean Design – Landscape and Visual Assessment
- SLR Consulting Australia Pty Ltd – Noise
- URS Australia Pty Ltd – Traffic and Transport

This EA is structured as follows:

- The Site and Context provides discussions of the major elements of the site and surrounds
- The Design Response details how the project has been designed in response to the site analysis.
- The Proposal describes the project in terms of the proposed use, buildings and works, connections to the grid and native vegetation removal.
- The Project Justification provides justification for the site selection, outlines community benefits, discusses alternatives and demonstrates greenhouse gas savings.
- The Statutory Provisions provides an overview and assessment of the planning and environmental legislation, regulations and guidelines as relevant to the project.
- Specialist Assessments of the following impact areas as they relate to the project, including:
    - Economic and social impacts
    - Landscape and visual impacts
    - Noise impacts
    - Flora and fauna impacts
    - Aeronautical impacts
    - Transport impacts
    - Electromagnetic interference impacts
    - Shadow flicker impacts
    - Heritage impacts
    - Geotechnical impacts
    - Hydrological impacts
- An outline of the Consultation strategies undertaken with the community and stakeholders of the project (to date and future).
- A Risk Analysis of the project,
- A Statement of Commitments which outlines the measures which UFWA will carry out, subject to project approval, in order to manage any project impacts.
- A Conclusion which concludes this EA.

In particular, this EA has been guided by the criteria set out in the DGRs (refer to **Appendix 2**). The DGRs outline the matters which this EA must address to enable an assessment of the project under Part 3A of the EP&A Act. The DGRs are set out in the table below, together with cross references to the corresponding sections of this report that address each of the issues raised.

Table 1 Director-General Requirements

General Requirements	Relevant Report Chapter	Relevant Figures
The Environmental Assessment (EA) must include:		
▪ An executive summary;	1	
▪ A detailed description of the project including:		
- construction, operation and decommissioning details;	5.13 – 5.16	
- the location and dimensions of all project components including the wind turbines (including map coordinates and AHD heights), underground cabling between turbines, electrical substation and transmission line linking the wind farm to the grid (adjacent Transgrid or to the Crookwell 2 wind farm substation, including easement width and height), on site control room and equipment storage, temporary concrete batching plant(s), construction compounds, access roads/road upgrades (including access tracks) and obstacle lighting	5	12, 13, 14, 51
- a timeline identifying the proposed construction and operation of the project components, their envisaged lifespan and arrangements for decommissioning and staging	5.13 – 5.16, 5.19	
- 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) and the location/ siting of the project (including associated infrastructure) in the context of this existing environment	3	3, 4, 5, 6
- and resourcing requirements (including, but not limited to, water supply and gravel)	5.12 – 5.16	
▪ Consideration of any relevant statutory provisions including the consistency of the project with the objects of the Environmental Planning and Assessment Act 1979 and the relevant matters within the Oberon Wind Power Generation Development Control Plan and the Oberon Development Control Plan (Part O) – Wind Power Generation	7	
▪ 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 considering cumulative impacts, as applicable. This should include the cumulative effect of the transmission line on the landscape in the vicinity of the existing Crookwell 1 Wind Farm, approved Crookwell 2 and proposed Crookwell 3 Wind Farm	8 – 21	29 – 60
▪ A draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project	24	

General Requirements	Relevant Report Chapter	Relevant Figures
▪ 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	25	
▪ Certification by the author of the EA that the information contained in the Assessment is neither false nor misleading	Page 3	
▪ Given the length of the grid connection transmission line to Crookwell 2, the EA should present, with respect to each relevant transmission line impact, a considered screening of potential impacts along the length of the line, to identify the areas of potentially significant impact for further, more detailed assessment. In addition to detailed assessment of areas of potentially significant impact other areas along the length of the line should be assessed in a more general manner, with a particular focus on the development of frameworks for the mitigation, management and monitoring of more minor and generic environmental issues	5.8, 8 – 14, 18 – 23	13, 17
Key Assessment Requirements	**Relevant Report Chapter**	**Relevant Figures**
▪ 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	6	18–27
- 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	6.5	
- 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, land of significant scenic or visual value, land of high agricultural value, mineral reserves and conservation areas), taking into account local and strategic land use objectives	3.3, 4, 7.4	7
- Describe the alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits including community benefits (for example community enhancement programs) on a local and strategic scale and how it achieves stated objectives	6.6	10, 12, 13, 17

Key Assessment Requirements	Relevant Report Chapter	Relevant Figures
▪ 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. 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. Consideration must be given to impacts on the values of the adjacent national parks, including impacts on wilderness and Greater Blue Mountains World Heritage area values	9	29 – 41
- assess the impact of shadow "flicker", blade "glint" and night lighting from the wind farm	17	51, 55, 56, 57
- identify the zone of visual influence (no less than 10 kilometres) and assess the visual impact of all project components on this landscape	9.7.2	30, 31
- include an assessment of the visual influence of the wind farm (no less than 10 kilometres) and assess the visual impact of all project components on this landscape	9.7	32 – 41
- 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	9.2, 9.8	32 – 41
- provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented	9.8	
▪ Noise Impacts - the EA must:		
- include a comprehensive noise assessment of all phases and components of the project including, but not limited to, turbine operation, the operation of the electrical substation, corona and / or Aeolian noises from the transmission line, construction noise (focussing on high noise-generating activities and any works proposed outside of standard construction hours), traffic noise during construction and operation, and vibration generating activities (including approved but not yet developed dwellings), baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness etc) generated by noise sources, noise / vibration criteria, modelling assumptions and worst case and representative noise / vibration impacts	10	42
-		

Key Assessment Requirements	Relevant Report Chapter	Relevant Figures
- 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	10.3	
- include monitoring to ensure that there is adequate wind speed/profile data and ambient background noise data that is representative for all sensitive receptors	10.3.2	42
- 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	10.2, 10.3, 10.4	
- identify any risks with respect to low frequency or infra-noise	10.4.2	42
- 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	10.5	
- 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	10.5	
- 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	10.5	
The assessment must be undertaken consistent with the following guidelines:		
- Wind Turbines – South Australian Environment Protection Authority's Environmental Noise Guidelines (2003)	10	
- Substation – NSW Industrial Noise Guidelines (2003)		
- Site Establishment and Construction – Interim Construction Noise Guidelines (DECC, 2009)		
- Traffic Noise – Environmental Criteria for Road Traffic Noise (NSW EPA, 1999)		
- Vibration – Assessing Vibration: A Technical Guideline (DECC, 2006)		

Key Assessment Requirements	Relevant Report Chapter	Relevant Figures
▪ Flora and Fauna - the EA must:		
- include an assessment of all project components on flora and fauna and their habitat consistent with the Draft Guidelines for Threatened Species Assessment (DEC, 2005), including details on the existing site conditions and quantity and likelihood of disturbance (including quantifying the worst case extent of impact on the basis of vegetation type and total native vegetation disturbed)	12	45 – 50
- The EA must specifically consider impacts to threatened species and communities listed under both State and Commonwealth legislation that have been recorded on the site and surrounding land, impacts to riparian and/ or instream habitat in the case of disturbance of waterways, and to biodiversity corridors. In addition, impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips, 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	12.2, 12.3	
- details of how flora and fauna impacts would be managed during construction and operation including adaptive management and maintenance protocols (including the mitigation and/or management of weeds)	12.2.11, 12.3.6, 12.3.7	
- measures to avoid, mitigate or offset impacts consistent with "improve or maintain" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project	12.3.5 – 12.3.7	
▪ Indigenous Heritage – the EA must include an assessment of the potential impact of the project components on indigenous heritage values (archaeological and cultural).The EA must demonstrate effective consultation with indigenous 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)	18	58
▪ Traffic and Transport – the EA must assess the construction and operational traffic impacts of the project including:		
- details of the nature of traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads, bridges and intersections, including any proposed road upgrades and repairs	14.3	15, 16
- details of measures to mitigate and/or manage the potential impacts, including measures to control soil erosion and dust generated by traffic volumes	14.4	
- details of site access roads including how these would connect to the existing road network and any operational maintenance or handover requirements	14.3.1	

Key Assessment Requirements	Relevant Report Chapter	Relevant Figures
▪ Hazard/Risks – the EA must include an assessment of the potential impacts on aeronautical safety considering nearby aerodromes and aircraft landing areas, defined air traffic routes, aircraft operating heights, radar interference, communication systems, and navigation aids	Hazards and risks covered in multiple chapters: 13 – Aeronautical 16 – Fire 11.4.9 – Blade throw 15 – EMI	51 – 54
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	13.3.3	
- Possible effects on telecommunication systems must be identified. Potential hazards and risks associated with electric and magnetic fields (EMFs) (with reference to Australian Radiation Protection and Nuclear Safety Agency standards)	15	52,53,54
- bushfires must be assessed	16	
- The EA should demonstrate the application of the Principles of Prudent Avoidance in relation to EMFs. The EA must also detail measures to contain any hazardous substances to prevent the contamination of pasture and dams	20	
▪ Water Supply and Waterways – The EA must determine whether an adequate and secure water supply is available for the life of the project including the statutory (licensing) context of the water supply sources, and assess potential environmental impacts associated with the identified sources, including impacts on groundwater. Where the project would cross significant waterways, the EA must identify likely impacts to the waterways and measures to minimise impacts. Details of the design of waterway crossings where such crossings are to be located I third order or higher streams are to be provided. Particular consideration should be given to the Abercrombie River. The EA must also assess the potential for water pollution impacts, including the risks to the environment and human health, consistent with the heads of consideration provided in Drinking Water Catchments Regional Environmental Plan No. 1, including determining whether the project will have a neutral or beneficial effect on water quality	20	
▪ 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	23	

Key Assessment Requirements	Relevant Report Chapter	Relevant Figures
▪ Consultation Requirements – The proposal must undertake a consultation program as part of the environmental assessment process, including consultation with, but not necessarily limited to, the following parties: - Oberon Council; - Oberon Shire Council; - Department of Environment, Climate Change and Water; - NSW Office of Water; - NSW Road and Traffic Authority; - NSW Rural Fire Service; - Land and Property Management Authority; - Sydney Catchment Authority; - Lachlan CMA; - TransGrid; - Commonwealth Department of Defence; - Civil Aviation Safety Authority; - Airservices Australia; - Aerial Agricultural Society of Australia; - Relevant minerals stakeholders (including exploration and - The local community and landowners.	22	
▪ The consultation process shall include measures for dissemination 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:	22.3	
- 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	22	
- 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)	22.3	
- Describe the issues raised during consultation and how and where these have been addressed in the EA	22.4	

Supplementary DGRs	Relevant Report Chapter	Relevant Figures
Under section 75F(3) of the *Environmental Planning and Assessment Act*, the following supplementary requirements must be addressed:		
▪ 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 is 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	22	
▪ the Environmental Assessment must clearly document and provide details and evidence of the consultation process and who was consulted with	22.3	
▪ all issues raised during the consultation process must be clearly identified and tabulated in the Environmental Assessment	8.4, 22.4	
▪ the Environmental Assessment must state how the identified issues have been addressed, and how they have informed the proposal as presented in the Environmental Assessment. In particular, the Environmental Assessment must state how the community's issues have been responded to	22.4, 22.6	

Referral Authorities' Submissions to DoPI	Relevant Report Chapter	Relevant Figures
Oberon Shire Council		
Council proposes the following issues for inclusion in the EA for the proposed wind farm development:		
▪ The Oberon Wind Power Generation DCP:	7	
- Address all matters within the DCP in respect to any impact within the Oberon Council area		
▪ Traffic and Transport:	14	
- A detailed pavement and structure analysis to be undertaken on any affected sections of public road.		
- A road safety audit to be undertaken on all affected sections of public road		
- An analysis of the horizontal and vertical alignment to determine the adequacy of the affected public road network for all expected traffic types		
▪ Noise Impacts:	10	
- An analysis of the Van de Berg effect on all residences in the Oberon council area within 2m of a proposed turbine		

Referral Authorities' Submissions to DoPI	Relevant Report Chapter	Relevant Figures
- Consideration of the cumulative impacts from other existing and proposed wind turbines in the area		
▪ Visual Impacts	9	
- Consideration of the cumulative impacts from other existing and proposed wind turbines in the area.		
- Impact of any lighting on the turbines		
▪ Hazards	16	
- Impact of bushfires on the turbines		
- Bushfire ignition threats from the turbines and sub-station		
▪ Proposed community enhancement program	8, 22	
In respect to the proposed transmission line, the following requirements are submitted:		
▪ Visual Impact		
- Analysis of the visual impact of the transmission line on all existing residences in the Oberon Council area.	9	
▪ Traffic and Transport		
- Analysis of the impact of construction traffic on the structural integrity of the road network and road safety in the Oberon Council area, including the road approaches to the Abercrombie Bridge and the bridge itself.	14	
▪ Environmental		
- Analysis of the impact on flora and fauna on the road network in the Oberon Council area.	12	
Sydney Catchment Authority (SCA)	20	
The EA for the part of the proposed wind farm and transmission line located in the Drinking Water Catchment must include an assessment as to whether the project will have a neutral or beneficial effect on water quality as per the following:		
▪ Consider the Drinking Water Catchment Regional Environmental Plan No. 1 and have regard to the aims of the plan and the water quality objectives detailed in the plan		
▪ Contain relevant studies and plans such as a Water Cycle Management Study (WCMS) that incorporates a Conceptual Construction Environmental Management Plan including a Soil and Water Management Plan (based on Managing Urban Stormwater: Soils and Construction, Vol 1, 4th edition (Landcom, 2004 – the "Blue Book") and Managing Urban Stormwater: Soils and Construction, Vol. 2C Unsealed Roads (DECC)). The WCMS should address the following:		

Referral Authorities' Submissions to DoPI	Relevant Report Chapter	Relevant Figures
- The proposed erosion and sediment control practices for the construction of the transmission line component that address its linear nature - Details of surface runoff and water quality management works proposed for access roads and tracks that will be used to construct and provide ongoing access to the transmission lines - Details of the management of any wastewater that is produced during construction and operational stages of the development - Details of proposed measures to prevent and manage fuel spills - Details the measures, responsibilities and reporting for the management of major incidents involving water quality - Demonstrate that the proposed water quality management measures for construction and operational stages of the project are based on SCA-endorsed Current Recommended Practices (CRPs). Where proposed measures are not based on SCA-endorsed CRPs, it needs to be demonstrated that the measures will achieve the same water quality outcomes - The sustainability of systems and proposed management measures over the long term, including delineation of ongoing maintenance responsibilities - Determine whether a neutral or beneficial effect on water quality of surface will occur during the construction and operational stages of the project		
NSW Government Industry & Investment Industry & Investment proposes the following DGRs for the wind farm project, in order to reflect the view of the Minerals & Energy Division and the Fisheries Division: ▪ Fisheries issues: - Details of any direct impacts to the Abercrombie River. If any is proposed or likely, then a Test of Significance for Macquarie Perch should be included - Proposals for erosion and sediment control across the site to ensure no impact upon water quality in the Abercrombie River - Details of all access tracks to be upgraded or constructed (both at the wind farm site as well as along the transmission line corridor). Include a map showing these sites in relation to watercourses (creeks and rivers)	20	

Referral Authorities' Submissions to DoPI	Relevant Report Chapter	Relevant Figures
- Details of the design of waterway crossings where such crossings are to be located in 3rd order or higher streams. The design of such crossings should conform to *"Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings, NSW Fisheries 2003"* - Details of any trenching or excavation required to cross waterways (e.g. to lay underground cabling) ▪ Mineral Issues: - Operating mines and quarries should be protected from sterilisation or hindrance by encroachment of incompatible adjacent development - Known resources and areas of high mineral potential should not be unnecessarily sterilised by inappropriate zoning or development - Access to land for mineral exploration and possible development should be maintained - Contact any relevant minerals related stakeholders to discuss the proposed Paling Yard wind farm and potential transmission routes in relation to the associated land use impacts. Details of these consultations and the major outcomes must be presented in the EA ▪ Energy issues: - The Precinct Advisory Committee be included in the list of parties requiring consultation	5.18 22	
NSW Government Office of Water The Office of Water requires the EA for the proposal to demonstrate the following: ▪ Identification of site water demands in terms of both volume and timing for life of project	20	
▪ Adequate and secure water supply is available for the life of project ▪ Existing and proposed water licensing requirements are in accordance with the Water Act 1912, Water Management Act 2000 and NSW Inland Groundwater Water Shortages Zone Order No. 2, 2008	20	
▪ An assessment of impact of tower construction due to blasting, road and crossing construction, and underground cable installation on adjacent licensed water users, basic landholder rights, and groundwater-dependent ecosystems ▪ Watercourse crossing construction is consistent with the NSW Rivers and Estuaries Policy and former DWE guidelines for controlled activity approvals	19 20	

Referral Authorities' Submissions to DoPI	Relevant Report Chapter	Relevant Figures
▪ A description and assessment of any potential requirement to intercept groundwater, including predicted dewatering volumes, zone of drawdown and associated impact, water quality and disposal methods ▪ Adequate mitigating and monitoring requirements to address surface and groundwater impacts ▪ The proposal must address the NSW State Government natural resource management policies, as applicable. Policies to include but not to be limited to: - NSW Inland Groundwater Shortage zones Order No. 2 (2008) - NSW Inland Groundwater Policy Framework Document (1997) - NSW Inland Groundwater Quantity Management Policy (1998) - NSW Inland Groundwater Quality Protection Policy (1998) - NSW Inland Groundwater Dependent Ecosystems Policy (2002) - Australian and NZ Guidelines for Fresh and Marine Water Quality (2000) - Australian and NZ guidelines for Water Quality Monitoring and Reporting (2000) - Guidelines for the Assessment and Management of Groundwater Contamination (2007) - Guidelines for Groundwater Protection in Australia (1995) - MDBC Guidelines on Groundwater Model Development ▪ General Environmental Risk Analysis - An environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation) - 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 these additional key environmental impacts must be included in the EA	23	

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CHAPTER 3

THE SITE & CONTEXT

3 The Site and Context

3.1 Site Locality

The site is located on the western extent of the Great Dividing Range in NSW, in an area known as the Central Tablelands. The site is situated approximately:

- 60km south of Oberon;
- 60km north of Goulburn in NSW;
- 140km north east of Canberra; and
- 140km west of Sydney.

Please refer to **Figure 3 – Location Plan** and **Figure 4 – Regional Plan**.

A large portion of the area surrounding the site is National Park. Abercrombie National Park borders the site to the west and south. To the east of the site is the Mount Werong State Forest and Kanangra Boyd National Park. Other land uses in the locality include rural and agricultural industries including wool, lamb and beef cattle.

The site and preferred transmission line are both situated within the Oberon Local Government Area (LGA).

The area is heavily undulating with some steep slopes. The site is bisected by Taralga Road which links the towns of Oberon and Goulburn. The closest towns are Porters Retreat and Curraweela which have township populations of approximately 180 and 320 respectively.

Several water courses traverse the area including the Abercrombie River which flows into the Lachlan River. The Abercrombie River forms part of the southern boundary of the site.

The site is approximately 40km to the north-east of the existing Crookwell 1 Wind Farm, the approved Crookwell 2 Wind Farm, and proposed Crookwell 3 Wind Farm. Work has recently commenced on the 46 turbine Crookwell 2 project (a UFWA Project).

3.2 Site Details

The site includes two land holdings over approximately 3,900 hectares, known as 'Mingary Park' and 'Paling Yards', and contains two homestead areas. Please refer to **Figure 5 – Site Analysis Plan** and the accompanying site photos at **Figure 6 – Site Photos**. The majority of the site has been cleared of native vegetation, although scattered trees are common within the site and thicker vegetation exists near the site boundary. The site is bordered by a National Parks and forested land to the south-east, all of which are heavily vegetated.

Topographic elevation ranges between 900 metres and 1065 metres above sea level with significant slopes in many areas. A number of ephemeral creeks and drainage lines cross the site and drain into the Abercrombie River. The site is currently used for agricultural purposes, such as predominantly sheep and cattle grazing).

Access to the site is achieved by Taralga Road which is a Council maintained road.

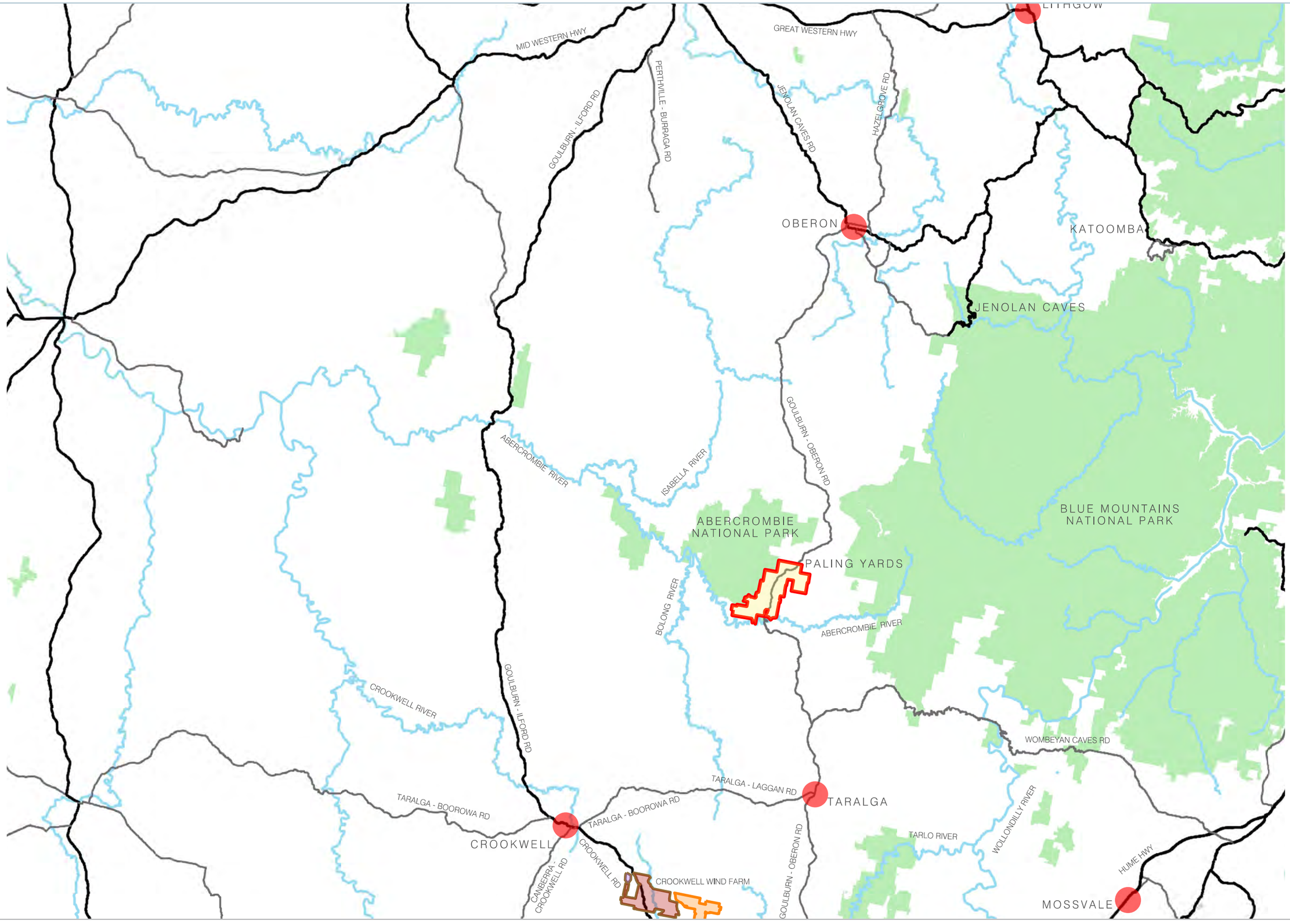


Figure 3 Location Plan

Source: *Tract Consultants*

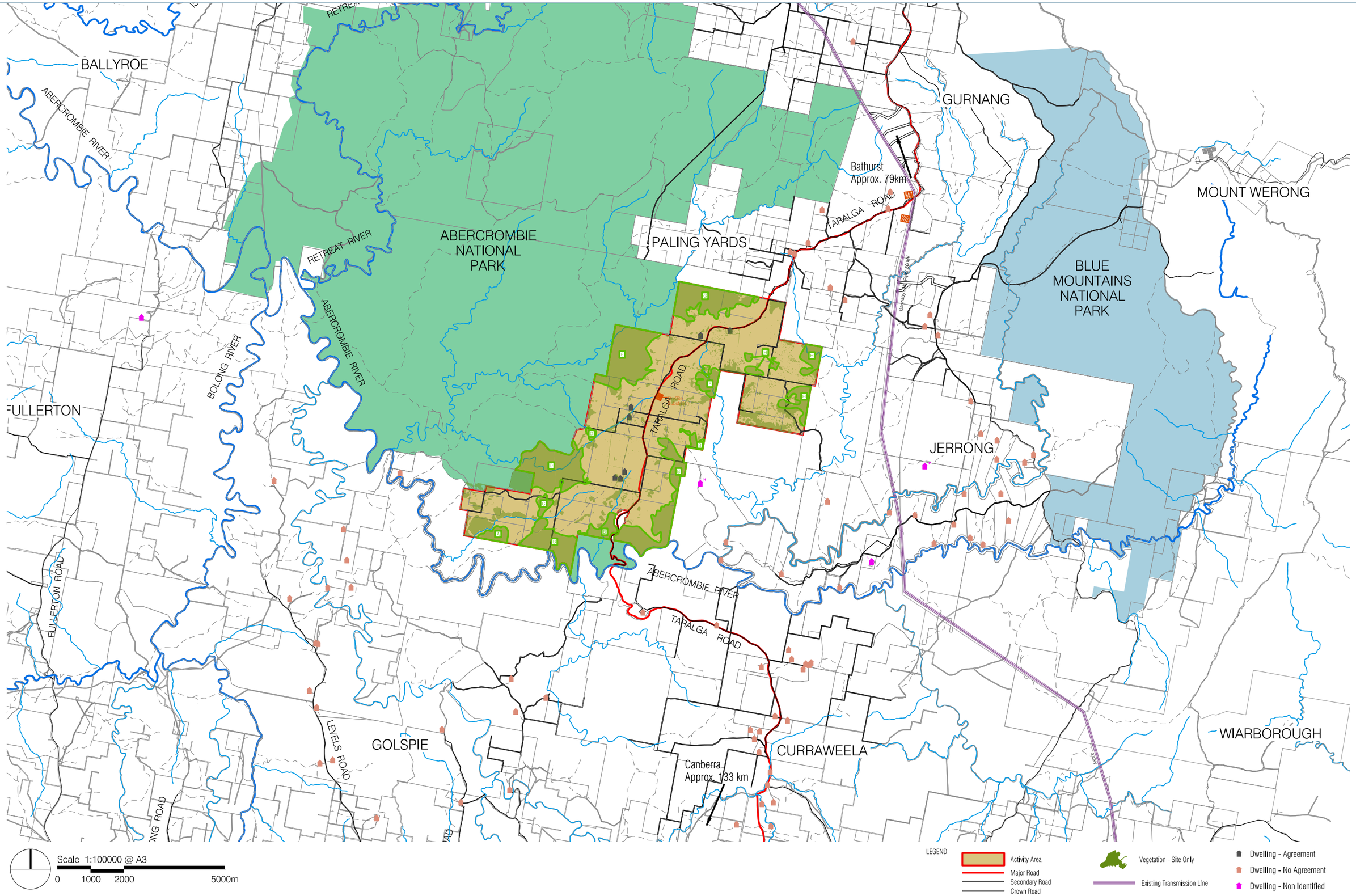


Figure 4 Regional Plan

Source: *Tract Consultants*

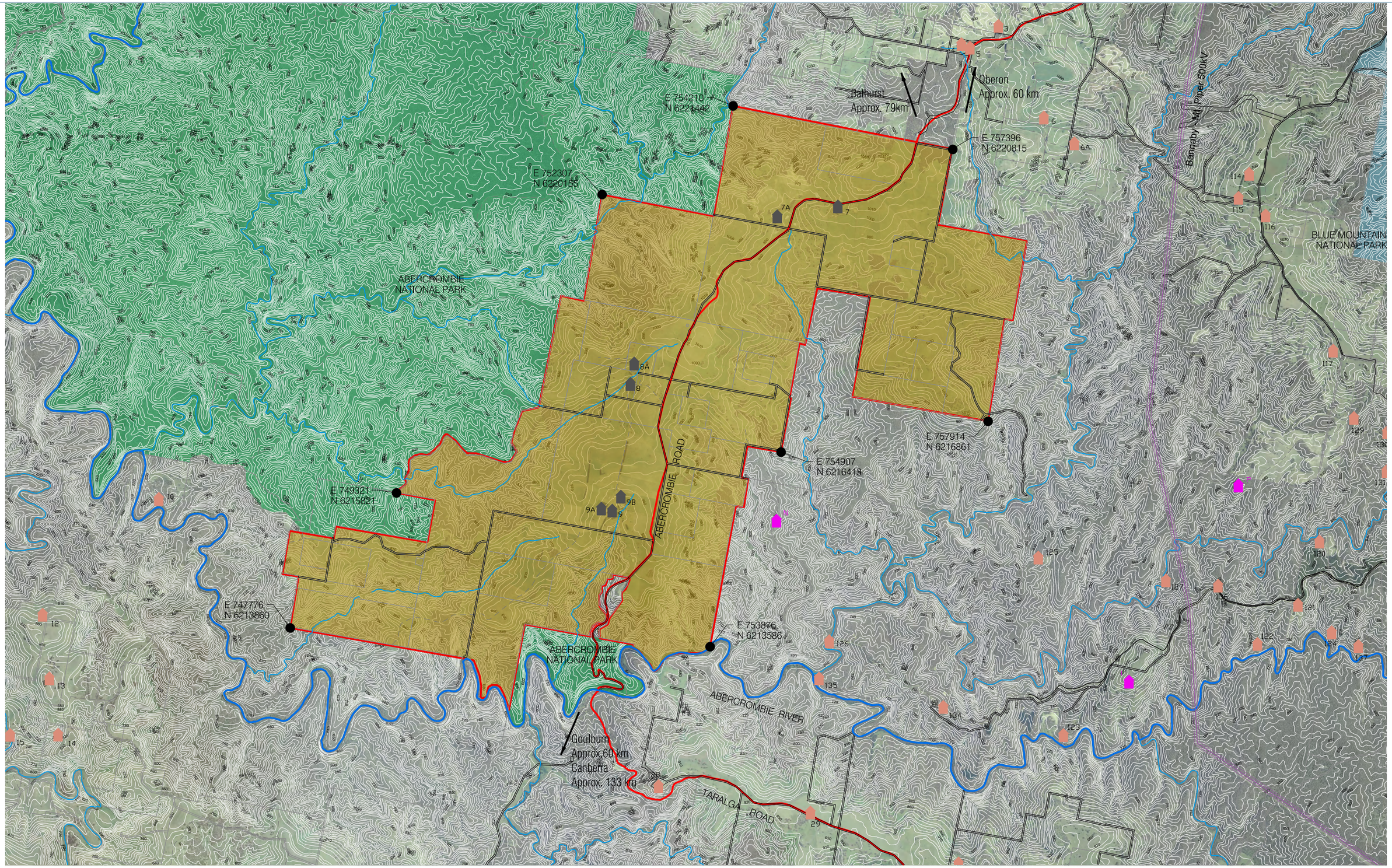


Figure 5 Site Analysis Plan

Source: *Tract Consultants*

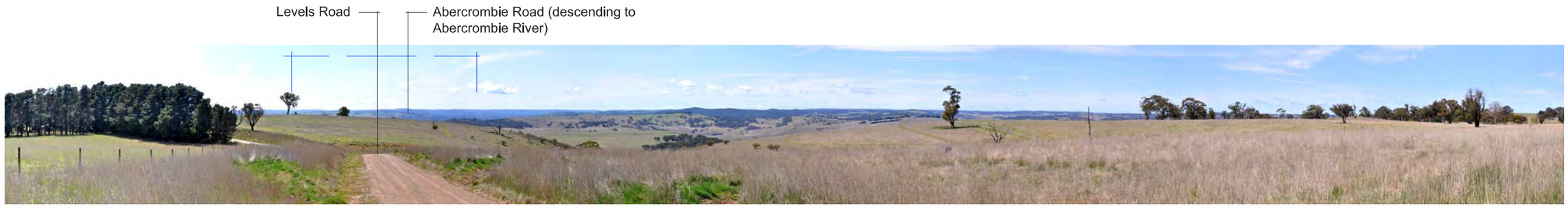


Photo Location P1- View north east from Levels Road, Golspie



Photo Location P9- View south from Abercrombie Road

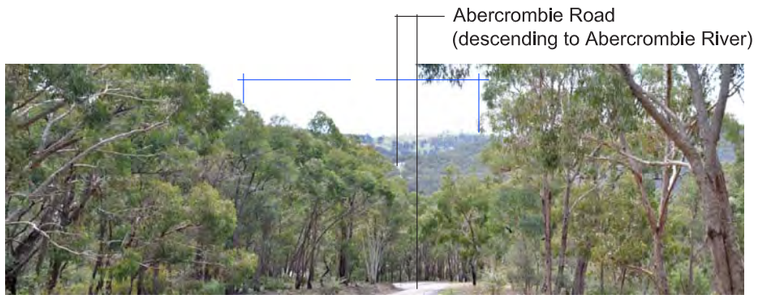


Photo Location P5- View north from Abercrombie Road



Photo Location P6- View north from Bummaroo Ford campground (adjacent Abercrombie River)



Photo Location P7- View north to west from Abercrombie Road

Figure 6 Site Photos

Source: *Green Bean Design*



Photo Location P13- View north to north east from Abercrombie Road



Photo Location P22- View south to west from Jerrong Road



Photo Location P23- View south to south west from Gurnang State Forest



Photo Location P16- View south to south west from Abercrombie Road



Photo Location P17- View south to south west from Abercrombie Road

Figure 6 Site Photos

Source: *Green Bean Design*

The MGA co-ordinates for the outer boundary of Paling Yards are;

NW	N:754212	E:6221425
NE	N:757397	E:6220798
SW	N:747778	E:6213843
SE	N:753878	E:6213569

For a list of lot details compromising the subject site, refer to **Appendix 3 – Lot Details**.

Some works, such as powerlines, access track crossings and road works, are also proposed within the adjacent road reserves and nearby private property. **Chapter 5** details these elements of the project and includes plans showing their location relative to property boundaries.

The proposed overhead transmission line route of approximately 9km connecting the electrical substation on site to the Mt Piper to Bannaby 500kV transmission line is located to the north-east of the site. The transmission line route has two sub-options and is proposed to be constructed over a maximum of eight or nine land parcels. These land parcels contain generally cleared farmland.

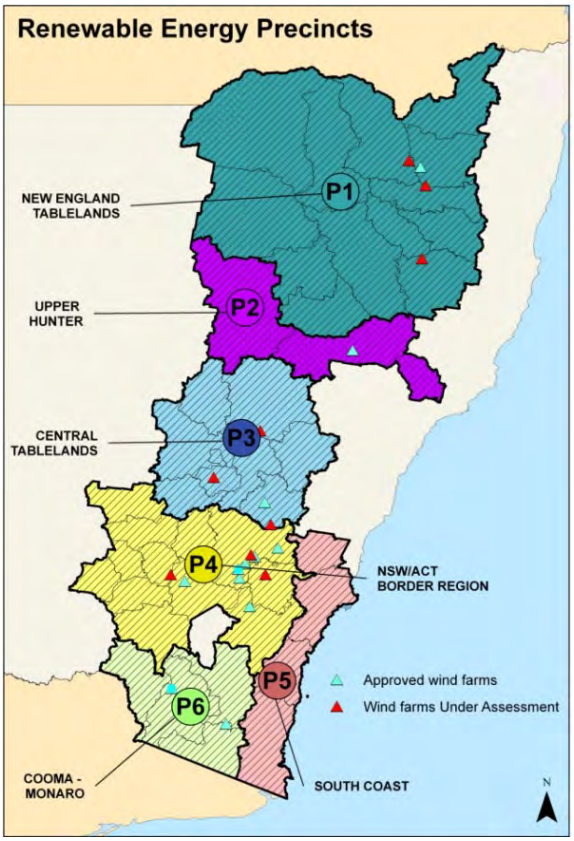
3.3 Site Suitability

The Central Tablelands is known for its strong wind resource and includes several other wind farms in various stages of planning and development. The area is located within one of six designated 'Renewable Energy Precincts' established by the NSW Government. The six designated precincts are known as the New England Tablelands, Upper Hunter, Central Tablelands, NSW/ACT Cross Border Region, Snowy-Monaro and the South Coast.

These precincts have been established as locations for the State's future wind power investment due to their suitability for the technology. The precincts are a community partnership initiative in areas where significant future renewable energy development is expected (especially wind farms), designed to give local communities a voice and a stake in renewable energy development.

The project is located in Renewable Energy Precinct 4 – NSW/ACT Border Region. This precinct has a number of wind farms (refer to **Figure 7** below).

Figure 7 Renewable Energy Precincts



Source: http://www.*environment.nsw.gov.au/climatechange/renewableprecincts.htm*

The average wind speed tested across the Paling Yards region is approximately 7.0 metres per second which is considered a good wind resource.

There are several other factors that are important in establishing a site as suitable for a wind energy facility. These have been taken into account in choosing the site as a location for a wind farm. These include:

- Distance from coastline;
- Population density and buffers to residential settlements;
- Willingness of land owners;
- Size of land holdings;
- Proximity to existing electricity grid;
- Strength of wind resource;
- Minimal impacts on:
    - Flora and fauna;
    - Heritage (including Aboriginal);
    - Non-stakeholder dwellings; and
    - Vistas and viewlines.
- Appropriate terrain and land capability; and

- Access to existing infrastructure (ports, good quality roads etc).

3.4 Land Use

The current land use of the site is primarily agricultural across medium sized land holdings. Common agricultural activities include grazing of sheep and cattle, with limited cropping due to the steep topography.

Human infrastructure, associated with the current land use, that is present on the site, includes:

- Residences, generally associated with a surrounding farm;
- Agricultural structures (such as sheds);
- Dams;
- Farm tracks; and
- Fencing and stockyards.

3.5 Demographic Profile

Based on the Australian Bureau of Statistics (ABS) 2006 Census Data, the demographic profile of Oberon Local Government Area's (Oberon (A) SLA) local population has following key characteristics:

- Rurally based with very low population density;
- 12.7 % of the population is aged between 15 and 24 years old;
- 12.9 % of the population is aged 55 years or over;
- Predominantly English speaking and Australian born;
- High proportion of persons in the labour force and in full time employment, with 4.6 % unemployment rate;
- Lower than average income; and
- High rates of home ownership.

3.6 Dwellings

The project is not located close to any significant population centres, and is located in a particularly remote part of the eastern New South Wales. The closest centres are Oberon and Goulburn, which are located approximately 60km north and 60km south of the site respectively. The lack of towns or other population centres in close proximity of the site is a significant determinant of the site's viability for a wind farm.

There are a small number of dwellings in the vicinity of the site, dispersed across the agricultural landscape at a low density, as shown in **Figure 5 – Site Analysis Plan**. Within the site there are seven dwellings, all owned by those with a declared interest in the project, having entered into commercial arrangements with UFWA.

Non-project involved dwellings are generally located on medium sized agricultural properties nearby, with some smaller hobby type farms present. The majority of the dwellings are located a significant distance from any turbines proposed as part of the project. In fact, there are no non-project related dwellings within 2km of any turbine.

According to Oberon Shire Council's records, there have been no approvals granted for residential dwellings or subdivisions immediately surrounding the site in the past decade.

3.7 Topography and Soils

A geotechnical assessment undertaken for the project found that the site topography comprises 'plateau' and 'hillcrest' areas at an elevation of between 900 and 1065 metres surrounded by steeply sloping gullies and creek lines that flow to the Abercrombie River. The gently sloping plateau areas are generally cleared and used for grazing, while the more steeply sloping areas are generally uncleared and heavily vegetated.

An investigation undertaken as part of the geotechnical analysis found that the plateau areas are underlain by 'Tertiary aged Volcanics', which comprises residual clay, frequently with cobbles and boulders, overlying variably weathered basalt.

The geotechnical assessment (refer to **Chapter 19**) found no major faults of shear zones cross the site and the boundaries between the rock units that are erosional.

The assessment concluded that further geotechnical investigations at the turbine sites are recommended to guide footing designs.

3.8 Hydrology

A hydrological assessment undertaken for the project found that the site is characterised by a prominent elevated plateaux landscape dissected by deep valleys. More than 50 ephemeral first order watercourses are present within the site, including the Abercrombie River (which is outside the site). The watercourses flow generally towards the south and west, to the Abercrombie River.

These first order watercourses are generally stable and well vegetated with pasture grasses. There are very few instances of active erosion along watercourses. The higher order watercourses also tend to be stable and well vegetated, with only minor areas of active erosion.

The Abercrombie River is present directly south of the site, flowing along the site's south-eastern boundary. It is 130 km in length and commences from Mount Werong in the east to the Wyangala Dam near Cowra to the west. The river is a tributary of the Lachlan, a significant river in central New South Wales, which it joins at Wyangala Lake.

The Goulburn-Oberon (Abercrombie) Road crosses the Abercrombie River in the Abercrombie Gorge.

Refer to **Chapter 20** for further details.

3.9 Transport and Infrastructure

The site is divided by the Goulburn-Oberon (Abercrombie) Road. There are six access points proposed to access the site from Abercrombie Road.

Goulburn-Oberon (Abercrombie) Road is a classified two-lane, two-way road of approximately 150 km between the Hume Highway, Goulburn in the south and O'Connell Road, Oberon in the north. The condition of the road's surface varies considerably in the vicinity of the site. On the northern side the road's surface condition is excellent, and on the southern section the road has winding parts with diminishing surface condition. Close to the Abercrombie River the road features strong bends and steep descents.

The Great Western Highway, known as the National Route 32 in the vicinity of the site, provides access to the area from Sydney. Key access routes to the site are also provided by Bells Line of Road (National Route 40), Jenolan Caves Road, Duckmaloi Road and O'Connell Road.

Refer to **Chapter 14** for further details.

3.10 Vegetation

The majority of the site comprises cleared grazing paddocks, most of which is highly disturbed, with only limited areas of native vegetation remaining. The site has been highly modified from its pre-disturbance state and whilst several patches of remnant native vegetation remain, these are generally located in areas that are not subject to wind turbine infrastructure.

No endangered ecological communities were identified as being present on site other than the State 2 (Box Gum Grassy Woodland State and Transition Model) which is protected by the conservation agreement applying to part of the site. Refer to **Chapter 12 – Flora and Fauna Impacts**, **Appendix 8a – Flora and Fauna Assessment** and **Appendix 8b – Supplementary Flora and Fauna Assessment** for detailed information regarding the ecological assessments undertaken in relation to the site and transmission line options.

The project has been designed to be situated mainly on cleared grazed paddocks, therefore avoiding as far as possible potential ecological impacts.

The results of the field surveys detected no threatened fauna species other than the Gang Gang Cockatoo, Flame Robin and Scarlet Robin which are listed under the *Threatened Species Conservation Act 1995 (NSW)* (TSC Act) as 'Vulnerable'. The Gang Gang Cockatoo was detected in the woodland area near turbine P14.

The Wedge-tailed Eagle (Aquilia audax) was also detected during the surveys (around the area of turbines P1-P8 and flying over the Abercrombie River and, while not a protected listed species under the TSC Act or the EPBC Act, it represents a significant species.

Refer to **Chapter 12 – Flora and Fauna Impacts** and **Appendix 8a – Flora and Fauna Assessment** and **Appendix 8b – Supplementary Flora and Fauna Assessment** for more information on the vegetation that exists in the site and the region.

3.11 Landscape and Visual Features

The landscape within and surrounding the site generally contains undulating pastoral farmland, steep sided valleys and hills, drainage lines, forested hills and ridgelines, and rural dwellings.

Remnant woodland occurs within the broader context of a modified landscape which continues to be managed through a variety of farming activities.

An assessment of the potential landscape and visual impacts of the project found that the surrounding areas has an overall 'medium to high sensitivity' to accommodate change, and represents a landscape that is typical that in the New South Wales Central Tablelands and the NSW/ACT Border Region Renewable Energy Precinct.

The site contains portions of plateau remnants above steep sided valleys cut by drainage lines, including the Abercrombie River.

Large portions of the NSW/ACT Border Region Renewable Energy Precinct landscape have been heavily modified by agricultural improvement post-European settlement.

A total of 78 residential dwellings were identified during the field surveys and were included and assessed in the landscape and visual assessment.

Refer to **Chapter 9** for further details.

3.12 Climate

The Bureau of Meteorology (BOM) publishes climate data from the Gurnang State Forest on temperature and rainfall (refer to **Figures 8** and **9** below).

The area has a temperate climate and receives rain all year round, peaking at 90.2mm in August, and having an annual average rainfall total of 984mm (BOM, 2011).

Temperatures peak in January with mean maximum of 22.8 degrees and drop in winter to a maximum of 7.4 degrees during the month of July. Frosts are common during the winter months, with an average overnight minimum temperature of -1.6 degrees (BOM 2011).

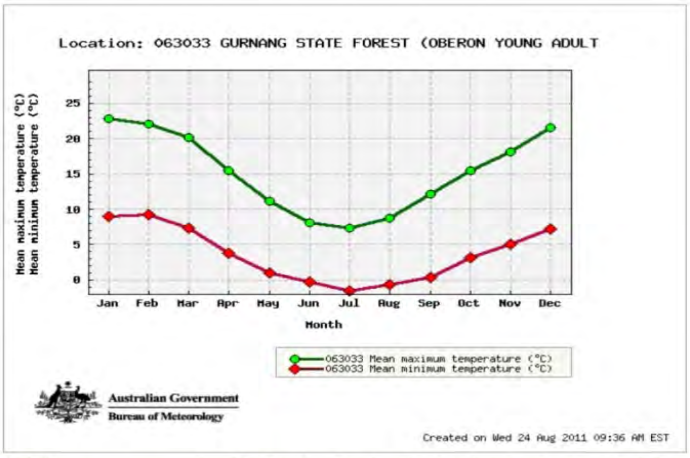
Figure 8 Oberon mean rainfall per month (1933-2008)



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 1933 to 2008	89.8	78.0	67.3	69.3	77.8	96.1	85.7	90.2	78.9	87.1	86.9	76.8	984.0	63

Source: www.bom.gov.au

Figure 9 Oberon mean maximum and minimum temperatures (oC) per month (1933-1975)



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean maximum temperature (°C) for years 1933 to 1975	22.8	22.1	20.2	15.4	11.1	8.1	7.4	8.7	12.2	15.5	18.1	21.5	15.3	33
Statistics	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**	**Years**
Mean minimum temperature (°C) for years 1933 to 1975	9.0	9.3	7.3	3.8	1.0	-0.3	-1.6	-0.7	0.4	3.2	5.1	7.2	3.6	34

Source: www.bom.gov.au

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CHAPTER 4

DESIGN RESPONSE

4 Design Response

Having established the characteristics of the site and surrounds and its specific constraints and opportunities, this chapter details how the project has evolved through the design phase;

- to respond to issues raised during consultation; and
- to minimise negative impacts.

4.1 Location Criteria

Chapter 3.3 of this report details the characteristics that make a region suitable for a wind farm. Early wind farms were often located along the coast, but advances in turbine technology have allowed wind farm proponents to select inland areas away from more sensitive coastline locations.

The undulating topography rising out of generally flatter lands to the west and south provide the project area with a wind resource that is stronger than most inland regions.

The strengths of the region have been recognised by the NSW Government through the inclusion of Paling Yards as part of the Renewable Energy Precinct 4: NSW/ACT Border Region, one of six such precincts across the state.

The subject site is also favoured by the presence of the existing Mt Piper to Bannaby 500kV high voltage transmission line, which is located approximately 2km to the east of the site.

Whilst a number of transmission line options have been proposed, the northern option, connecting to the Mt Piper to Bannaby 500kV transmission line is the preferred and proposed option for this project. Refer to **Chapter 5.8** for more details.

4.2 Design Criteria

In designing the wind farm the consultant team and proponent have had regard to the following site specific factors as described in **Chapter 3 – The Site and Context**;

- Site Details;
- Wind Resource;
- Land Use;
- Dwellings;
- Topography and Soils;
- Hydrology;
- Transport and Infrastructure;
- Vegetation; and
- Landscape and Visual Features.

The design of the wind farm followed an iterative process whereby specialist inputs and consultation influenced the design at various stages. An initial wind farm layout was produced which was the subject of preliminary consultant studies. Stakeholders have been provided opportunities to express their views on the project through a community door-knock consultation which was conducted on 30 and 31 May and 1 June 2011 and again on 5 and 6 July 2011, as well as through telephone discussions, emails and letters with UFWA representatives. Furthermore, newsletters about the project have been widely distributed in the region and advertisements published in

three local newspapers. UFWA has responded to queries via the information line and email.

The results from the preliminary technical studies and the community consultation undertaken have informed changes to the proposed layout of the wind farm. Refer to **Chapter 22** for details of the community consultation undertaken and how the issues raised during this process have been responded to in the project design.

The key changes made to the project since its renewed commencement in 2010 include:

- Selection of the northern transmission line as the least impact option;
- Removal of the southern substation;
- Removal of turbine P26 in response to the findings of the noise assessment to reduce potential noise impact for the project involved landowners;
- Removal of turbines P2, P6, and P7 in response to the findings of the flora and fauna assessment and the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth Government's Environmental Stewardship program;
- Removal of turbine P11;
    - removal of associated crane pad from the remnant area; and
    - removal of associated 1,184m of access track of which 353m were in the remnant area.
- Relocation of turbine P10 to 184m south of original location;
    - removing 184m of access track from the remnant area.
- Relocation of turbine P13 to 70m south-east of original location;
    - removing 77m of access track from the remnant area; and
    - turbine and crane pad will be located in a more cleared area, hence reducing the vegetation clearing by 50% for this location.
- Relocation of turbine P14 to 86m south-east of original location;
    - removing 101m of access track from the remnant area; and
    - turbine and crane pad will be located closer to the edge of the remnant area, hence reducing the vegetation clearing by approximately 20% for this location.
- Micrositing of the turbines to minimise local impacts;
- Changes to the location of:
    - several access tracks to further utilise the existing farm tracks and reduce the infrastructure footprint;
    - underground cabling to provide more efficient transfer of electricity and reduce the infrastructure footprint;
    - an access road to separate the wind farm construction vehicle traffic from the access used by the project involved landowners;
    - selecting a smaller wind turbine envelope size for specific locations to reduce potential noise and shadow flicker impact for the project involved landowners;

- substations to reduce length of overhead powerlines; and
- powerline poles for the northern transmission line route to minimise and avoid where possible the removal of native vegetation.

Refer to **Figure 10 – History Plan** for further details.

Modern wind farms also differ from older projects because they have greater distances between turbines and therefore have fewer turbines per site, through the use of taller turbine models. This has been reflected in the evolution of the project, where there has been a significant increase in generating capacity through only a moderate increase in the number of turbines.

The following principles have guided the evolution of the wind farm layout.

Access to infrastructure – UFWA investigated a number of options for connection to the electricity transmission grid:

- Northern connection option: The Mt Piper to Bannaby 500kV transmission line is located approximately 10km to the east of the site; and
- Southern connection option: The Crookwell 2 Wind Farm substation provides a connection to the Yass to Bannaby 330kV transmission line.

It has been determined that the northern connection option is the most feasible and approval for this connection is being sought.

Connection to transport routes is provided via Taralga Road, Goulburn to Oberon Road to the Hume Highway. This enables efficient access for operations and ongoing maintenance.

Balance impacts with energy production – The wind farm has been designed to minimise the following impacts, to the extent practicable, whilst retaining the viability of the project to substantially contribute to the generation of renewable energy:

- Economic and Social Impacts – Ensure the project minimises any negative impacts and maximises positive impacts.
- Visual amenity – Ensure visual impact is minimised and where appropriate employ mitigation measures to reduce impact.
- Noise – Ensure noise impacts are acceptable with significant buffers to non-project involved land holders.
- Flora and Fauna – Ensure that the project is designed so that native vegetation is avoided where possible and that any unavoidable loss of vegetation is minimised and mitigated through replanting of areas disturbed during the construction phase and other offset planting.
- Aeronautics – Ensure the safety of aircraft in the vicinity.
- Transport – Ensure the safe and efficient transportation of equipment to the site and the upgrading of roads to facilitate access and for the benefit of the community.
- Electromagnetic Interference – Ensure any disruption to telecommunication services is ameliorated.
- Fire – Ensure the potential risk of fire is managed appropriately.
- Shadow Flicker – Ensure the incidence of shadow flicker is managed to acceptable standards.

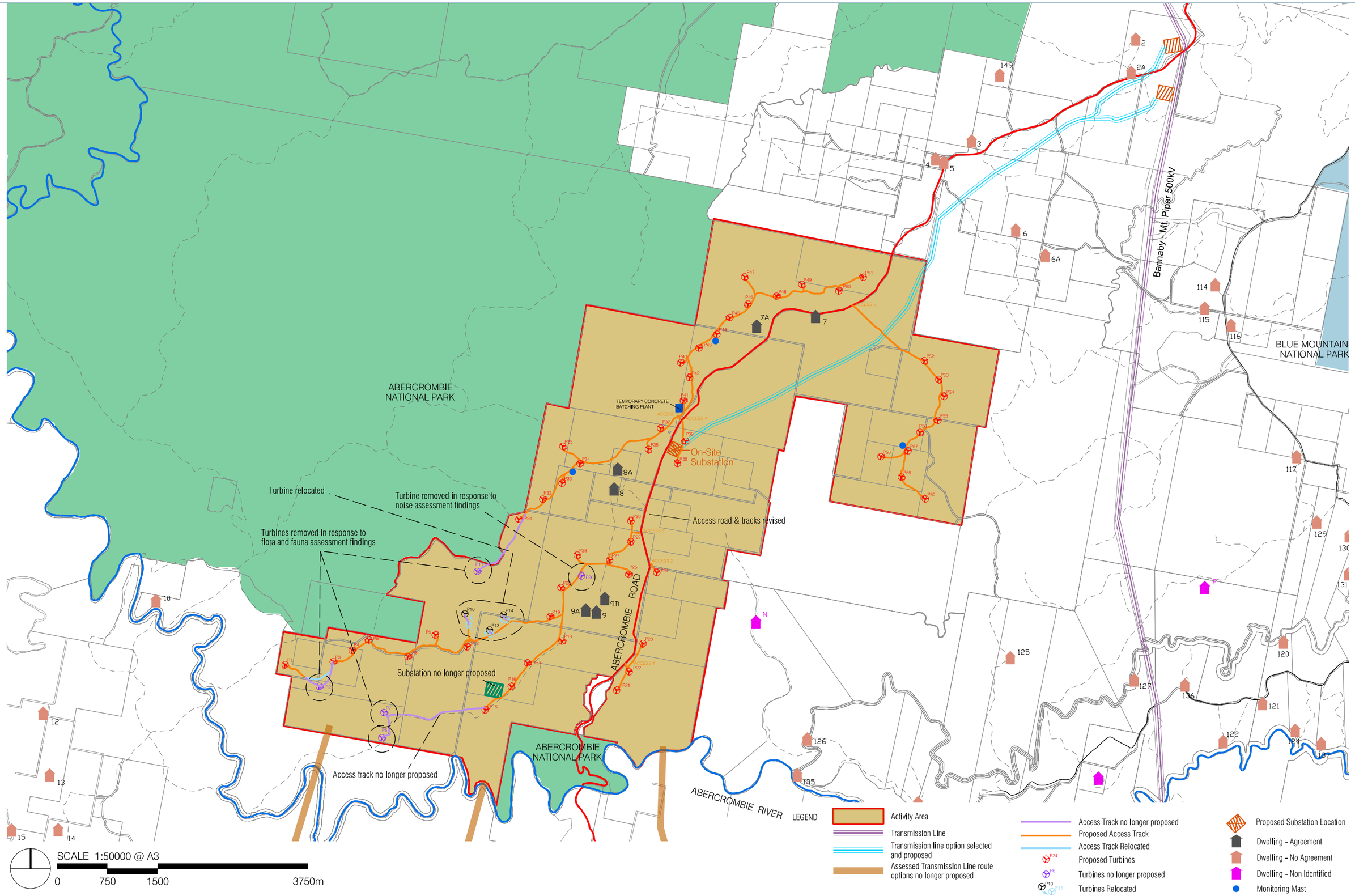


Figure 10 History Plan

Source: *Tract Consultants*

- Heritage – Ensure the protection of aboriginal and cultural heritage.
- Health and Safety – Ensure the safety and wellbeing of the community is preserved.
- Geotechnical – Ensure the design of turbine footings, access roads and other infrastructure is appropriate and minimises the impact of soil erosion and/or groundwater contamination.
- Hydrology – Ensure that site activities do not pollute local streams and water bodies.

Match turbines with the wind resource – The turbine selection has been made to respond to the good wind resource at the site with low cut in speeds.

Separation to non-project involved land holders – The site is bounded by National Parks to the west and south. Adjoining national park reduces the number of non-project involved landholders in close proximity, thereby reducing potential impacts on households. Notwithstanding this, substantial buffer distances from turbines to non-project involved landholders have been employed to manage the impact on neighbouring residents.

UNION FENOSA
WIND AUSTRALIA

gasNatural fenosa

PALING YARDS WIND FARM

CHAPTER 5

THE PROPOSAL

5 The Proposal

This chapter details the project and all associated buildings and works that support the wind energy facility. It also details the major elements of the commissioning, operational and decommissioning phases.

5.1 Overview

The proponent, and its successors and assigns, is seeking project approval for the construction, operation and decommissioning of a wind energy facility known as the Paling Yards Wind Farm (the 'project'). The project is located on two land holdings over approximately 3,900 hectares known as 'Mingary Park' and 'Paling Yards' (refer to **Figure 11 – Indicative Site Plan**).

The project will comprise a number of elements, including:

- Up to 55 individual wind turbines with a capacity of up to 4.5MW;
- Up to 55 individual kiosks for the housing of transformers and switchgears and associated control systems, to be located in the vicinity of the wind turbine towers (in some turbine models the equipment is integrated within the tower or nacelle);
- Upgrades to local road infrastructure including up to six access points from Abercrombie Road;
- Internal unsealed tracks for vehicle access to turbines and infrastructure;
- An underground electrical and communication cable network linking turbines to each other and the proposed on-site substation;
- Up to three wind monitoring masts fitted with various instruments such as anemometers, wind vanes, temperature gauges and potentially other electrical equipment;
- A temporary batching plant to supply concrete for the foundations of the turbines and other associated structures;
- Obstacle lighting to selected turbines (if deemed necessary);
- Removal of native vegetation (if required);
- Vegetation planting to provide screening;
- Wind farm and substation control room and facilities buildings;
- An on-site electrical substation and approximately 9km of overhead powerline of up to 500kV;
- Grid connection achieved via an off-site 500kV electrical Terminal Station (including control room and other associated facilities) for the grid cut-in to the Mt Piper to Bannaby 500kV transmission line; and
- All associated and ancillary uses and activities.

Several options for connection to the electricity transmission grid were explored:

- Northern connection: an overhead powerline connection of approximately 9km to the Mt Piper to Bannaby 500kV transmission line, which bypasses the north-east and east of the site, or,
- Southern connection: a 55km overhead transmission line connection to the approved Crookwell 2 Wind Farm substation which connects to the Yass to Bannaby 330kV transmission line.

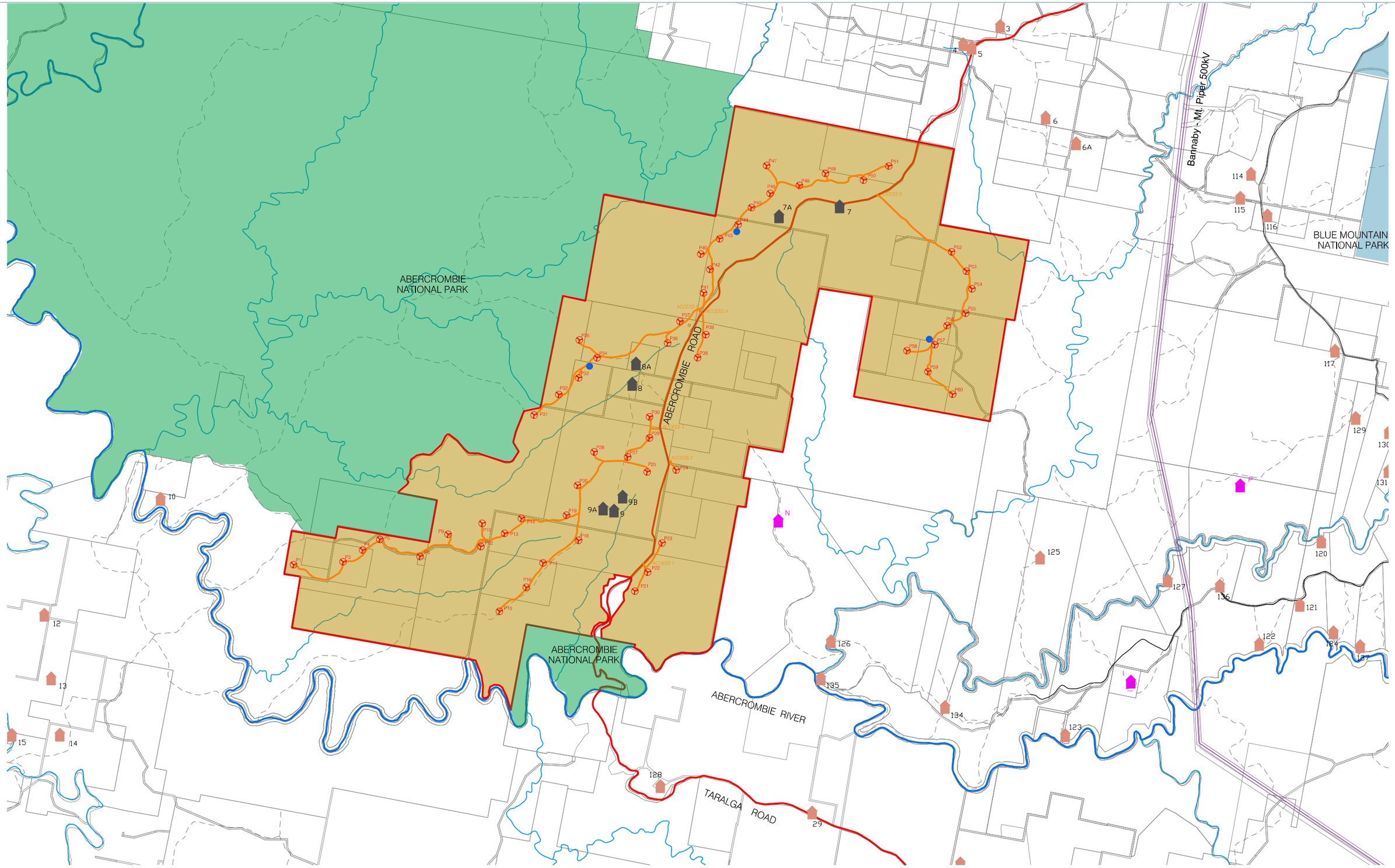


Figure 11 Indicative Site Plan

Source: *Tract Consultants*

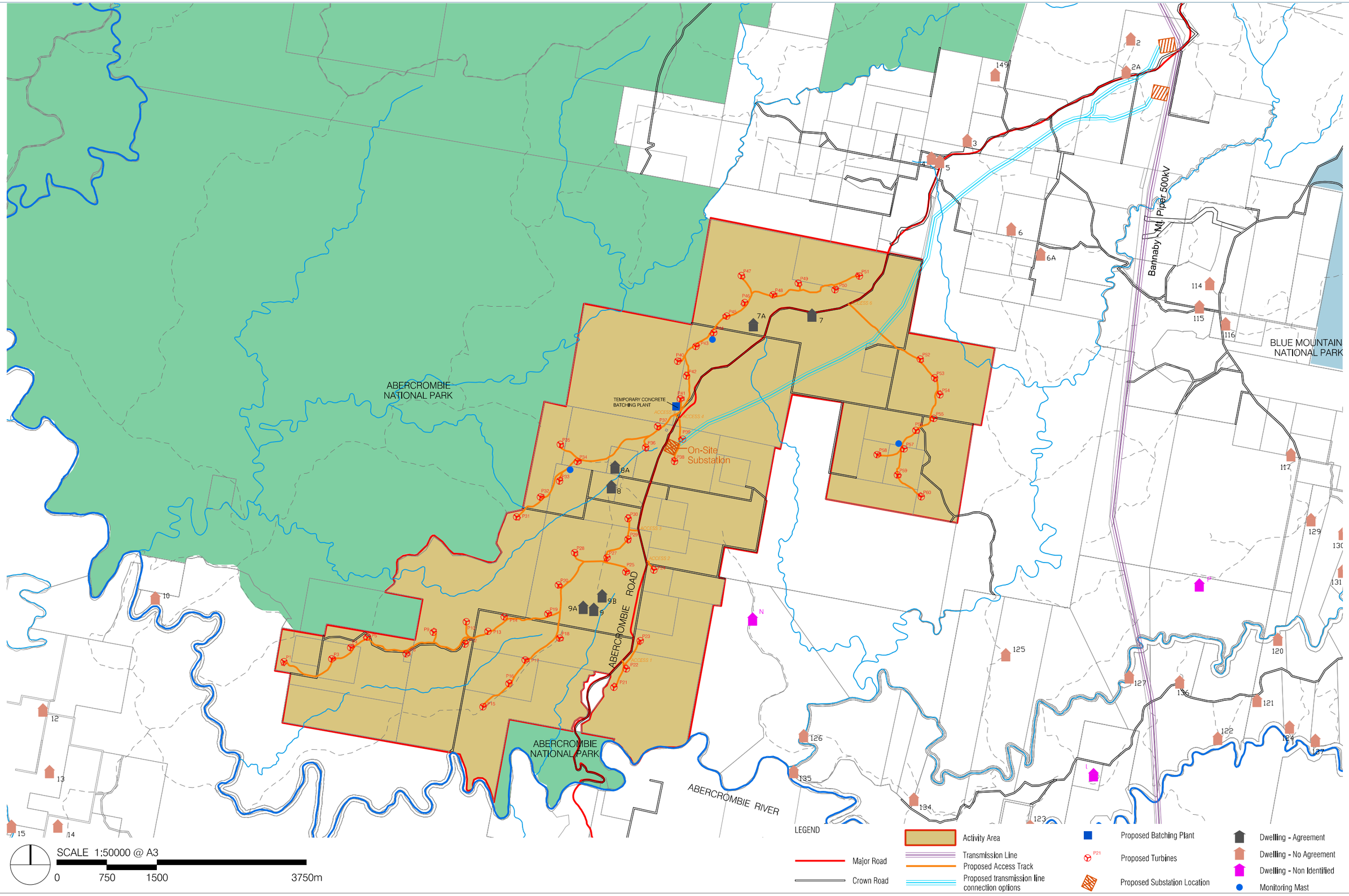


Figure 12 Indicative Access & Infrastructure Plan

Source: *Tract Consultants*

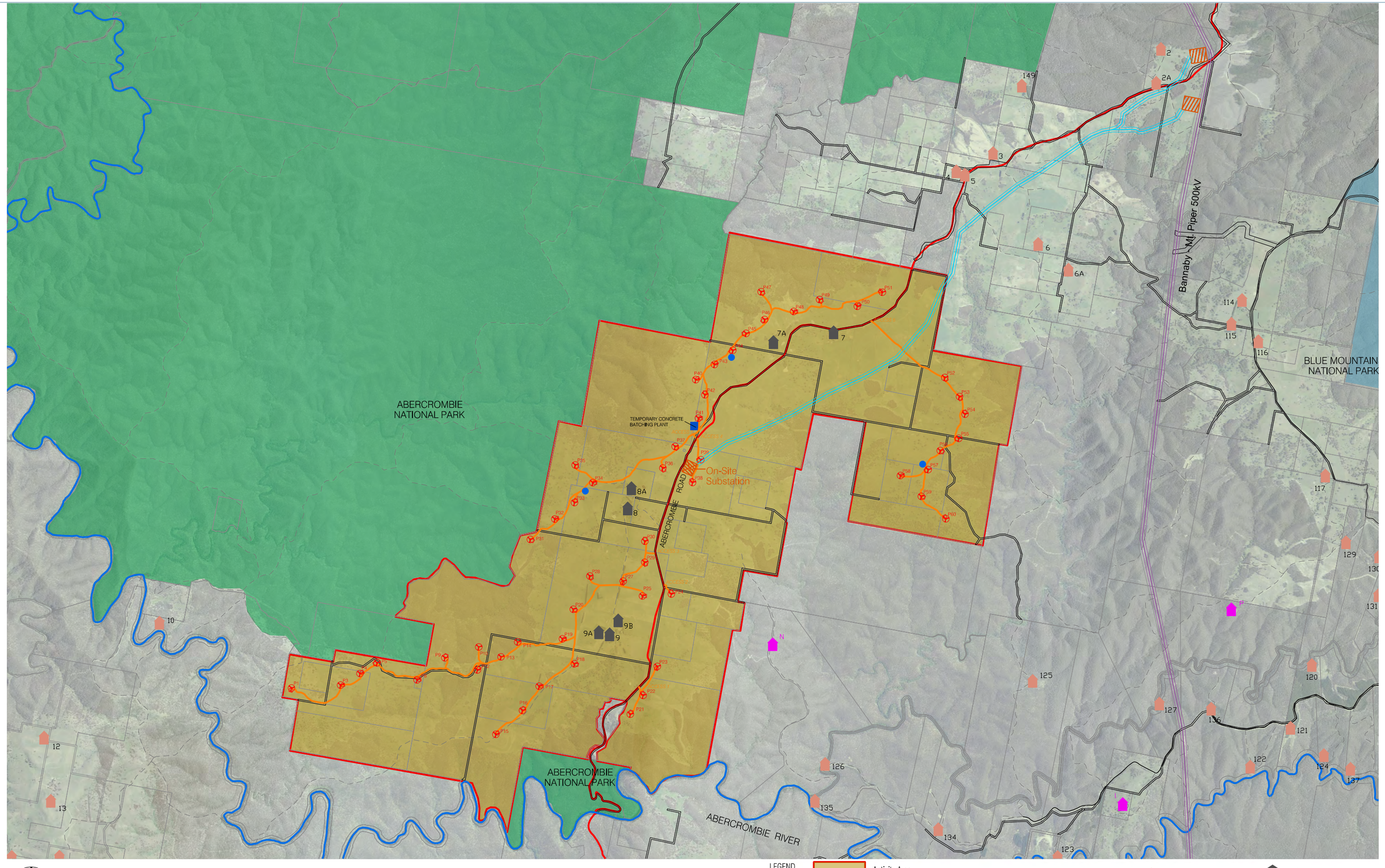


Figure 13 Proposed Transmission Line Plan

Source: *Tract Consultants*

The technical assessment and consultation activities undertaken in preparing this EA established the northern connection option as the most feasible and therefore preferred option. Approval is accordingly being sought for this option.

Please refer to **Figures 12 – Indicative Access & Infrastructure Plan** and **13 – Proposed Transmission Line Plan**.

5.2 Turbine Specifications

The most important element in any wind farm is the wind turbine, often referred to as a wind turbine generator (WTG). Turbines consist of a tall tower with three long blades mounted at the top that capture the wind.

The turbine manufacturing industry is dynamic, with new and updated models regularly released. Existing models are often made redundant only a few years after their release. The industry is rapidly growing and is experiencing benefits from constant innovation and advancement in the efficiency of the turbines.

The major part of a wind farm's cost is the initial construction phase; and turbine selection is a critical determinant of this cost. A turbine's cost depends on a number of factors, including the current economic climate (for example, whether other wind farms also require supply in the upcoming period) and competition between suppliers. In order to maintain competition between suppliers of turbines and ensure that the most up to date turbines can be used, it is important that the project has flexibility to select from a number of different turbine models from alternative suppliers (including new models which may become available in the future).

UFWA is currently considering turbines from the following suppliers:

- Vestas, Denmark
- REpower, Germany
- Gamesa, Spain
- Nordex, Germany
- Siemens, Germany
- General Electric, USA
- Alstom, France/Spain

To provide this flexibility, the proponent is seeking approval for an indicative turbine 'envelope' rather than a single turbine model. This envelope represents the largest and widest of the turbine models currently under consideration.

Many of the turbine models currently under consideration are smaller than the assessed envelope. In general, if any of the smaller turbines are utilised for the project, the impacts described and assessed in this report are likely to be less significant.

The proposed envelope contemplates that the turbine would have an overall height of up to 175 metres when constructed. This envelope includes a tower of up to 107 metres in height to the hub, coupled with a 67 metre long blade (excluding hub) and an approximate 2 metre wide hub. Some of the turbine models considered have a smaller rotor diameter than the maximum proposed, and these can utilise a taller tower up to 119m to bring their tip height up to 175 metres. New turbines are continually coming onto the market; therefore it is possible that minor variations to these dimensions could occur prior to final turbine selection.

Accordingly, for the purposes of this EA, the largest turbine model under consideration has been assessed in relation to all potential impacts other than noise and shadow flicker impacts where these assessments have considered a mix turbine size layout to comply with the relevant standards. For details on the mix of turbine size layouts please refer to the Landscape Visual Assessment at **Appendix 6** and the Noise Assessment at **Appendix 7**. For an illustration of the wind turbine envelope under consideration refer to **Figure 14 – Wind Turbine Elevation**.

Whilst the majority of potential impacts of wind turbines are related to its height and length of blades, the noise produced by an individual turbine is a function of the various mechanical characteristics of the turbine, and not necessarily its height. Therefore, in assessing noise impacts, three models currently under consideration has been assessed based on the information provided by each of the turbine manufacturers on noise characteristics at various wind speeds. Should different models be ultimately selected, further testing will be undertaken.

The following table represents the differences between the various turbine models currently under consideration by UFWA for the project.

Table 2 Turbine comparison

Turbine Manufacturer	Turbine Model	Hub Heights	Blade Length	Rotor Diameter	Total Height (To Tip)	Turbine Capacity	Total Capacity (up to)
Alstom	ECO100	90-100m	49m	101m	140-150m	3.0 MW	165 MW
Alstom	ECO110	90-100m	54m	110m	145-155m	3.0 MW	165 MW
Gamesa	G90	78-98m	44m	90m	125-145m	2.0 MW	110 MW
Gamesa	G97	80-90m	48m	97m	129-139m	2.0 MW	110 MW
Gamesa	G128	111m	63m*	128m	175m	4.5 MW	247.5 MW
Gamesa	G136	107m	67m*	136m	175m	4.5 MW	247.5 MW
GE Energy	2.75-103	85-98m	50m	103m	136-150m	2.75 MW	151.25 MW
Nordex	N100	80-100m	49m	100m	130-150m	2.5 MW	137.5 MW
Nordex	N117	91m	58m	117m	150m	2.4 MW	132 MW
REpower	MM92	80-100m	46m	93m	127-147m	2.0 MW	110 MW
REpower	MM100	80-100m	49m	100m	130-150m	2.0 MW	110 MW
REpower	M104	80-100m	51m	104m	132-152m	3.4 MW	187 MW
REpower	M114	93m	56m	114m	150m	3.2 MW	176 MW
Siemens	SWT101	80-90m	49m	101m	130-140m	2.3 MW	126.5 MW
Siemens	SWT108	80-96m	53m	108m	134-150m	2.3 MW	126.5 MW
Siemens	SWT113	93-99m	55m	113m	150-156m	2.3 MW	126.5 MW

Vestas	V90	80-95m	44m	90m	125-145m	2.0 MW	110 MW
Vestas	V100	80-95m	49m	100m	130-145m	2.0 MW	100 MW
Vestas	V112	84-95-119m	55m	112m	140-150-175m	3.3 MW	181.5 MW

** Segmented blade, transportable similar to G8X*

There are some slight differences in the electrical construction of the turbines under consideration. Some of the turbines under consideration have a 690V / 33kV transformer in the nacelle, and 33kV switchgear either in the base of the tower or next to the tower in a kiosk. Some turbines have the 690V / 33kV transformer and the 33kV switchgear in the base of the tower. Other turbines have the 690V / 33kV transformer and the 33kV switchgear on the ground in a kiosk next to the tower.

The components of all turbine models currently under consideration are as follows:

- Reinforced concrete 'gravity foundations' up to 20 x 20 metres wide and between 1.5 to 3 metres in depth, and/or Reinforced concrete 'rock anchor foundations' of up to 12 x 12 metres wide and reinforced concrete anchors of up to 20 metres into the bedrock depending on the prevailing ground conditions. Both gravity and rock anchor foundations are being investigated which would allow for much smaller concrete footing areas;
- A tubular steel or hybrid steel / concrete tower with a total height of up to 119 metres, weighing between 250-300 tonnes. Some of the larger towers are either concrete precast towers or hybrid towers with the concrete precast base and an upper steel section. The towers are painted in a non-reflective light grey/off-white paint;
- A nacelle at the top of the tower housing the gearbox (where a direct drive mechanism is not in operation) and electrical generator, ensuring that the turbine is always facing into the wind and adjusting the angle of the blades to ensure maximum output of electricity and minimum noise;
- A rotor comprising a hub (attached to the nacelle) with three blades, and a shaft that connects to the generator via the gearbox or direct drive mechanism; and
- Three blades, each up to 67 metres in length (excluding hub), made of lightweight materials.

A safety component incorporated in all models under consideration is a lightning protection system. All blades are manufactured with an anti-lightning protection system which minimises the damage to the turbines in the event of an atmospheric discharge (lightning). In the event of a lightning strike, power is diverted from the lightning to the nacelle which is grounded to the earth.

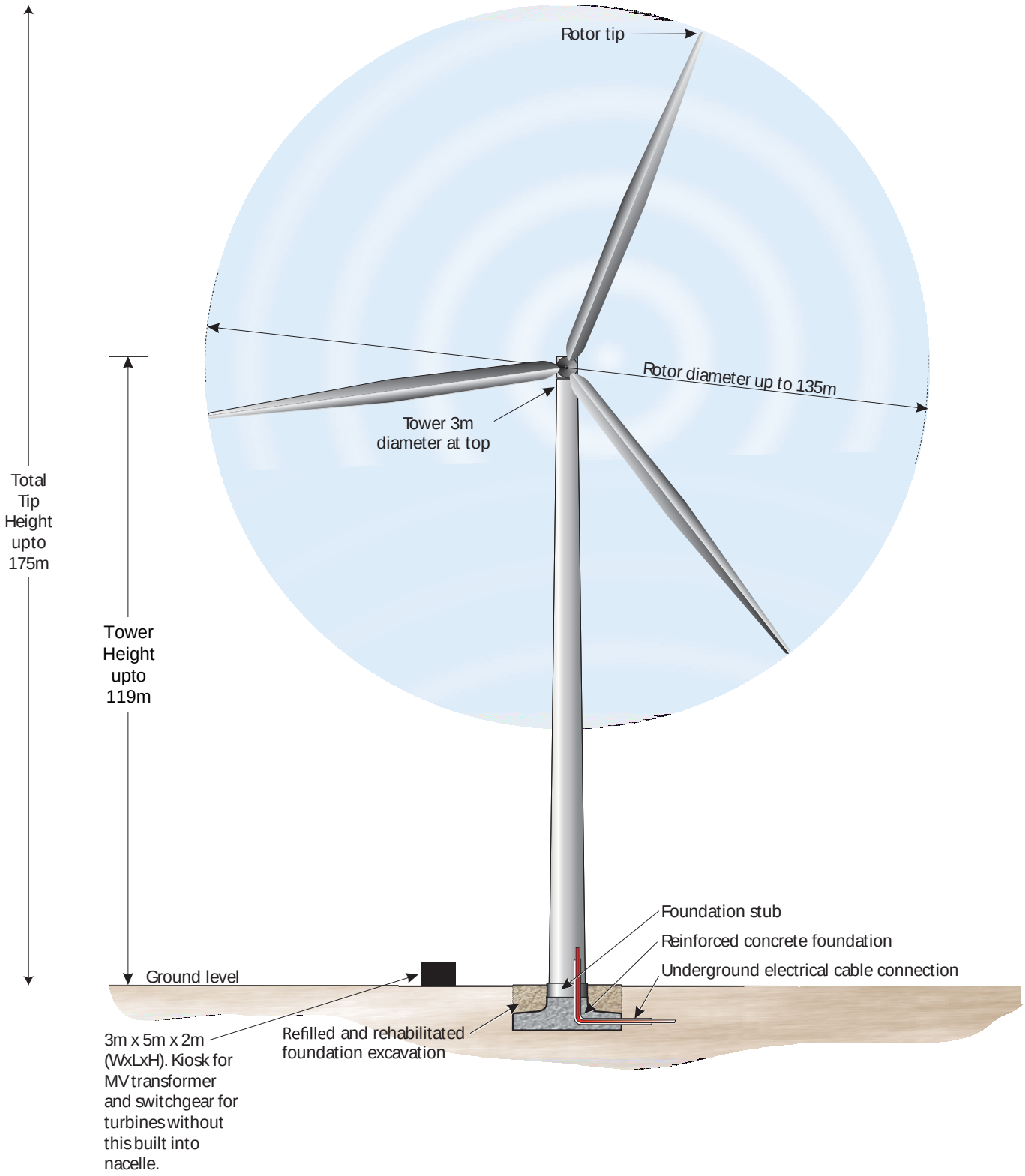


Figure 14 Wind Turbine Elevation

Source: *Tract Consultants based on URS 2006*

Other safety components of the turbines include:

- Sufficient standing and working space;
- Full containment of any leakage or spillage, by using dry-type transformers in the nacelle or using an oil-filled transformer in a kiosk adjacent to the tower with oil bunding built into the kiosk; and
- Fibreglass weather protector.

The turbines currently under consideration would result in efficient transfer of electricity as they have been chosen to match the local conditions at the site. As the height above the ground increases the wind resource generally increases and, as a result, the turbines under consideration are significantly more efficient than previous smaller models.

The turbines have a low 'cut-in' speed at nominal wind speeds (i.e. maximum output capacity is achieved at lower wind speeds). Generally, the wind turbines commence operation at a wind speed of approximately 3 to 4 metres per second, gradually increasing to the maximum output rate at 12 to 15 metres per second (depending on the turbine model). From this rate to approximately 20 to 25 metres per second (depending on the turbine model), the turbine operates at maximum capacity. In order to prevent damage to the, the turbines employ automatic shutdown at speeds above 20 to 25 metres per second (depending on the turbine model).

As turbines are becoming more technologically advanced they now incorporate other features which assist in monitoring performance with relevant standards. For example, turbines can employ a low noise mode or wind sector management to reduce the noise output and avoid reaching critical noise levels. These systems act to mitigate any isolated occasions where noise output has the potential to exceed the permitted threshold, facilitating adaptive management of noise impacts.

5.3 Turbine Layout

An indicative wind turbine layout plan has been prepared for up to 55 turbines (refer to **Figure 12 – Indicative Access & Infrastructure Plan)**. The indicative layout was prepared by the proponent using wind modelling software and reflects the site constraints and the typical spacing required for the wind turbines currently under consideration.

The indicative locations shown reflect the current understanding of the preferred location for the turbines, given the currently proposed turbine models, knowledge of the wind characteristics and the presence of significant vegetation.

The indicative wind turbine layout was based on a number of inputs, principally:

- The site boundary;
- Topographical data;
- Wind speed data collected on and off site;
- Dwelling locations;
- The location of significant native vegetation and native fauna;
- Noise assessments at key receiver points;
- Visual amenity impacts (including shadow flicker at the nearby dwellings); and
- Typical spacing required.

A number of draft layouts were provided and reviewed by the consultant team and the relevant stakeholders consulted. The feedback provided by the consultant team and stakeholders was incorporated into the current indicative layout plan so as to mitigate the potential impacts of the project.

On a hilly terrain such as the site, the wind speeds vary across the site depending on the elevation and the location of hills around the site. The predominant winds in the area are from the west and south-east, and therefore, wind turbine sites are designed to take maximum advantage of these flows.

The indicative turbine layout is based on the turbine models shown in **Table 2 – Turbine comparison**. If project approval is granted, this proposed layout will be refined at the detailed design stage and once the final turbine has been selected so as to achieve the best energy generation from the selected turbine model. It is estimated that this may result in individual turbines being moved approximately 25 to 100 metres from the currently nominated location on the site plan.

The determination of the final turbine locations during detailed design is required to address:

- the particular siting characteristics of the final turbine chosen;
- any additional site constraints discovered during ongoing site investigations (e.g. environmental or constructability constraints, such as the discovery of an unusual geotechnical issue);
- further wind speed analysis; and
- access issues determined during the detailed design phase.

Depending on final turbine selection, it is possible that not all turbine locations proposed would be used to ensure that the wind farm continues to meet all approval conditions.

Approval is sought on terms which allow the micrositing of the final turbine locations and infrastructure during detailed design subject to the following criteria:

- turbines would not be moved by more than 100 metres from their indicative locations;
- turbines would not be moved any closer than 1.0km to any non-project involved dwelling; and
- turbines would be located so as to avoid any unnecessary impacts on flora and fauna or heritage items (including items of Aboriginal heritage).

It is considered that any micrositing in accordance with the above criteria would have negligible influence on the impacts of the project.

The proposed micrositing approach is common for wind farm projects. It was endorsed by the NSW Land and Environment Court (Taralga Landscape Guardians v. Minister for Planning NSWLEC 2007) which found that that a 250 metres relocation of wind turbines is not unreasonable. It is also expressly contemplated by the standard conditions of approval prepared by DoPI.

5.4 Access Points

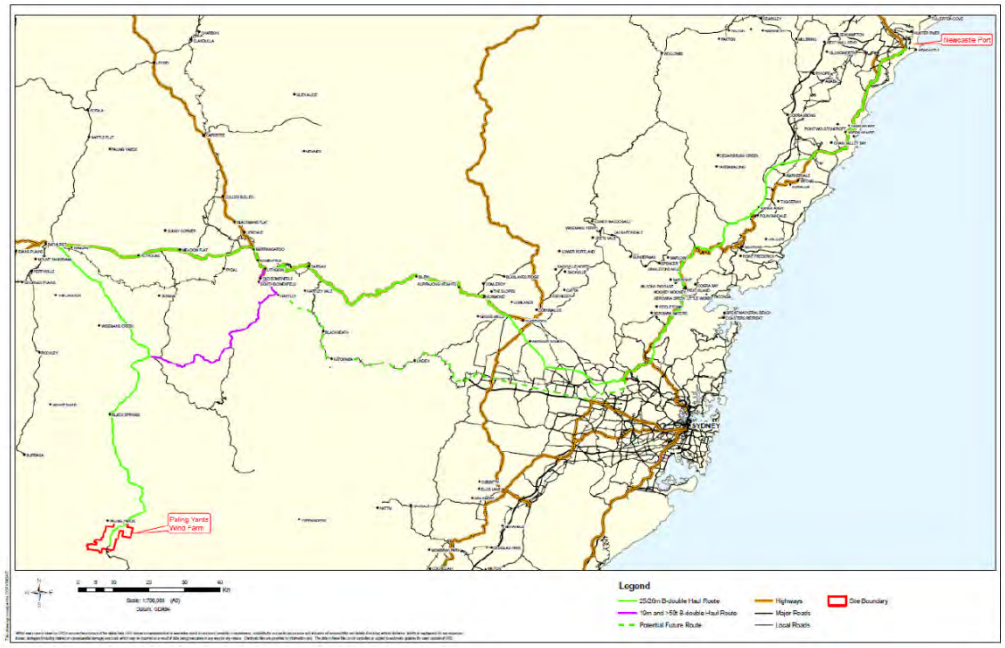
Major wind farm components would be shipped to Australia, with raw construction materials and individual turbine components delivered to either Port Kembla or the Port of Newcastle.

As the turbine components would be considered over-dimensional (OD) loads, the different route options from Port Kembla and the Port of Newcastle to the site are of particular importance, and are shown in **Figures 15** and **16**. URS Australia Pty Ltd prepared a transport impact assessment, which identified the route options for OD vehicles to the site (refer to **Appendix 10 – Transport Impact Assessment**). The routes were selected based on road grade, road width, extent of works required for safe transportation of goods, costs, and appropriateness and directness of route.

Figure 15 Proposed Over Dimensional Route (Port Kembla)



Figure 16 Proposed Over Dimensional Route (Port of Newcastle)



The roads from the ports to Oberon are generally national highways or state roads and are able to accommodate OD vehicles, such as the Hume Highway, Westlink M7 and the Great Western Highway. From the ports, OD vehicles would travel to Bells Line of Road in the Blue Mountains National Park, which is a major arterial road.

The travel time from the Port of Newcastle to this point is slightly longer than from Port Kembla. From Bells Line of Road, two key options are available to the site via Oberon, which is approximately 60km north of the site.

For OD vehicles taking the first route option from Bells Line of Road, vehicles would continue in a southerly direction onto the Great Western Highway, which connects to Jenolan Caves Road, Duckmaloi Road and finally Abercrombie Road at Oberon. Access to the site from Oberon would be achieved by continuing south along Abercrombie Road for approximately 60km.

For OD vehicles taking the second route option from Bells Line of Road, vehicles would continue in a northerly direction onto the Great Western Highway, which connects to O'Connell Road at Kelso and finally Abercrombie Road at Oberon. Again, access to the site from Oberon would be achieved by continuing south along Abercrombie Road for approximately 60km.

The site is divided by the Goulburn-Oberon (Abercrombie) Road. To allow some flexibility for access this EA presents 6 entry options to the site from Abercrombie Road. The first access is located approximately three kilometres north of the Abercrombie River and the remaining five access points are positioned within a distance of 7.5 kilometres from the first access.

Refer to **Chapter 14 – Transport Impacts** for further details.

5.5 Access Tracks

A network of access tracks would lead from the proposed access points on the public roads to the turbines. The access tracks would connect each turbine and allow the safe passage of vehicles to the base of the tower. These access tracks would only intersect with government roads at nominated access points, therefore reducing impacts on public roads. Please refer to **Figure 12 – Indicative Access & Infrastructure Plan**.

Existing farm tracks would be used where possible to reduce the need for additional soil disturbance. During the construction phase of the project, these would be temporarily widened to approximately 8 to 10 metres in order to support the extra load of trucks carrying equipment and cranes for the erection of the towers. This width would then be reduced during the operation phase of the project to approximately 6 metres.

The tracks would continue to be used by the farmer to access the property and to attend to grazing livestock.

5.6 On-Site Substation, Control Room and Facilities Building

An on-site substation, together with a control room and facilities building, is proposed as part of the project, located at the heart of the site between turbines P38 and P39 off Access Track 4, as shown on **Figure 12**.

The substation would increase the voltage of electricity generated by the wind farm as is required for compatibility with the electricity transmission network. The substation would contain a number of circuit breakers of varying sizes as well as busbars and transformers.

A construction envelope of approximately 250m by 210m would house the buildings surrounded by a fence and screening vegetation. This area includes the control room and facilities building that are approximately 400m2 each.

The control room and adjoining facilities will include the following components;

- control room and office;
- canteen and toilets for the duty staff;
- small storage and workshop and maintenance area (for greases/cleaning agents and oils);
- electrical relay room, and;
- car parking.

The storage and workshop area will encompass safety measures to ensure that chemicals stored on site do not pose a risk to the surrounding area. Chemicals taken off-site would be transported by a licensed carrier. Rainwater would be collected from the roof of the building and stored in a tank and topped up by delivery if necessary. At such time as the project is operational, staff would be on-site during the normal working week and continuous remote monitoring will take place over a 24-hour period.

5.7 Electrical works

Electrical works are required to connect the turbines to each other and to the sub-station.

The electrical works comprise:

- 33kV electrical cables linking the turbines to each other and the substation. The electrical cables will be generally installed underground but overhead power lines may be utilised to overcome access and terrain constraints where required.
- Control cables linking the turbines to the control room, installed generally underground and adjacent to the 33kV electrical cabling.

The underground electrical cables are comprised of conductive wire surrounded by protective coating, and laid approximately 1 metre deep underground surrounded by soft sand with back fill. Cable markers would identify the path of the underground cabling to prevent accidental digging around the cable trenches.

All cables would generally follow the same alignment as the access tracks, thereby limiting the development footprint of the project. However, there may be several locations where the cable would diverge from the access tracks to reduce electrical losses and to overcome ground constraints.

5.8 Transmission Lines

The project proposes an overhead powerline connection of approximately 9km to a proposed off-site electrical Terminal Station, which would connect to the Mt Piper to Bannaby 500kV transmission line (the 'north-eastern option').

Two options were considered for overhead connection to the existing power transmission network. These are a southern and northern connection, with each including sub-options. Please refer to **Figure 17 – Former Transmission Line Options Plan**. The options are as follows:

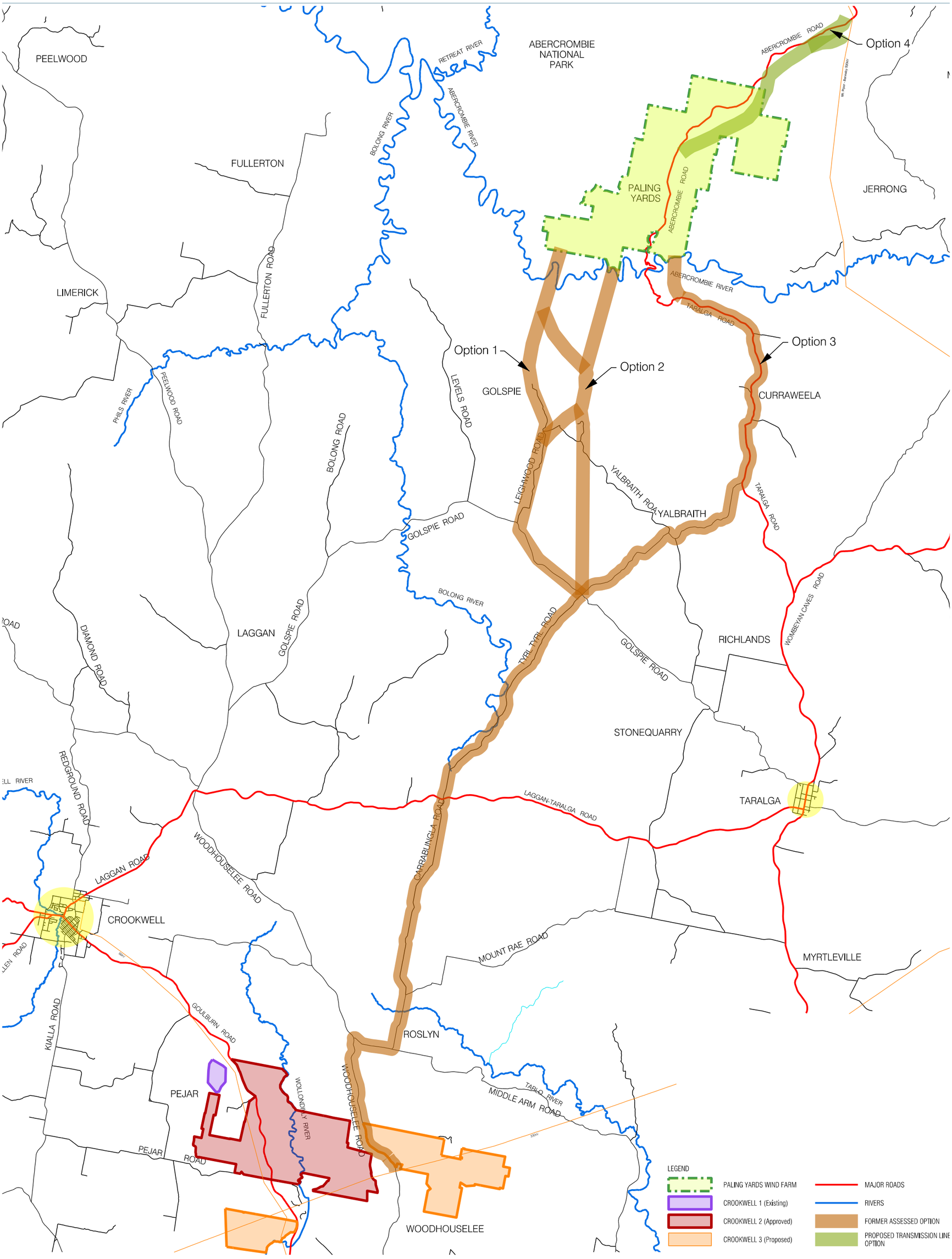


Figure 17 Former Transmission Line Options Plan

Source: *Tract Consultants*

- North-eastern option: an overhead powerline connection of approximately 9km to a proposed off-site electrical Terminal Station that would connect to the Mt Piper to Bannaby 500kV transmission line which passes the north-east and east of the site. This option has two sub-options, or
- Southern option: a 55km overhead powerline connection to the approved Crookwell 2 Wind Farm substation which connects to the Yass to Bannaby 330kV transmission line. This option has three sub-options.

Through the technical assessment and consultation process, it was established that the northern transmission line is the least impact route and the most feasible option. On this basis, approval is only being sought for the northern option. Please refer to **Figure 13 – Proposed Transmission Line Plan**.

The proposed transmission line will include the following:

- A proposed corridor of approximately 9km in length and 70 metres in width to avoid removal of native vegetation as much as possible.
- Transmission line power poles will be spaced approximately 200 to 250 metres apart. It is proposed that the spacing is flexible so as to minimise impacts on environmental features such as waterways.
- Power poles will be located no closer than 40 metres to any watercourse, except where these are only first order "minor streams" as defined by the *Water Management Act 2000*.
- A permanent access track will not be constructed along the length of the transmission line. Instead, access will be gained informally across grassed paddocks using the closest route from existing tracks/roads nearby. The routes which are selected will have the least potential for environmental impact.
- There will be no need to construct watercourse crossings for the purpose of vehicle access, whether permanent or temporary, during transmission line construction. This is on the basis that in situations where the lines cross a creek, cables can be pulled from one side of a creek to the other without needing to drive across the creek.

The proposed transmission line would be constructed over a maximum of eight or nine parcels of land (depending on the sub-option chosen). The parcels are generally cleared farmland, and the line route has been designed to avoid removal of native vegetation where possible.

5.9 Vegetation Removal and Planting

5.9.1 Vegetation Removal

Some vegetation removal is required to facilitate access and allow construction of the turbines. The required clearing is considered to be minimal as the site is already largely cleared and the project has been designed to avoid the need to remove native vegetation.

Approximately 1.0% of the site is required for wind farm infrastructure during the operation phase of the project.

The key reason for vegetation removal is for the provision of access tracks and potentially electricity easements. The access tracks have been designed to avoid native vegetation; however, some vegetation removal is unavoidable.

The areas and types of identified remnant vegetation within the development area are described in **Chapter 12 – Flora and Fauna Impacts** and in **Appendix 8a** and **Appendix 8b**.

A flora and fauna impact assessment for the project was undertaken, which included an assessment of native vegetation on site. It found that most of the areas where the turbines and access roads/electricity easements are proposed represent cleared grazing paddocks with high levels of disturbance. A total area of approximately 14.0 hectares of remnant vegetation removal would be required for the project including the transmission line, of which approximately 1.4 hectares is proposed to be rehabilitated post-construction.

5.9.2 Vegetation Planting

Vegetation screen planting can be an effective tool in mitigating the visual impact of wind turbines or other infrastructure. It is employed in the vicinity of nearby residences and along the roadside to screen potential views of turbines. However, screen planting is only effective where the planting can occur in close proximity to the viewing location (i.e. at a nearby dwelling). Planting would involve a variety of dense native vegetation, including both trees and shrubs, to effectively screen views. The flammability of the vegetation would be a key consideration in selecting species.

Many of the dwellings in the locality are already surrounded by vegetation that performs, at least to some extent, a screening role.

While the screening is proposed to be in close proximity to viewing locations, the exact area of screening and provision would depend on detailed design and discussions between an affected land holder and the proponent following the grant of project approval. The planting would be carried out at no cost to the landowner.

5.10 Wind Monitoring Equipment

Up to three new permanent wind monitoring masts are proposed to be installed during construction of the wind farm. These will be fitted with various instruments such as anemometers, wind vanes, temperature gauges and potentially other electrical equipment.

The proposed locations for these masts are:

- near the east of the site near turbine P57;
- near the northwestern edge of the site near turbine P43 and P44; and
- near the western edge of the site near turbine P34.

The masts consist of a tall, thin tubular or lattice structure and guy wires for support. These masts are up to 105 metres in height (though generally up to 60 metres) and are proposed to be located generally as shown in **Figure 12 – Indicative Access & Infrastructure Plan.**

The main purpose of the permanent wind monitoring masts is to provide an ongoing wind data source to assist with assessing the overall wind farm performance.

5.11 Hazard Lighting

Obstacle lighting consists of two flashing red lights mounted on the turbine nacelle to highlight their presence to nearby aircraft.

An obstacle marking and lighting assessment was undertaken in accordance with the guideline document - *Obstacle Marking and Lighting of Wind Farms (CASA Advisory Circular AC139-18(0))*.

An assessment under these guidelines shows that night lighting of 25 of the proposed turbines may be required. This lighting design is subject to confirmation of the final turbine layout. The characteristics of the lights would be consistent with CASA guidelines.

Visual impacts would be minimised by restricting the downward component of the light to either, or both, of the following:

- *Such that no more than 5% of the nominal intensity is emitted at or below 5° below the horizontal,*
- *Such that no light is emitted at or below 10° below the horizontal.*

The need for obstacle lighting for structures of this height is currently under review. It will also be reviewed at regular intervals by the proponent and, in the event that the CASA guidelines are revised such that night lighting is no longer required, then night lighting would not be installed, or switched off after installation.

5.12 Temporary Construction Facilities

A temporary construction area is required. The temporary construction area would contain portable toilets, vehicle parking, assorted construction equipment, a concrete batching plant and vehicle wash down facilities.

A temporary hardstand area of approximately 50 x 50 metres would be required to enable the construction of each turbine. The hardstand area would be constructed of compacted soil and gravel to provide a stable platform for construction equipment and the crane. The hardstand area is only required for the construction phase and would be removed following construction.

A temporary concrete batching plant would be required for the construction stage of the project to supply concrete for the turbine foundations. Batching plants need to be central to the activity area and well removed from houses due to the occasional generation of noise and dust. In consideration of these matters, the proposed temporary concrete batching plant is to be located west of Abercrombie Road, between P41 and P37. Access Road Number 5 will service this facility. Please refer to **Figure 12– Indicative Access & Infrastructure Plan** for the indicative location of the proposed batching plant.

This location is central to the activity area, which minimises travel distances to individual turbines. The area for the batching plant would be approximately 80 x 80 metres. This area would incorporate loading bays, hoppers, silos, hardstand areas, water tanks and stockpile areas for the storage of the aggregates, sands and other raw materials.

The concrete batching plant is likely to produce between 250m^3 and 500m^3 of concrete on an average day.

Where possible, raw materials for the concrete batching plant would be sourced on site, with all materials brought in from external sources being as clean as possible to minimise the potential of introducing weeds to the site. The water for the concrete would either be sought on site subject to a separate licence issued by the NSW Office of Water, or transported to the site via tanker trucks (refer to **Chapter 20** and **Appendix 14** for further details).

The areas affected by temporary construction activities would be rehabilitated to their former agricultural state on completion of the construction stage. Detailed Environmental Management Plans would be prepared prior to the commencement of

construction, which would incorporate further detail to manage the impacts of construction activities including the temporary construction facilities.

5.13 Pre-Construction

If the project is approved, a number of further steps are required to prepare for construction. These include:

- Detailed design phase of the final wind farm layout, including determination of the final turbine and infrastructure locations in accordance with the principles set out at **Chapter 5.3** above;
- Obtaining all required secondary approvals;
- Preparation of the Pre-Construction Compliance Report;
- Finalisation and approval of the Construction Environmental Management Plan;
- Additional surveying and marking of locations for proposed infrastructure;
- Additional geotechnical investigation for the detailed design of the infrastructure;
- Obtaining a construction certificate (if required by the conditions of approval, if granted);
- Tendering for wind turbine components and other key infrastructure; and
- Tendering for the contracts for construction of the wind farm.

These further steps would take approximately one year.

Following this period the full construction phase would commence. This phase would likely take 18 to 24 months subject to delays due to weather and unforeseen circumstances.

5.14 Construction

At the peak of construction, the project is likely to be employing 65 people, across the tasks detailed in **Table 3** below.

Table 3 Construction activities

Activity	Works Involved
Site Establishment	Clearing of work areas, levelling and compaction, installation of portable buildings and installation / connection of utility services. Site Survey.
Internal Road Works	Removal of topsoil, levelling, sub-base compaction, gravel, drainage.
External Road Works	Upgrade existing roads where required. Provide new access roads to the site.
Foundations	Removal of topsoil, excavation, screed concrete, reinforcement steel bottom, installation of foundation ring, reinforcement steel top, concreting, concrete ring and conduits, backfilling.
Crane Pad Establishment	Removal of topsoil, base compaction, rock / gravel compaction.
Trenches and Cable Laying	Excavation; sand infill; lay cable; lay protective covering; back filling and compacting; installation of cable route markers.
Overhead Powerline	Installation of overhead powerline from the on-site substation to the off-site switching station adjacent to the Bannaby-Mt Piper 500kV transmission line.
Electrical Works (on-site substation)	Installation of control and auxiliary buildings; high voltage power transformer and switchgear; medium voltage switchboard, cabling and switchgear; communications equipment, Supervisory Control and Data Acquisition (SCADA) systems and turbine control panels. .
Turbine Supply	Transport of towers, nacelles, hubs and blades to site.
Turbine Erection	Erection of towers, nacelle, blades, installation of cabling.
Electrical Works (off-site switching station)	Installation of high voltage switchyard equipment; control and auxiliary buildings; communications pole; new transmission line tower adjacent or in line with existing transmission line; and all other ancillary equipment as required by TransGrid for construction and operation of a new Terminal Station; potential installation for an additional high voltage transformer and switchgear.
Wind Farm Commissioning	Pre-commissioning of turbines, SCADA, cables testing, optical fibre. Testing and commissioning of turbines, switchgear, SCADA.
Electricity Grid Connection Commissioning	Final commissioning by the transmission network service provider (Currently TransGrid) prior to connecting the generated electricity on the national electricity grid.
Construction Closure, Site Clean Up	Site cleanup, revegetation, landscaping.

The majority of the early work in the construction period is to prepare the site for the arrival of turbine infrastructure. This involves road upgrades, access track and hardstand area preparation.

Once this stage is complete, the turbine components can be transported and erected on site, usually at the rate of one or two per week. This involves transportation to the hardstand area at the base of each turbine and using cranes to lift turbine components to assemble the structure. In most circumstances, the turbine blades are assembled into the hub at ground level and are then lifted up to the nacelle by crane as a complete ensemble. In other circumstances, the turbine blades are individually lifted and assembled into the hub.

The turbines are anchored using large concrete gravity footings. In areas where granite rocks lie at or just below the surface, the footing is directly attached to the rock which would reduce the amount of concrete required. This may include the potential for rock blasting based on an assessment by the geotechnical engineer. Details of any rock blasting, and associated management techniques, would be provided in the Construction Environmental Management Plan (CEMP).

As outlined above, temporary facilities within a construction area would include portable toilets, vehicle parking, assorted construction equipment, a concrete batching plant and vehicle wash-down facilities. All temporary facilities would be located so as to minimise native vegetation loss and the land would be reinstated to its former state at the conclusion of the construction stage.

While this section provides an overview of the construction process, the construction would be managed by a management plan, which would address matters such as:

- Erosion control
- Water quality protection
- Soil protection
- Vegetation protection
- Air and dust pollution
- Safety
- Public road network access

Standard construction hours would apply to the project, as outlined below:

- Monday to Friday: 7:00am to 6:00pm
- Saturdays: 7:00am to 1:00pm
- Sundays: No construction

The following activities may be carried out outside of these hours as required:

- Any works that do not cause unreasonable noise emissions to be audible at any nearby residence not located on the site;
- The delivery of materials as requested by authorities for safety reasons; and
- Emergency work to avoid the loss of lives, property and / or to prevent environmental harm.

5.15 Operation

The operation phase of the project reflects the leasing arrangement with landowners. Landowners have agreed to grant the proponent a 30 year lease with the option to renew for another 30 years. Whilst no plan of subdivision will need to be registered as a result of these proposed leases, the project includes the grant of these leases and any deemed subdivision arising as a result.

During operation of the wind farm, all infrastructure associated with the wind farm would remain the property and responsibility of the proponent.

All access tracks used by the proponent would be maintained by the proponent as part of the operation of the wind farm, but would remain available for project involved landowners' use.

The wind farm would be controlled by a computerised system. The system would link each turbine by fibre-optic cables, typically laid in the same trench as the electrical cables. The computerised system would log all operating parameters and initiate the most efficient functionality of the turbines according to prevailing atmospheric conditions. The computerised system would also enable the controller to stop the turbine if required.

The system would ensure that rotational speed and the wind turbine angle operates automatically within the wind speed design envelope. Turbines would be disconnected from the grid at very low and very high wind speeds.

Maintenance of the turbines and associated infrastructure would be conducted throughout the operation phase. Maintenance includes a number of activities over different time periods. These are outlined in **Table 4** below.

Table 4 Typical maintenance schedule

Interval	Task
Monthly	Inspection of turbine generator and electrical infrastructure.
3-6 Monthly	Inspection of all machinery, greasing of bearings, checking of hydraulic oil.
As Required	Periodic painting of tower structure; Replacement of electronic and electrical components; Access track maintenance including erosion control; Substation maintenance inclusive of insulator cleaning, removal of debris and greasing of contacts.

As with any infrastructure project there is potential for equipment breakdown or failure during the lifetime of the project. Whilst most repairs would likely occur without impacts outside the wind farm site, should any of the raised components (within the nacelle or the blades themselves) need to be replaced, construction equipment such as cranes and other heavy machinery may be required to access the site temporarily. Such equipment may have a temporary impact on the road network but that impact would likely be minimal.

As part of the operation phase, a number of monitoring protocols would be implemented. These would include a program to ensure compliance with all approval

conditions, including conditions relating to noise, flora and fauna and any other relevant potential impacts.

Whilst the life of a turbine is more than 20 years and often extends to 30 years, the project has been designed to allow for the possible removal and replacement of turbines during the lifetime of the project. If a turbine needs to be replaced, this process would follow the construction stages outlined above and be consistent with any project approval granted for the project.

Where possible, the existing footings, access tracks and other infrastructure would be reused for any replacement turbine(s) during the operation phase.

5.16 Decommissioning

As noted above, UFWA has entered into agreements for lease of land with the landowners who own land within the site. These agreements provide UFWA with leases for a term of 30 years and grant the proponent the opportunity to extend the lease for a further term of 30 years.

Any continuation of the wind farm beyond the first 30 year period may take the form of one of:

- Extended operation of the original turbines;
- Turbine replacement with the similar model that has newer and more efficient technology; or
- Turbine replacement with a different model that would be subject to the requisite approvals being obtained at that time.

Once the wind farm reaches the end of its useful economic life, the project would be decommissioned.

Decommissioning essentially involves the reverse process to construction. All materials would be removed from the site and recycled appropriately. Access tracks would remain where beneficial to the ongoing agricultural land use. Tracks considered surplus to the landowners' requirements would be rehabilitated and revegetated by introducing soil, mulch and grass seeds of local provenance.

AECOM Australia Pty Ltd (AECOM) was engaged by UFWA to prepare a Decommissioning and Rehabilitation Plan (DRP) for the project. It is a requirement of the Draft Guidelines that the EA for the project includes a DRP. Refer to **Appendix 4** of this report for the DRP for the project.

The proponent is responsible and committed to the decommissioning of the wind farm infrastructure, and the landowner is not liable for this obligation (as outlined in the land lease agreements with each of the project involved landowners).

The proponent seeks to mitigate the potential impacts resulting from the cessation of operation of the facility. The DRP outlines the stakeholder and landowner consultation, expected operational life, dismantling, land rehabilitation, funding arrangements, timeframes and responsibility associated with the decommissioning of the proposed project. UFWA has committed to implementing this plan.

The proponent has also consulted with the Oberon Shire Council regarding the project in general and aspects of the construction, operation and decommissioning phases.

The proponent will undertake further consultation with stakeholders prior to and during the decommissioning process.

5.17 Crown Land

Crown land is present within the site boundary and along the proposed transmission line route to the north-east.

Crown land is highlighted on **Figures 5**, **12** and **13**. A number of disused crown roads are impacted by the project infrastructure such as turbines, access tracks and the proposed transmission line options to the north-east. The Indicative Access and Infrastructure Plan at **Figure 12** identifies the locations where the impacts to crown land occurs within the site boundary, and the Proposed Transmission Line Plan at **Figure 13** identifies the locations where the impacts to crown land occurs on along the proposed northern transmission line route options.

Most of these roads are disused and not evident on the ground.

Where the impacts occur, turbines will be micro-sited (as described in **Chapter 5.3** of this report) to avoid the crown land where practicable, and where necessary the proponent will apply to have the crown roads closed, following the appropriate process for closing these roads, and consulting with the relevant authorities.

5.18 Minerals Titles

The project will not impact upon any minerals titles or mining areas. The formerly considered and assessed southern transmission line route options crossed minerals title boundaries; however these options are not proposed as part of this application.

5.19 Staging

The following table provides a timeline of the construction, operation and decommissioning phases of a 30 year lifespan of the project.

Table 5 Staging Timeline

Stage	Activity	Timing
Construction	Site establishment	March 2016
	Internal road works	30 weeks*
	External road works	24 weeks*
	Foundations	40 weeks*
	Crane pad establishment	41 weeks*
	Trenches and cable laying	45 weeks*
	Overhead powerline	
	Electrical works (on-site substation)	15 months*
	Turbine supply	12 months*
	Turbine erection	17 months*
	Electrical works (off-site switching station)	18 months*
	Wind farm commissioning	18 months*
	Electricity grid connection commissioning	19 months*
	Construction closure, site clean up	20 months*

Operation	Inspection of turbine generator and electrical infrastructure	Monthly, as specified by the turbine manufacturer
	Inspection of all machinery, greasing of bearings, checking of hydraulic oil	3-6 monthly as specified by the turbine manufacturer
	Periodic painting of tower structure	As required
	Replacement of electronic and electrical components	As required
	Access track maintenance including erosion control	As required
	Substation maintenance inclusive of insulator cleaning, removal of debris and greasing of contacts	As required
Decommissioning	Permanent cessation of electricity generation	At the end of either 30 or 60 years from commencement of operation**
	Electricity grid connection decommissioning	3 months***
	Removal of turbines	12 months***
	Removal of Electrical Works (on-site substation)	10 months***
	Removal of Electrical Works (Off-site switching station)	15 months***
	Removal overhead powerline	10 months***
	Removal of foundations	12 months***
	Removal of miscellaneous electrical works	11 months***
	Removal of crane pads	14 months***
	Site rehabilitation	15 months***
	Decommissioning closure	18 moths***

* denotes approximate completion timeline for the construction activity from the date of the site establishment activities.

** denotes approximate duration for the operation of the wind farm. The proponent has an agreement with the landholders for a minimum 30 years with an option of another 30 years.

*** denotes approximate completion timeline for the activities from the date of permanent cessation of electricity generation from the wind farm.

UNION FENOSA
WIND AUSTRALIA

gasNatural fenosa

PALING YARDS WIND FARM

CHAPTER 6

PROJECT JUSTIFICATION

6 Project Justification

This chapter contains a strategic assessment of the justification for the project and discusses its environmental, economic and social benefits. It also discusses the alternatives to the project in relation to its type, location and scale.

6.1 Climate Change

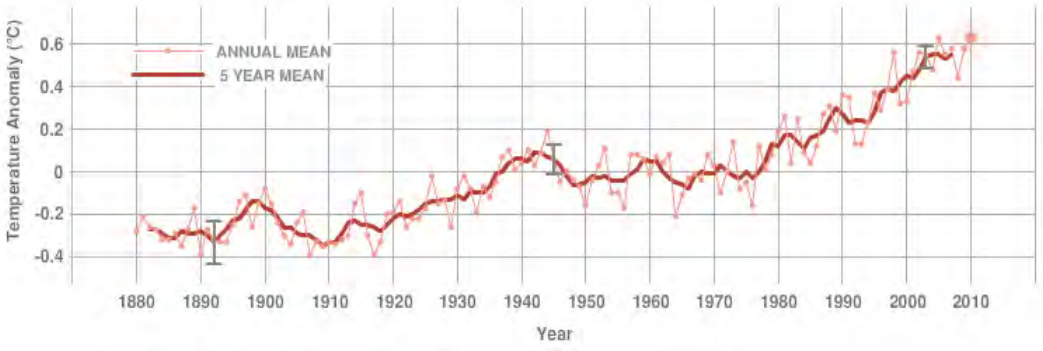
6.1.1 International and Australian Impacts

Climate change is an increase in global average surface temperature resulting from an increase in the amount of greenhouse gases, such as carbon dioxide (CO_2), methane and certain other trace gases in the atmosphere (DCCEE 2010). Greenhouse gases contribute to a warming of the earth's surface and lower atmosphere. The earth's climate has always changed; however, since the industrial revolution, the earth has warmed at an unprecedented speed. The amount of greenhouse gases entering the atmosphere has caused an advanced level of climate change and global warming that has had major influence on sea level rise, biodiversity depletion and extreme weather events (DCCEE 2010).

It is recognised by the majority of scientists and all major scientific associations that human-induced global warming and its subsequent harmful consequences are real, and must be mitigated. The United Nation's Intergovernmental Panel on Climate Change projects that average temperatures around the world will increase by up to 5.8°C over the coming century (GWEC 2012). This is predicted to result in dramatic climate shifts, including increased global average air and ocean temperature, melting ice caps, flooding of low-lying land, storms, droughts and dramatic changes in weather patterns. The majority of the world's population will experience these effects by 2050 (Garnaut 2008, UN 2009).

In 2010, the global average temperature was 0.53°C (0.95°F) above the 1961-90 mean, and the year ranked as the warmest year on record (WMO 2011). The World Meteorological Organisation (WMO) emphasises that *"over the ten years from 2001 to 2010, global temperatures have averaged 0.46°C (0.83°F) above the 1961-1990 average, and are the highest ever recorded for a 10-year period since the beginning of instrumental climate records"*. This data confirms the Earth's significant long-term warming trend (refer to **Figure 18**).

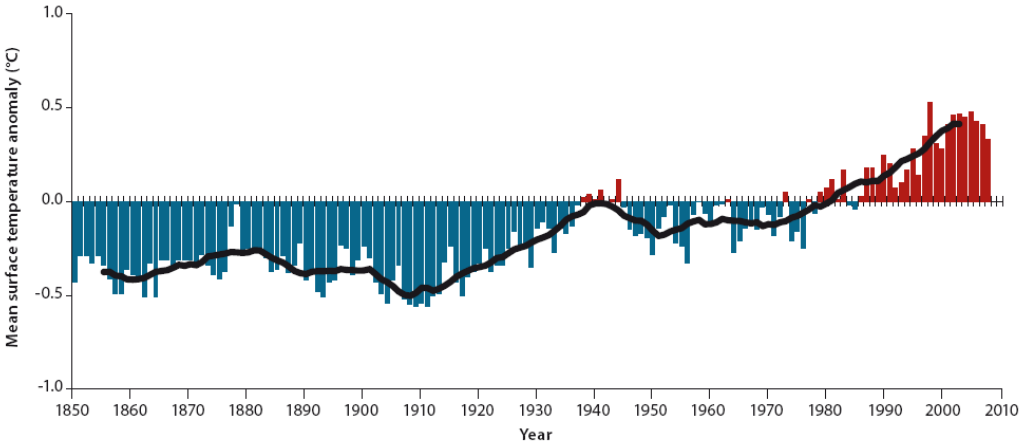
Figure 18 Global temperature rise (1880-2010)



Source: www.climate.nasa.gov

Since the mid-20th century, Australian temperatures have, on average, risen by about 1°C (BOM, 2010) (refer to **Figure 19**). An increase in the frequency of heatwaves and a decrease in the numbers of frosts and cold days have also been observed in Australia over that time (BOM, 2010). Rainfall patterns have also changed, as the northern areas have seen an increase in rainfall over the last 50 years while much of Southern Australia has experienced a decline in rainfall over the same period (BOM, 2010).

Figure 19 Mean surface temperature change (1910-2007) for Australia



Source: BOM, 2011

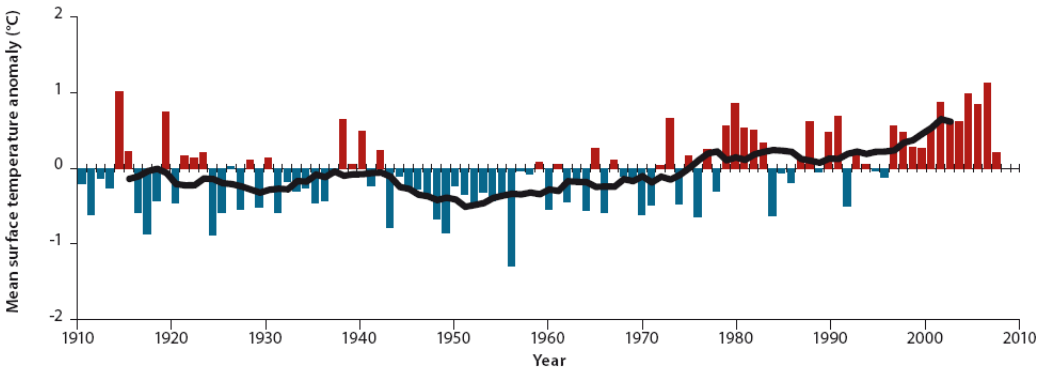
The *Garnaut Review Final Report* (2008) found that *"Australia's level of exposure and sensitivity to the impacts of climate change is high"* and that the major impacts of climate change are likely to include considerable drying in southern Australia, with risk of much greater drying, stressed urban water supply and the effects of changes in temperature and water availability on agriculture. This is expected to have a severe and costly impact on agriculture, infrastructure, biodiversity and ecosystems in Australia, as well as flow on effects on neighbouring nations (Garnaut 2008).

The update to the Garnaut Climate Change Review (2011) advocates that Australia should *"calibrate its emissions reductions proportionately to the global mitigation effort which aims to limit global warming to below 2 degrees above pre-industrial global average temperatures"*, and that a target to reduce Australia's carbon pollution to 25% below 2000 levels by 2020 is appropriate (Garnaut, 2011).

6.1.2 NSW and Local Impacts

Current climate trends identified by the Bureau of Meteorology (BOM) indicate an accelerating increase in average annual temperature in NSW (refer to **Figure 20**). During the 1950s to 1980s, the annual average temperature rise was around 0.1°C per decade; since 1990 it has been about 0.5°C per decade (BOM 2010). All years from 1997 to 2008 were warmer than average, which represented *"an unprecedented sequence in the historical records"* (BOM 2010).

Figure 20 Mean surface temperature change (1910-2007) for NSW



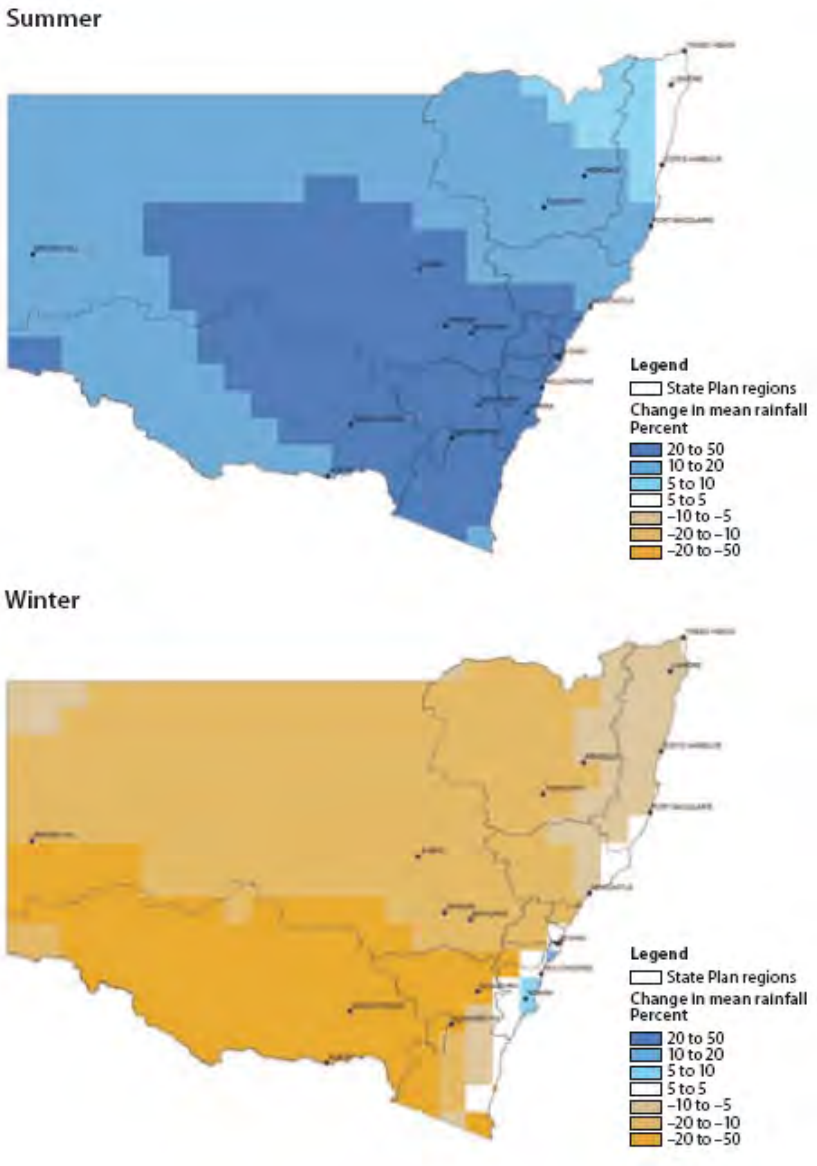
Source: BOM, 2010

According to the NSW Government, CSIRO and Bureau of Meteorology projections, the NSW community needs to prepare for higher temperatures, rising sea levels, less rainfall, more frequent and more severe droughts, and more extreme storms (DECCW 2010). These changes *"are likely to have significant impacts on agriculture, water supply, settlements and infrastructure, natural resources, biodiversity and human health"* (DECCW 2010).

The NSW *Climate Impacts Profile* predicts greater maximum and minimum temperatures to be experienced across the state in all seasons. Winter and spring maximum temperatures are expected to rise by around 2–3°C across much of northern NSW by 2050 (DECCW 2010).

In addition, many parts of the state are forecasted to experience a shift from winter-dominated to summer-dominated rainfall, which may have implications for the length and severity of drought in these areas (refer to **Figure 21** below).

Figure 21 Projected changes in summer and winter rainfall by 2050 for NSW



Source: NSW Climate Impact Profile, DECCW, 2010

The *NSW Climate Impact Profile* is the first integrated assessment of the biophysical changes projected for the state as a result of climate change. It outlines risks, and provides regional projections for eight different areas of the state. The climate impact projections for the South-East region by 2050, in which the site is located, are:

- *"The climate is virtually certain to be hotter, with a likely rainfall increase in summer and decrease in winter. Snowfall is likely to decrease.*
- *Run-off and stream flow are likely to decrease in spring and winter, particularly in the west, and increase during summer.*
- *Sea level is virtually certain to keep rising.*
- *The rate of erosion is likely to increase on some soils. Coastal agricultural soils are likely to be inundated and acidification is likely to increase.*
- *Sea level rise coupled with increased flooding is virtually certain to pose an increased risk to property and infrastructure in coastal areas. Developments near coastal lakes and estuary entrances and on coastal floodplains are vulnerable.*
- *Widespread changes to some natural ecosystems are very likely. Those most at risk are alpine ecosystems, low-lying coastal ecosystems and those sensitive to fire" (DECCW 2010).*

6.2 Renewable Energy

6.2.1 Energy Generation

Internationally, the world is heavily dependent on the supply of fossil fuels, which emit large levels of CO2, for electricity production. Further, per capita consumption rates and energy demands are expected to rise, driven by an estimated global population of approximately 9.2 billion people by 2050, and the increasing industrialisation of the large Chinese, Indian, and other economies (Garnaut 2008, United Nations 2006). It is projected that world consumption of energy from all fuel sources will increase by 49 % from 2007 to 2035 (EIA 2010). The known impacts of fossils fuels, combined with increasing energy demand, highlight the global need for renewable energy technologies that emit less greenhouse gases.

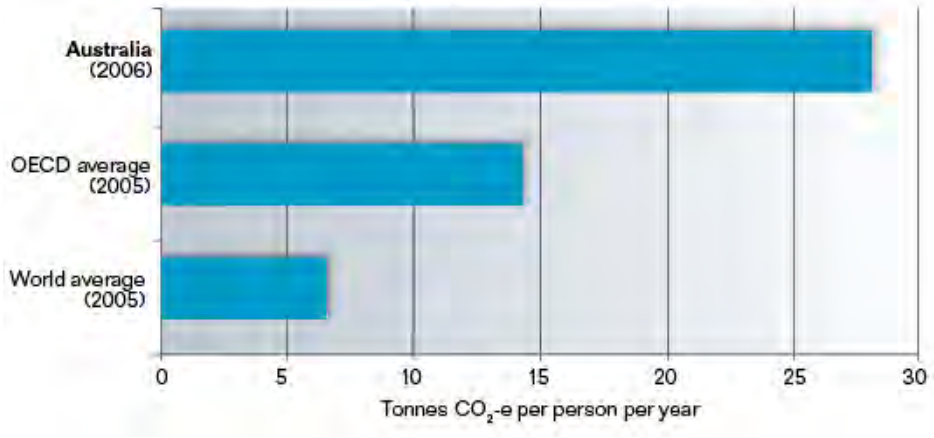
Australia has the highest per capita emissions in the OECD and is among the highest emitters in the world (Garnaut 2008, OECD 2009). Garnaut's (2008) Climate Change Review identifies that Australia's per capita emissions are nearly twice the OECD average and more than four times the world average (refer to **Figure 22 – Per capita greenhouse gas emissions, Australia, OECD average and the World average, 2005**).

The Review also highlights findings from the Department of Climate Change (2008) and the International Energy Agency (2007) that *"the high emissions intensity of energy use in Australia is mainly the result of our reliance on coal for electricity"* (refer to **Figure 23 – Per capita emissions due to electricity, 2005**).

Australia's long-term energy projections show total energy production nearly doubling due to strong export demand, primary energy consumption rising by 35%, and electricity demand increasing by nearly 50% by 2030 (ABARE 2010).

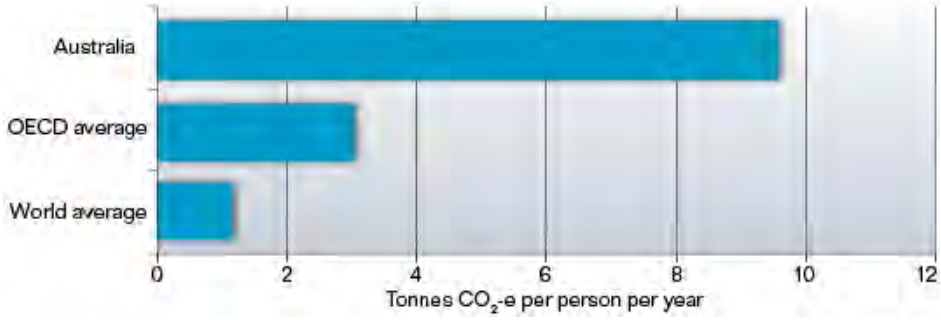
At current rates of production, the Australian Coal Association estimates 500 years supply of brown coal, 100 years of black coal and 60 years for conventional gas (ABARE 2009). **Figure 24 – Composition of Australian energy supply**, demonstrates the domination of the fossil fuels in Australian energy sources.

Figure 22 Per capita greenhouse gas emissions, Australia, OECD average and the World average, 2005



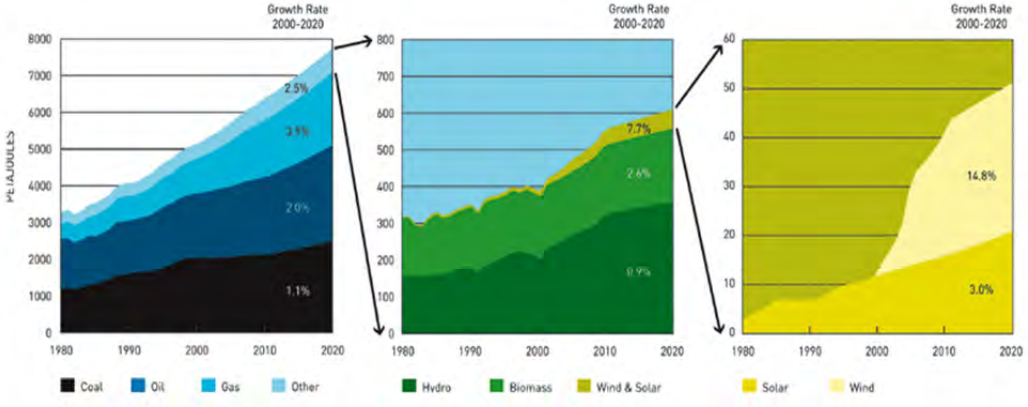
Source: DCC (2008c); IEA (2007a) cited in Garnaut 2008, http://www.garnautreview.org.au/chp7.htm

Figure 23 Per capita emissions due to electricity, 2005



Source: DCC (2008b); IEA (2007a) cited in Garnaut 2008, http://www.garnautreview.org.au/chp7.htm

Figure 24 Composition of Australian energy supply



Source: http://www.energymatters.com.au/faqs/renewable-energy-faq.php

6.2.2 The role of renewable energy

As the negative impacts of climate change and global warming become increasingly apparent, society is looking at the role of innovative technology to address these concerns. A key example is renewable energy. Renewable energy harnesses the replaceable natural energies of the Earth and can be defined as *"energy that is drawn from sources that cannot be depleted or can be replaced"* (House of Representatives Standing Committee on Industry and Resources, 2007).

As energy demands continue to rise and non-renewable energy supplies are depleted, new sources of energy are increasingly required. The adoption of renewable energy is acknowledged as a primary solution to increase energy security, reduce greenhouse gas emissions and cater for future energy needs.

One of the greatest benefits of renewable energy is its potential to provide clean sources of electricity. When generating electricity, renewable energy sources produce less greenhouse gas emissions than fossil fuel or non-renewable energy sources. Additionally, renewable energy produces little or no waste products such as chemical pollutants so, therefore, have a smaller direct impact on the surrounding environment. Renewable energy technologies have, therefore, been sought and developed *"not only to increase the diversity of energy supplies but to potentially displace fossil fuels and consequently reduce greenhouse gas emissions generated by electricity production"* (IEA 2009 cited in NSW Legislative Council 2009).

Renewable energy can also provide opportunities for rural economic development and establish vibrant new industries in local communities, reducing the dependency of the local economy on agriculture alone.

Australia is a nation endowed with significant renewable energy potential, including: *"high levels of solar rays to be used for solar projects; some of the best dry hot rock sites in the world in South Australia, Tasmania, New South Wales and Victoria for geothermal energy production; a vast coastline bordering the southern ocean available for wave energy; and significant wind resources"* (DEWHA 2009, Sustainability Victoria 2010).

Currently, renewable energy accounts for approximately 8.67% of all electricity generated in Australia (CEC, 2010).

6.2.3 The role of wind energy

There are many benefits of wind energy technology.

Wind energy is clean and renewable. Unlike conventional energy sources, wind energy can produce electricity locally, thus reducing transference distances and loss of energy in the process (Diesendorf 2007b).

Wind energy does not involve the harmful side-effects which may result from other energy sources such as the risk of gas explosions, nuclear meltdowns or produce radioactive by-products requiring future storage for thousands of years (Diesendorf 2007b).

Wing energy is currently the most commercially viable and proven renewable technology and, since the 1970s, has been viewed as a key part of a new generation energy mix.

Wind energy can play a key role in reducing greenhouse gas emissions, by providing energy security, decreasing transmission losses, and reducing water consumption. The Australian Energy Regulator (AER), in its State of the Energy Market 2008 report, found that *"renewable energy sources, such as hydroelectric, wind and solar, produced*

some of the lowest greenhouse gas emissions" (AER 2008 in NSW Legislative Council, 2009). Within three to six months of operation, a wind turbine has offset all carbon emissions resulting from its construction, enabling it to operate 'carbon free' for the remainder of its operational life (GWEC, 2010).

Wind energy avoids the negative environmental impacts that are associated with coal-fired electricity generation, such as direct emissions of oxides of nitrogen and sulphur, which cause acid rain and other atmospheric pollution (SEDA NSW 2002).

Other types of electricity generation (such as coal-fired) also require a considerable amount of water during operation. In the case of a coal-fired plant, water is required for the cooling towers, to replace water lost from the boilers, and to stabilise the mine.

Wind energy does not require the use of water during operation and does not require large amounts of water during construction. In contrast, other types of electricity generation such as coal-fired generators require a considerable amount of water during operation. In the case of a coal-fired plant, water is required for the cooling towers, to replace water lost from the boilers, and to stabilise the mine.

Technological advancements have increased wind energy capacity across the world. By June 2011, worldwide wind capacity reached 215,000 MW (WWEA, 2011), accounting for almost 3% of the electricity demand all over the world (WWEA, 2011).

The global wind industry has set itself *"a target of saving 1.5 billion tons of CO^2 per year by 2020"* (GWEC, 2010).

Wind energy also has benefits for land owners involved in the projects. The small development footprint of wind energy projects diversifies the revenue stream available from the land without compromising the core business of agricultural production (due to the small development footprint of a wind farm). Wind farms also provide significant local investment and direct and indirect employment. Refer to **Chapter 5 – Economic and Social Impacts** for more information.

One of the present challenges of wind power is the intermittent nature of its power production. Varying wind speeds affect the energy produced from wind turbines. It is recognised that with current technology, a single wind farm cannot produce sufficient electricity to meet base load power requirements. However, wind farms can meet a significant portion of electrical demand where the transmission network is well linked and wind farms are geographically diverse. This is because, whilst the wind may not be blowing at peak generation speeds in NSW, a modern transmission network is able to utilise wind power generated from Victoria or South Australia where the wind is blowing at a more favourable rate, and vice versa.

Considerable research is underway within the energy industry to improve the management of different types of energy generators as part of the overall modern power generation network. For example, improvements in wind forecasting can increase the ability of grid operators to schedule and accommodate generation from wind, whilst reducing the generation from polluting sources of base load generation. Furthermore, wind generation can be combined with other renewable sources such as hydroelectricity to improve its ability to supply base load power when required. Additionally, advances in energy battery technologies also offer the potential for short term storage of energy to be utilised when the wind is not blowing. Wind power is seen as a key component of a modern energy network that also includes solar, hydro and gas.

As technology advances, the role of wind power in Australia's energy mix is increasing. The University of Melbourne Energy Research Institute team has established an organisation, Beyond Zero Emissions, a non-profit, independent climate change

solutions research and advocacy group that has developed the *Zero Carbon Australia 2020 Project*. The Zero Carbon Australia 2020 Project is a *"costed, detailed blueprint for a transition of Australia to a Zero Emissions Economy by 2020 using proven, commercialised technology"* (University of Melbourne, 2010).

The Zero Carbon Australia 2020 Project only uses proven and costed technologies that are commercially available. Importantly, wind power is one of only two primary technologies utilised (the other being concentrating solar thermal (CST), providing a significant proportion of (approximately 40%) of the proposed energy mix (University of Melbourne, 2010). Wind power and CST are backed up by a 2% annual contribution from crop waste biomass and hydroelectricity (University of Melbourne, 2010).

The Zero Carbon Australia 2020 Project mid-term goals are to have 15,000 MW of wind and 5,000 MW of CST operational by 2015. Australia, however, currently has less than 2,000 MW of wind turbine capacity installed (University of Melbourne, 2010). Wind power was selected as a key source for Australia's future energy requirement on the basis that:

- wind power is generally the cheapest renewable energy source to deploy;
- it is technologically mature;
- 40% wind power can be readily integrated with the CST-based electricity supply grid; and
- at least 15% of the installed wind capacity would always be producing power, with the same reliability as conventional 'base load' power.

Wind power, therefore, can play a crucial role in Australia's future energy. Accordingly, developments such as the Paling Yards Wind Farm project are important in supplying Australia's increasing demand for clean renewable energy.

6.3 Wind Power Context

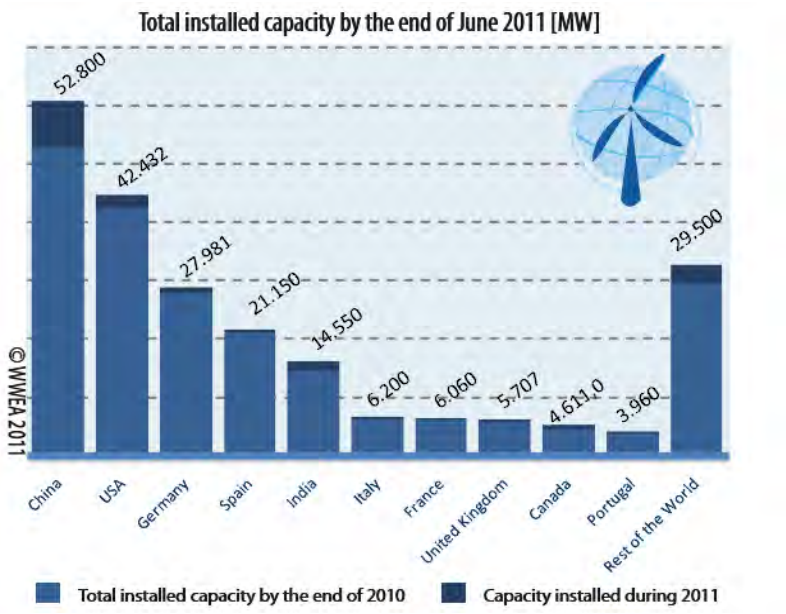
6.3.1 International Context

Wind power is one of the fastest growing energy technologies in the world (Diesendorf 2009). According to the World Wind Energy Association, at the end of June 2011 over 215 GW of wind energy capacity was installed globally (WWEA, 2011), of which 18.4 GW of new capacity had been installed in the first half of 2011. Wind power showed a growth rate of 22.9 % from June 2010 to June 2011 (WWEA, 2011). This rate was lower than the growth in 2008 (29%) and 2009 (32%) due to a large volume of projects that had been initiated in late 2006 through 2008 (Pike Research, 2011a). However, global wind generation capacity is expected to grow from 194.3 GW in 2010 to 562.9 GW by 2017 (Pike Research, 2011b). **Figure 25** - **World total installed capacity (MW) from 2001 to 2011** shows the total installed wind capacity at the end of 2010 and June 2011 for the top ten wind energy markets and the rest of the world.

Wind power now accounts for a significant majority of the world's renewable electricity capacity, after hydropower.

The international wind energy industry witnessed growth worth over 56 billion in 2010 (Pike Research, 2011a) and is predicted to see an investment in new wind power capacity of $820 billion between 2011 and 2017 (Pike Research, 2011b). A global capacity of 600 GW is predicted as possible by the year 2015 and more than 1,500 GW by the year 2020 (WWEA, 2010).

Figure 25 World total installed capacity (MW) from 2001 to 2011



Source: World Wind Energy Association, 2011

The international wind industry is responsible for significant employment. The World Wind Energy Association estimated that the wind sector employed 670,000 persons worldwide by 2010 (WWEA 2010).

Whilst wind energy is most commonly utilised in Europe, it is being increasingly embraced by nations outside that continent. In 2010, China became number one in total installed capacity, and added 18.9 GW within one year, accounting for more than 50% of the world market for new wind turbines (WWEA 2010). In the first 6 months of 2011, China added 8 GW, accounting for 43% of the world market for new wind turbines (WWEA, 2011).

While the wind energy industry has grown by over 30% over the past decade, wind energy currently supplies less than 3% of global electricity generation (WWEA 2011). It is considered, however, that wind energy has the potential to supply *"10-12% of global electricity demand by 2020, reducing greenhouse gas emissions by 1.5 billion tonnes per year"* (NSW Legislative Council, 2009).

6.3.2 Australian Context

Wind energy in Australia has shown rapid growth over the last 30 years, and is increasingly recognised as a key component needed to supply our increasing energy needs. The Australian wind industry is generally concentrated in the southern states of Western Australia, South Australia, Victoria, Tasmania and New South Wales (NSW).

The Renewable Energy Target (RET) scheme outlines the Australian Government's commitment to reducing greenhouse gas emissions and expanding the use of renewable sources from 2020 and beyond. On 20 August 2009, the Renewable Energy (Electricity) Amendment Bill 2009 was passed in the Commonwealth Parliament, which expanded the MRET (Mandatory Renewable Energy Target) scheme into a single national scheme, called the RET. This scheme places a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of

renewable energy (Sustainability Victoria, 2010). In June 2010, the Government passed an enhanced RET scheme, which created new categories for renewable energy to encourage commercial scale energy development.

The aim of the RET is to ensure that *"20 per cent of Australia's electricity comes from renewable sources by 2020"* (Commonwealth of Australia, 2013), and to:

- *"encourage the additional generation of electricity from renewable sources;*
- *reduce emissions of greenhouse gases in the electricity sector; and*
- *ensure that renewable energy sources are ecologically sustainable." (Clean Energy Regulator, 2012),*

The RET achieves this by *"the creation of online certificates by eligible renewable energy sources based on the amount of electricity in megawatt hours (MWh)"* and *"placing a legal obligation on liable entities (usually electricity retailers) to purchase and surrender a certain amount of these certificates each year"* (Clean Energy Regulator, 2012). The RET places an obligation on electricity retailers and large users of electricity to purchase 20% of their electricity from renewable energy sources by 2020 (Minister for Climate Change, Energy Efficiency and Water, June 2010).

On 1 January 2011 the RET split into two separate schemes, and the 'Large-scale Renewable Energy Target' (LRET) and the 'Small-scale Renewable Energy Scheme' (SRES) became effective. The LRET encourages large scale energy generation to be produced using technologies such as hydro, biomass, solar, tidal and wind power. The LRET will drive investment in renewable energy projects like wind farms, commercial solar and geothermal, which will deliver the majority of the 2020 target. The annual targets for the LRET increase each year up to 41,000 GWh by 2020 (DCCEE 2010).

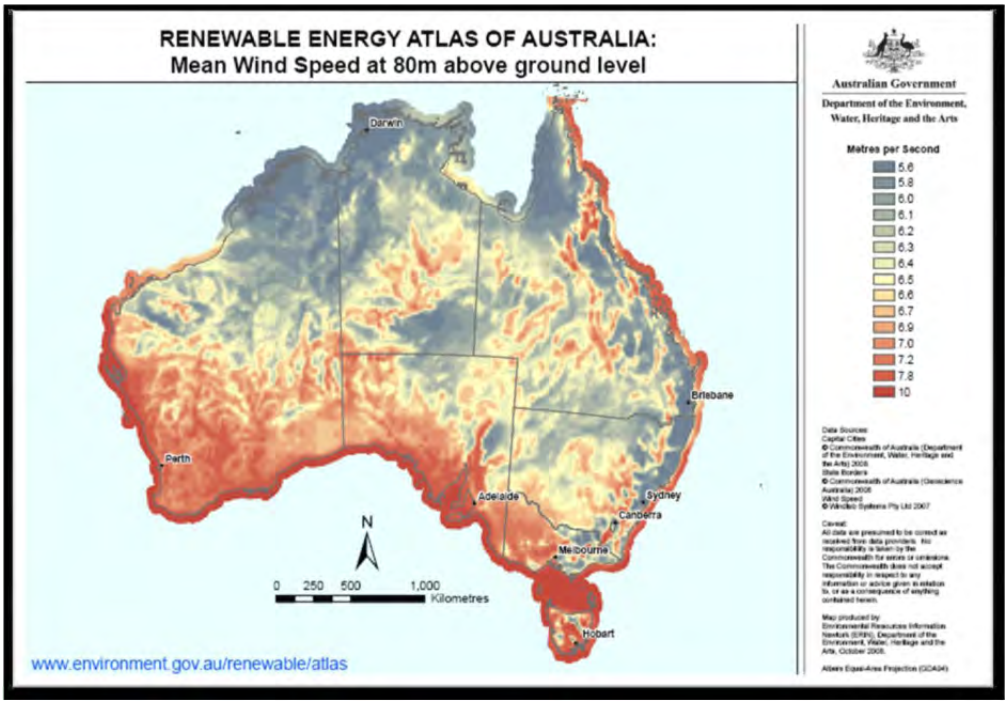
To achieve this target, Australia will require significant investment in renewable generation. As wind power is currently one of the most economic and mature renewable energy technologies available, it is likely to contribute a large share of this target. The development of up to 178 MW of wind generation at the site will make an important contribution to Australia's renewable energy sector.

At the end of 2011, the total investment in large-scale renewable energy power stations was approximately $10.5 billion and their generating capability was approximately 13,700 gigawatt hours of eligible renewable energy per year (Clean Energy Regulator, 2012). This generating capability is *"equivalent to the residential electricity needs of over 2.1 million households"* (Clean Energy Regulator, 2012).

Billions of dollars of investment of additional wind generation capacity will be required to meet the RET target by 2020 (Infigen Energy, 2012, Origin Energy, 2013). Wind power remains the renewable technology leader in cost competitiveness and is expected to play a significant role in meeting the large scale target.

Beyond the environmental benefits, the profile of wind power in Australia has grown due to its status as a market ready technology, at an increasingly affordable price. Moreover, Australia is described by the GWEC as having some of the world's best wind resources (DEWHA 2009, CEC 2010), making it a prime location for wind farm development (refer to **Figure 26 – Renewable Energy Atlas of Australia**).

Figure 26 – Renewable energy atlas of Australia



Source: The Department of the Environment, Water, Heritage and the Arts 2009.

Investment in wind energy technology has increased substantially over the last few years. Australia's total operating wind capacity at the beginning of 2011 was 1991 MW (CEC 2012). Wind power generation in Australia has increased by approximately 30%each year over the previous decade (CEC 2012). Since 2000, *"more than 1400 direct jobs and $3.3 billion of investment have been generated through the development of wind energy in Australia"* (GL Garrad Hassan cited in CEC 2011).

However, total installed wind generation capacity in Australia is considerably lower in comparison to many other developed and developing nations (WWEA, 2010).

In September 2011, the Commonwealth Government moved towards implementing its carbon reduction initiatives by introducing the Carbon Bill package to the Australian Parliament. The key component of this legislative package is the Clean Energy Act 2011 (Cth) which was passed by the Senate on 8 November 2011. The carbon price commenced under this Act on 1 July 2012.

The Australian Government announced that the Australian carbon pricing mechanism and Europe's emissions trading scheme will be linked onwards and that the proposed $15/t price floor in the Australian mechanism will be scrapped from July 2015. These changes will not affect the Australian fixed price between now and 30 June 2015 ($23/t CO2e, rising to $25.40/t CO2e).

The introduction of a carbon price for high polluting users promotes low and zero emission energy sources and provides funding for the development and transition to low emission methods; including wind farms. Therefore, the development of the Paling Yards by UFWA is consistent with the current policy of the Commonwealth government.

The intention of the current Federal Government (elected in 2013) is to repeal Australia's carbon pricing scheme, as stated by Prime Minister Tony Abbott; however the date and likelihood of success of this repeal is unknown (SMH, 2013).

By the end of 2012, Australia was home to 62 operating wind farms (CEC, 2013) (refer to **Table 6** below). This wind energy investment has created:

- 2,584 MW total installed wind capacity
- more than 7,700 GWh of electricity
- a supply that accounts for over 3.4 per cent of Australia's overall electricity needs
- 1,397operating wind turbines
- A situation where over 1 million equivalent Australian homes are powered
- $7 billion total capital investment $4.25 billion of local investment
- 1,700 direct jobs
- 5,200 total jobs

Table 6 Jurisdictional breakdown of wind farms in Australia (2013)

Jurisdiction	Wind farms Installed	Turbines Installed	Capacity Installed
New South Wales	9	170	282 MW
Queensland	2	22	12 MW
South Australia	16	561	1205 MW
Tasmania	6	68	142 MW
Victoria	12	314	519 MW
Western Australia	17	262	424 MW
Northern Territory	Nil		
Australian Capital Territory	Nil		
Australia	**62**	**1,397**	**2,584 MW**

Source: Clean Energy Council, Technologies, Wind Energy, 2013:
http://www.cleanenergycouncil.org.au/technologies/wind-energy.html

South Australia and Western Australia contain the highest number of wind farms, and South Australia is reported to have the highest level of total electricity coming from wind energy production.

6.3.3 NSW Context

In NSW, more than 90% of electricity is generated from coal, and one third of NSW's total greenhouse gas emissions are due to the generation of electricity (NSW Government 2010b). Most of NSW's electricity is sourced from black coal fired power stations in the Hunter Valley, such as the Bayswater Power Station. In NSW, each kW of electricity produced from coal generation results in 1.07 kg of carbon pollution (NSW Government 2010a), whilst electricity produced from wind farms produces no direct carbon pollution. The greenhouse gases generated by the manufacture of the turbines and the construction of the farm are offset within three to six months of wind farm operation.

Additionally, there is increasing community concern in regional NSW regarding air and water pollution caused by both coal fired power stations and coal mines. The Sydney Morning Herald has publicised community concerns over health impacts thought to be associated with the coal mining industry in the Hunter Valley (SMH, 2010).

Energy demands in NSW are predicted to rise as a result of increased population and consumption rates. Governments have recognised that renewable energy sources should be encouraged in order to reduce the greenhouse gas emissions resulting from increased generation. In lieu of the RET legislation, the NSW government introduced the draft NSW Renewable Energy Target (NRET) in 2007. This scheme required 10% of NSW's electricity to be sourced from renewable energy by 2010, and 15% by 2020 (NSW Government 2006).

The NSW scheme's target, which applied to all electricity retailers required electricity retailers to purchase 10% of their electricity supply from accredited renewable generation sources (NSW Government 2006). Due to the introduction of the RET scheme by the Federal Government, the draft NRET scheme was not legislated.

While dependence on fossil-fuelled energy remains high, the wind energy sector in NSW is currently experiencing rapid growth. By the end of 2012, there were 9 operating wind farms and 282 MW of installed wind power in NSW.

The key reasons for the emergence of the wind energy industry in NSW include:

- the status of wind energy technology as 'market ready';
- its role in reducing greenhouse gas emissions;
- the potential for considerable investment and economic activity driven by the Commonwealth Renewable Energy Target (RET);
- the significant wind resources available in NSW; and
- the price competitiveness of electricity generated by wind energy.

NSW has an excellent wind resource (refer to **Figure 27 – NSW Wind Atlas**). Background wind speeds in NSW are comparable to northern Europe, where a large portion of international wind generation is currently installed (NSW Government 2010a). NSW has an estimated potential for over 5,000 MW of wind energy (NSW Government 2010c).

Many of the ideal sites in NSW are "*the hills and ridges of the Great Dividing Range and calmer background winds that blow from west to east across the vast NSW inland*" (NSW Government 2010c). The extensive NSW transmission network is linked to the

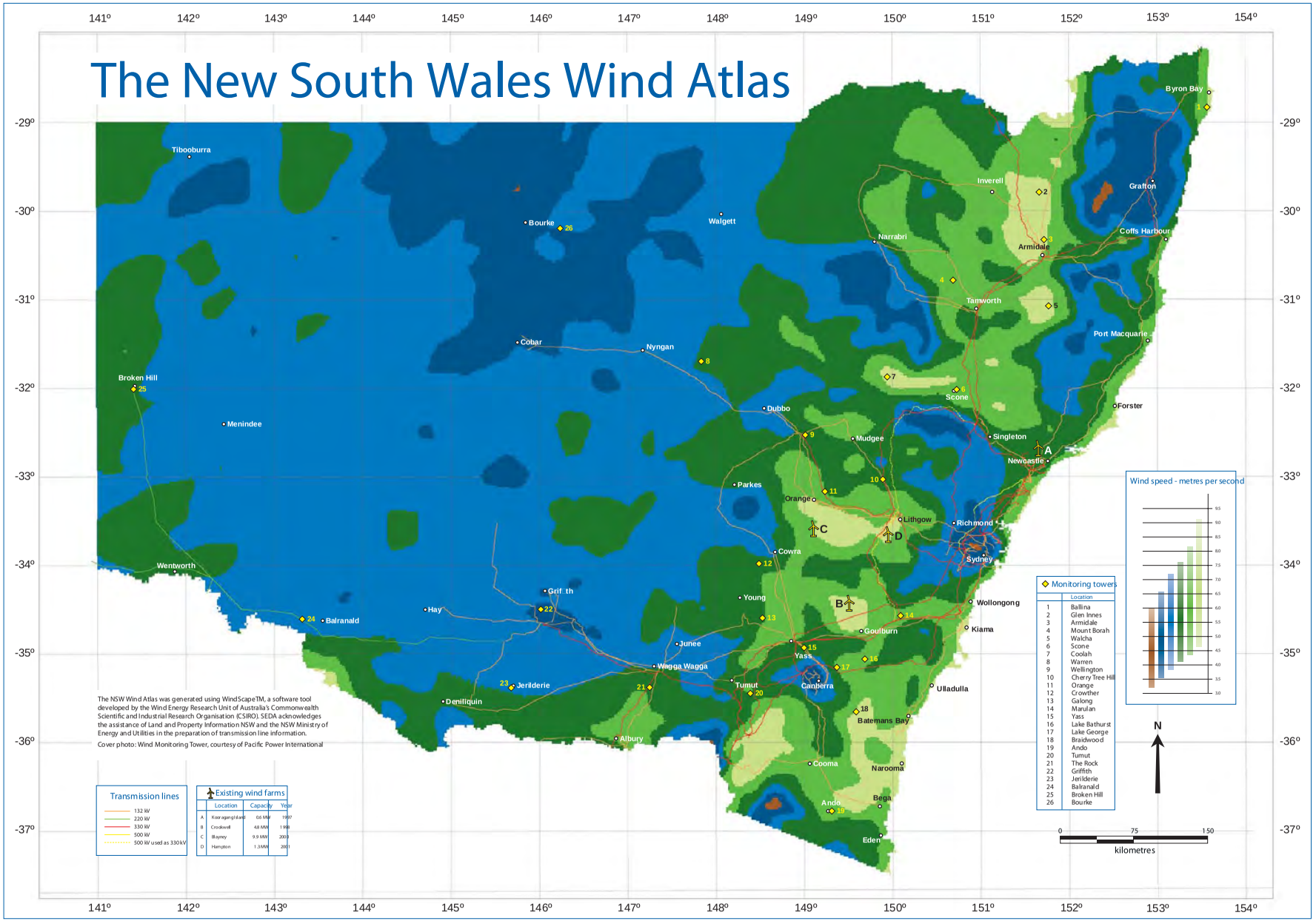


Figure 27 NSW Wind Atlas

Source: *NSW State Government*

national grid, offering easy access for wind farms (SEDA NSW 2001). Furthermore, NSW has one of the biggest wind monitoring networks in Australia.

6.4 Community Attitudes

In 2012 CSIRO conducted an investigation, *Exploring Community Acceptance to Rural Wind Farms in Australia: a snapshot* that sought to improve the understanding of community attitudes to rural wind farms.

The study involved interviews and media analysis across nine wind farms of different sizes and operational status across New South Wales, Victoria and South Australia. Overall, the study found that "*community acceptance of wind farms could be increased by developers intentionally adopting frameworks for transparent and well structured community engagement*".

The study produced four high level findings:

1. *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. This finding contrasts with the level of opposition that may be assumed from the typically 'conflict-oriented' portrayal of wind farm proposals in the popular media.*
2. *The actual and perceived local costs and benefits of wind farms are strongly influenced by the design, implementation, and community engagement processes.*
3. *Existing regulatory approaches provide an appropriate framework for negotiating wind farm developments, but there is scope for improving outcomes.*
4. *The emerging notion of a 'social licence to operate' provides a useful framework for wind farm developers to engage local communities in ways that could enhance transparency and local support, and complement formal regulatory processes. This approach could provide a structured and cooperative framework for exploring strategies for reducing potential adverse impacts, sharing financial benefits equitably, and building local trust and understanding through a clear communication process.*

An in-depth and thorough community consultation program has been designed for the project for direct community consultation and have stakeholders' views heard and responded to. The proponent has already taken appropriate steps in the process to proactively inform and engage the local community and relevant stakeholders about the project. Community input has influenced the design of the wind farm and any concerns will continue to be addressed.

At the end of 2010, the NSW Government conducted a survey of approximately 2,000 people and 300 businesses in rural NSW in order to assess public attitudes to wind farms. The results showed that around 80% of respondents said they would strongly support wind farms in their region (SMH, 2011).

Refer to **Chapter 22** of this EA for details on the extensive community and stakeholder consultation undertaken by the proponent for this project.

6.5 Project Benefits

6.5.1 Environmental benefits

Wind energy plays a key role in reducing greenhouse gas emissions and mitigating climate change. The NSW State Government promotes the development of renewable energy as part of an approach to ensuring sustainable development in the NSW energy sector and reducing the state's greenhouse gas emissions.

The project would contain up to 55 turbines, generating up to 178 MW of wind energy. If approved, the project would save between 269,827 and 535,961 tonnes of CO_2 annually (when compared to generating the same amount of electricity from black coal fired power stations). An equivalent CO_2 reduction could be achieved by taking up to 123,778 cars off the road, or planting up to 799,941 trees. The electricity generated by the wind farm could supply up to 85,344 households with energy, or a population of 221,895.

The environmental benefits of wind energy projects such as the Paling Yards Wind Farm project are clear: wind farms do not generate any greenhouse gas emissions during electricity production (NSW Legislative Council, 2009), and minimal quantities during the manufacture of its equipment and construction phase. By contrast, fossil fuels such as coal, gas and oil are major emitters of carbon dioxide.

Wind power generation also mitigates other adverse environmental impacts such as landscape degradation from fossil fuel exploration and mining, the pollution caused by accidental oil spills, and waste from fuel (GWEC 2010). Furthermore, wind energy does not require large water resources or make large tracts of land unusable, as the turbines and associated infrastructure use, on average, approximately 0.1% of land upon a site (GWEC 2010). This footprint is slightly larger during the temporary construction period.

Another key environmental benefit of wind power generation is energy security. An energy future based on conventional fuel sources is uncertain as oil, coal and gas are non-renewable and by definition will one day run out. It is estimated that by 2030 world energy needs will be between 30 and 60% higher than current levels (GWEC 2010). However, the main fossil fuels used in power generation, which nations are heavily reliant upon, are becoming more expensive and more difficult to extract (GWEC 2010). There is uncertainty over supply and cost associated with the importation of fossil fuels. In contrast, wind energy is a renewable energy source that is endlessly obtainable in almost every country in the world.

Air Pollution

The generation of wind power at Paling Yards Wind Farm would also have a positive effect on regional air quality by displacing pollutants generated from coal power stations. The combustion of coal to generate electricity produces sulphur dioxide and nitrogen oxide, which are emitted into the atmosphere and are the main components of the ‘acid rain’ effect. Acid rain negatively impacts upon forests, water courses and human health (GWEC 2010). Based on 2008/09 NSW Electricity Generation figures (NPI 2010) approximately 240 million kg of acid rain producing sulphur dioxide, as well as 170 million kg of oxides of nitrogen, are emitted by NSW electricity generators per year. The majority of this pollution is emitted by coal power stations. For example, NSW’s largest electricity generator, the Bayswater Power Station in Muswellbrook, emitted 37 million kg of Oxides of Nitrogen and 70 million kg of Sulphur Dioxide in 2008/2009 (NPI 2010). By contrast, the Paling Yards Wind Farm would produce no oxides of nitrogen, sulphur dioxide, or any other direct air pollutants.

Other pollutants emitted by coal power stations include (NPI 2010):

- Ammonia
- Arsenic & compounds
- Beryllium & compounds
- Boron & compounds
- Cadmium & compounds
- Carbon monoxide
- Chromium (III) compounds
- Chromium (VI) compounds
- Cobalt & compounds
- Copper & compounds
- Cumene (1-methylethylbenzene)
- Fluoride compounds
- Hydrochloric acid
- Lead & compounds
- Manganese & compounds
- Mercury & compounds
- Nickel & compounds
- Particulate Matter
- Polychlorinated dioxins and furans
- Polycyclic aromatic hydrocarbons
- Selenium & compounds
- Sulfuric acid
- Zinc and compounds

As wind farms do not produce any direct pollution, every MW of energy produced by wind farms displaces the emission of the above pollutants.

Greenhouse gas reductions

A key determinant in calculating the emission reductions of the project is the type of energy that is displaced by the wind energy. Whilst in Victoria wind energy displaces brown coal fuelled energy at a rate of 1.31 tonnes per MWh of energy, in NSW it is less as black coal converts to energy at a higher efficiency. A co-efficient of 0.973 tonne per MWh of energy has been used to support the calculations below. This pool co-efficient is derived from GGAS (2009). The table below outlines the savings that would be made as an outcome of the project.

Table 7 Greenhouse gas savings

	Maximum up to	Source
Total Capacity (MW)	178*	Calculated – Union Fenosa
Capacity factor (%)	35%	Calculated – Union Fenosa
Output (MWh)(Annual)	550,833	Calculated – Union Fenosa
Greenhouse gas displaced (tonnes)	535,961	Based on NSW GGAS 2010
Number of households supplied electricity	85,344	Based on AGO, 1999
Population supplied electricity	221,895	Based on Vic Sustainable Energy Authority 2003
Equivalent cars off road	123,778	Based on Vic Sustainable Energy Authority 2003
Equivalent number trees planted	799,941	Based on Vic Sustainable Energy Authority 2003

* The 178 MW figure has been derived from an estimate of the mix of turbine capacities. Whilst it is theoretically possible for the wind farm to produce up to 247.5 MW (4.5 MW x 55 turbines), this is unlikely given site constraints. As a result, it is more likely that a mix of turbine models with different capacities will be pursued. It has therefore been estimated that the maximum output will be up to 178 MW.

As outlined in the table above, the greenhouse gas savings attributable to the project equates to the electricity use of a population up to 221,895 or 85,344 households. This is approximately two-thirds of Canberra's population (350,000) or more than ten times the size of Goulburn (20,127).

Water Savings

In addition to electricity savings, due to the amount of water required to fuel black coal energy production, significant amounts of water would be saved by the production of energy through the project.

The five coal power stations currently in operation in NSW use approximately 85,000 ML per year or 15% of Sydney's annual water consumption (NGH Environmental 2009). As coal fired electricity production continues to rely on potable rather than recycled water, this represents a major environmental impact in addition to the pollution and greenhouse gases produced by coal fired power stations.

Based on the annual water consumption and energy production rates for coal fired power stations in NSW, approximately 1316 litres is used per MWh produced (NGH Environmental 2009). The project would therefore significantly reduce the amount of potable water consumption attributable to energy generation in NSW every year.

6.5.2 Economic benefits

The Global Wind Energy Council emphasises the significant economic benefits of utilising wind power, as follows:

- No fuel price risk: Wind energy is a large indigenous power source which is permanently available in virtually every country in the world.
- Investment and jobs: According to the GWEC scenario, the annual value of global investment in wind energy would reach €149.4 billion by 2020 and account for over 2.2 million jobs.
- Regional economic development: The wind power industry is revitalising regional economies, providing quality jobs and expanding tax bases in rural regions.
- No geo-political risk: There are no fuel costs, no geo-political risk and no supply dependence on imported fuels from politically unstable regions.
- Speed of development: Wind power also has the advantage that it can be deployed faster than other energy supply technologies.
- Emissions: Wind energy emits neither climate change inducing carbon dioxide nor the other air pollutants and, as a result, has none of the high external costs related with conventional energy sources.

Environmental Resources Management Australia Pty Ltd has calculated the specific economic impacts of the project, as follows:

- A total capital investment of approximately $275 million.
- Stimulation of the economy in the Oberon Shire as a result of greater income generation and subsequent expenditure in the region.
- Provision of flow on economic benefits in terms of employment and commercial opportunities from the economic investment.
- Up-skilling of the local workforce within a growing energy market.
- Creation of up to 65 full time jobs during the construction phase.
- Creation of 11 full time jobs during the operational phase of the wind farm.
- Use of a significant portion of locally sourced materials and employment.
- Increases in the local tourism industry, and in turn, increased expenditure on local services such as accommodation and retail.

In addition, UFWA is exploring potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations. The door-knock survey which UFWA representatives and environmental consultants undertook asked respondents to suggest community funding projects that they would like to see occur if the project went ahead.

The Clean Energy Council of Australia (CEC) released a publication, *Wind Farm Investment, Employment and Carbon Abatement in Australia*, in June 2012. The study provides a snapshot of wind farm investment, jobs and carbon abatement in Australia and each of the states. The key findings of the study are as follows:

- Total local capital investment in Australian wind farms is $4.25 billion (of a total $7 billion) and potential further local investment in proposed wind farms is $17.8 billion (of a total $29.6 billion).

- Construction of a 50 MW wind farm would provide a gross value added of some $50 million to a state and contribute between 0.012% and 0.21% to gross state product (GSP) depending on the size of the state economy.
- Based on four indicative regions, construction of a 50 MW wind farm could contribute 0.1% to 2.6% to regional gross regional product, depending on the size of the regional economy.
- Construction of a wind farm could lead to potential local personal expenditure of $25,000 per person per annum on accommodation, food and other services in the region.
- A typical 50 megawatt (MW) wind farm:
    - Has an estimated average construction workforce of 48 people with each worker spending $25,000 per year in the local area. This equates to some $1.2 million per year flowing into hotels, shops, restaurants, and other local service providers.
    - Employs around five staff for operations and maintenance, equating to an ongoing local annual influx of $125,000.
    - Creates 795 one-year, full-time equivalent construction jobs per 50MW wind farm in Australia, including 504 jobs in the State and 160 in the region.
    - Creates 44 one-year, full-time equivalent operation jobs per 50MW wind farm in Australia, including 19 jobs in the State and 12 in the region.
- The national average of emissions abatement achieved by wind farms across Australia is 246,200 tons per annum which is equivalent to 57,300 cars removed from the road.

The study concluded that the development of wind farms contribute significantly to investment, employment and emissions abatement at regional, state and national levels.

6.5.3 Social benefits

Chapter 8 details the social impacts of the project. The specific social impacts of the project are as follows:

- beneficial social outcomes through supporting national and international efforts to reduce the potential impacts of global warming and climate change;
- greater employment opportunities and up-skilling of the local workforce;
- establishment of a collaborative approach to implementing local business assistance programs;
- the development of a formal approach to community investment programs and partnerships which provide sustainable benefits to the local community and the surrounding districts;
- potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations; and
- beneficial social outcomes arising from landowner payments flowing through the local economy.

6.6 Consideration of Alternatives

6.6.1 Do Nothing

An alternative is to not proceed with the project. Such an option has a number of significant consequences, primarily the continued reliance on fossil fuels for electricity generation and the consequential emission of greenhouse gases. The continued emission of greenhouse gases will contribute to anthropogenic climate change and its impacts such as sea level rise and extreme weather. For example, the project is expected to displace up to approximately 535,961 tonnes of greenhouse gases, the equivalent of taking up to approximately 123,778 cars off the road, or planting up to approximately 799,941 trees.

The 'Do Nothing' alternative will also forego the project benefits outlined in **Chapter 6.5**. These include the reduction of pollutants otherwise emitted by fossil fuels and water savings. The Paling Yards region and wider NSW would not realise the economic benefits of the project, such as an investment of $287 million and the creation of 65 jobs during construction and 11 ongoing jobs during operation.

6.6.2 Alternative energy sources

The key alternative energy source to wind power is the continued use of fossil fuels, such as coal and natural gas. However, the combustion of these fuels results in the release of CO_2 that contributes to the warming of the Earth and results in the dangerous impacts of climate change. State and National legislation has been passed to address climate change by reducing greenhouse gas emissions. Ambitious targets have been put into place at all levels of government to substantially reduce emissions over the coming decade.

Further, it is considered unlikely that power generation companies would invest in higher emitting fossil fuel sources, especially coal, with the worldwide movement away from such forms of energy and the introduction of a market mechanism for carbon in Australia.

Since the 1970s, alternative renewable technologies have been researched, promoted and developed, to varying extents in many nations. Other forms of renewable energy include:

- solar energy, including solar thermal energy;
- hydro energy;
- ocean energy, including tidal; wave energy;
- geothermal energy; and
- bioenergy.

The likely degree of adoption and commercial viability of these forms of renewable energy is difficult to ascertain, as most depend on technological advances and overcoming major barriers. With the exception of solar energy, all are in the early stages of development and are not 'market ready'. None have benefited from several decades of operation like wind power.

Hydroelectricity, the conversion of strong water flows to electricity using a water turbine, has been utilised since the early 20th Century on a large scale. It is known to have environmental impacts, such as the direct loss of flora and fauna from the flooding of the dam site, aquatic temperature impacts, the creation of aquatic fauna barriers, the reversal of seasonal flows, and the reduction in flooding events. In recent years, doubts have been raised over the ability for hydroelectricity to generate sufficient energy given the low dam levels associated with reduced rainfall patterns.

Whilst alternative forms of renewable energy are promising and are likely to form a component of Australia's future energy mix, they are currently unable to compete with wind energy on a cost-effectiveness basis. Wind is the only proven energy source used internationally for decades.

Furthermore, each of these alternatives has their own environmental and social impacts, and many are simply incompatible with the climate and topography of the locality. Wind speeds, population density, land use, vegetation and transmission lines combine to make the Paling Yards locality and surrounding region ideally suited to wind energy. On balance, it is considered that wind energy is the most commercially viable renewable energy, and is the best technology for the site.

6.6.3 Wind Farm location

As outlined in **Chapter 4 – Design Response** of this report, the location of a wind farm is dependent on a number of location criteria, including the following factors:

- distance from coastline;
- population density and buffers to residential settlements;
- willingness of land owners;
- size of land holdings;
- proximity to existing electricity grid;
- strength of wind resource;
- access to existing infrastructure (ports, good quality roads etc); and
- general environmental constraints.

The Great Dividing Range in NSW presents a consistent wind resource that meets many of the above criteria. This is evidenced by the number of wind farms planned, proposed or built within the Central and Southern Tablelands.

Whilst it may appear that countless sites exist across NSW, finding a suitable location for a wind farm is a difficult exercise. More remote areas of the State where population densities are lower, such as Western NSW, do not possess the transmission infrastructure necessary to ensure a project's viability. Most energy generators, including wind, are unviable if it is necessary to construct hundreds of kilometres of transmission lines to connect the farm to the electricity grid.

In some cases, where existing transmission lines are available in more remote areas, wind speeds are insufficient to power the turbines. In other areas, where transmission lines combine with high wind speeds, the land is publicly owned or has significant flora and fauna constraints.

Other constraints not evident at the site include significant landscape and visual constraints, close proximity to urban areas, high population density, proliferation of non-stakeholder dwellings, geotechnical constraints, and lack of supporting infrastructure.

UFWA have been active in the region and currently have two additional proposals in various stages of planning and development (the approved Crookwell 2 Wind Farm and proposed Crookwell 3 Wind Farm). UFWA's involvement in the area is based on a long history of wind monitoring and existing relationships with local land holders.

The subject site is also favoured by the proximity of the existing 500kV high voltage power line, which passes the site approximately 2km to the east and north-east of the site.

6.6.4 Wind Farm Scale

In addition to the location criteria outlined above, the scale of the project has been determined by several factors. This includes:

- the number of willing land owners and their proximity to each other;
- environmental constraints;
- proximity to nearby dwellings;
- landscape and visual impacts;
- the amount of turbines required to create a viable project; and
- the consultation carried out with the local community.

The majority of wind farms proposed in NSW are greater than 25 turbines and, in recent times, greater than 50. At up to 55 turbines, the project is of a scale comparable to most modern wind farms in Australia.

Whilst the subject site has an area of 3,900 ha, less than 1% of the land is directly used for the turbines, access tracks and supporting infrastructure during the operation phase**.** It is not possible to reduce the area of the subject site as turbines must be placed at minimum distances apart in order to maintain operational efficiency. It is noted that because modern turbines are taller and wider and are generally spaced further apart than older, smaller turbines, the total number of turbines per hectare is lower.

Therefore, the scale of the project has been optimised in consideration of the given characteristics of the site and locality.

For more information on the scale of other proposed, approved or built wind farms in the area, please refer to **Chapter 21 – Cumulative Effects**.

6.6.5 Turbine size

The general size of turbines for the project is influenced by the following criteria:

- The type and characteristics of the of wind resource;
- Visual impacts from neighbouring receptor points;
- The topography of the land;
- The cost and availability of turbines from various turbine manufacturers; and
- The 'capacity factors' of different turbine sizes (the larger the turbine the smaller the capacity factor).

Advances in technology and construction techniques have seen turbines steadily increase in size since the 1970's. This is evident in the region by comparing the size of the turbines for Crookwell I Wind Farm, established in the late 1990s, with the larger turbines at Cullerin Wind Farm and Capital Wind Farm, which were developed in recent years. Taller turbines are more efficient, as they are able to capture higher winds that are less affected by surface roughness caused by obstacles such as trees.

The project would utilise turbines up to 175 metres tall at the top of the blade tip. The wind turbines currently under assessment are outlined in **Table 2**. New turbines are continually coming onto the market; therefore it is possible that minor variations to these typical dimensions could occur prior to final turbine selection.

The output of each turbine will vary depending on the final turbine selection. The output of the turbines is currently expected to be up to 4.5 MW depending on the final turbine selection.

The wind turbines currently under assessment for this project are commonly available and frequently used in projects around Australia. Smaller turbines are now difficult to source and do not represent an efficient use of capital.

A reduction in turbine height or width would also result in less energy produced from the farm and a consequential reduction in the greenhouse emissions displaced. A wind farm with a reduced total energy output would make a smaller contribution to meeting the Federal Government's Renewable Energy Target of 20% of renewable energy by 2020.

The noise generated by a wind turbine is not necessarily related to its size, as larger modern turbines can produce less sound than older, smaller turbines. The various turbines currently under assessment for this project have differing noise characteristics and have been assessed based on these differences.

It is important to note that whilst the modern turbines are taller and have a greater zone of visual influence, they are more efficient and are spaced further apart. Therefore, by increasing the height of the proposed turbine, the number of turbines per hectare decreases, thus reducing the overall scale of the project.

6.6.6 Electricity Connection

Several options were investigated for connection of the project to the electricity grid. These include:

- North-eastern option: an overhead powerline connection of approximately 9km to a proposed off-site electrical Terminal Station that would connect to the Mt Piper to Bannaby 500kV transmission line which passes the north-east and east of the site. This option has two sub-options, or
- Southern option: a 55km overhead powerline connection to the approved Crookwell 2 Wind Farm substation which connects to the Yass to Bannaby 330kV transmission line. This option has three sub-options.

The northern and southern options include a number of sub-options.

Please refer to **Chapter 5** and **Figure 13 – Proposed Transmission Line Plan** for more information.

The assessment carried out has been established that the northern connection option is the most feasible and will result in lower impacts to the environment and to the community. On this basis, approval is only being sought for the northern connection option.

The preferred option was selected based on the following criteria:

- length of route; and
- minimising vegetation loss.

The preferred northern route represents a reasonable balance between the avoidance of native vegetation loss, reducing impact to the community, and the economic viability of the route.

The proposal is for an overhead powerline. Whilst an overground connection may increase the visual impact of the project, it reduces impacts on native vegetation, as disturbance can be generally restricted to the base of electricity poles and some clipping of tree canopies, in contrast to the underground cabling which would disturb the vegetation along its path.

UNION FENOSA
WIND AUSTRALIA

gasNatural fenosa

PALING YARDS WIND FARM

CHAPTER 7

STATUTORY PROVISIONS

7 Statutory Provisions

7.1 Introduction

This chapter of the EA addresses the relevant statutory provisions relating to the project.

The development of the project requires project approval under Part 3A of the EP&A Act.

DGRs were issued for the Project within two years before Part 3A of the EP&A Act was repealed (on 1 October 2011), therefore, the project is a transitional Part 3A project under clause 2(1)(c) of schedule 6A of the EP&A Act. Accordingly, the project will continue to be assessed and determined under Part 3A notwithstanding the repeal of Part 3A.

This chapter discusses and assesses compliance of the project under the relevant Federal, State and Local Government legislation, policies and guidelines.

7.2 Commonwealth Instruments

7.2.1 Environment Protection and Biodiversity Conservation Act 1999

The objectives of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) are to:

- provide for the protection of the environment, especially matters of national environmental significance
- conserve Australian biodiversity
- provide a streamlined national environmental assessment and approvals process
- enhance the protection and management of important natural and cultural places
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.

The EPBC Act is administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). The EPBC Act is aimed at environment and heritage protection and biodiversity conservation.

The EPBC Act requires referral to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities of any "action" that has, will have, or is likely to have a significant impact on:

- a matter of national environmental significance;
- the environment of Commonwealth land (even if the action is taken outside Commonwealth land);
- the environment of a Commonwealth Heritage Place outside the Australian jurisdiction; and
- the environment anywhere in the world (if the action is undertaken by the Commonwealth).

Once a referral is made, the Minister for the Sustainability, Environment, Water, Population and Communities (Environment Minister) determines whether the action is a "controlled action" which requires assessment and approval under the EPBC Act.

An action includes a project, development, undertaking, activity, or series of activities.

The eight matters of "national environmental significance" protected under the EPBC Act are:

- world heritage properties;
- national heritage places;
- wetlands of international importance;
- listed threatened species and ecological communities;
- migratory species protected under international agreements ;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- nuclear actions

The Significant Impact Guidelines 1.1: Matters of National Environmental Significance (Significant Impact Guidelines) have been prepared by the former Department of Environment, Water, Heritage and the Arts, now DSEWPAC, to assist any person who proposes to take an action to decide whether or not they should submit a referral to the SEPAC for a decision by the Environment Minister on whether assessment and approval is required under the EPBC Act. These guidelines define significant impact as:

"… an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts". [1]

EPBC Act Policy Statement 2.3 – Wind Farm Industry provides further guidance to assist operators in the wind farm industry to decide whether or not proposed actions require referral under the EPBC Act.

The project was referred to the then Minister for Environment and Heritage (now the Minister for Sustainability, Environment, Water, Population and Communities) under the EPBC Act in 2005. The Minister determined on 31 March 2005 that the project was not a controlled action which required approval under the EPBC Act.

The flora and fauna assessments contained in **Appendix 8a** and **Appendix 8b** confirm that the project is not likely to result in a significant impact on any endangered ecological community or species listed under the EPBC Act. Please refer to **Chapter 12** for details.

7.2.2 Renewable Energy (Electricity) Act 2000 (Cth)

The *Renewable Energy (Electricity) Act 2000* (Cth) (the REE Act), provides the statutory framework for mandatory renewable energy targets (MRET) and an energy trading scheme. The REE Act initially established an MRET of 2% (or 9500 GWh) to be reached by 2010, which means that 2% of total energy produced must be from renewable energy sources. The REE Act identifies wind as an eligible renewable energy sources.

[1] *Significant Impact Guidelines, p 3.*

In August 2009, the Government implemented the Renewable Energy Target (RET) Scheme, designed to legislate the Government's commitment of 20% of Australia's electricity supply coming from renewable sources by 2020.

On 26 February 2010, the Government announced changes to be made to the RET scheme to provide greater certainty for households, large-scale renewable energy projects and installers of small-scale renewable energy systems like solar panels and solar water heaters. The enhanced RET legislation was passed by the Commonwealth Parliament on Thursday 24 June 2010. As of 1 January 2011, the enhanced RET was split into two parts, the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES).

The LRET creates a financial incentive for large-scale renewable power stations such as wind, solar and hydro-electric by providing a mechanism for the creation of large-scale generation certificates (LGCs) by these power stations according to how much renewable energy electricity they produce.

The LRET also places a legal liability on liable entities (typically electricity retailers) to purchase an amount of large-scale generation certificates (LGCs) from these power stations to meet an annual target. The annual targets for the LRET increase each year from 16,763GWh in 2012 up to 41,850 GWh by 2020 (DCCEE 2010) or 18% of total energy.

The project directly and specifically supports the REE Act by supplying up to 550,833 MWh (or 551 GWh) of renewable energy per year and, therefore, contributing to the LRET target.

7.2.3 Civil Aviation Safety Regulations 1998

The *Civil Aviation Safety Regulations 1998* made under the *Civil Aviation Act 1988* (Cth), require that CASA must be informed of proposals to build a structure greater than 110 metres above Australian Datum. This is required to allow assessment of whether the structure may represent a hazard to aircraft, and to provide any associated requirements including any requirements for markings or lighting.

A circular: *Obstacle Marking and Lighting of Wind Farms* (AC139-18(0) (the circular) was released by CASA. Clause6.2 of the circular provides that where CASA has been informed of a proposal to build a wind turbine greater than 110m above the Australian Dataum, CASA will conduct an aeronautical study to determine if the wind turbine will be a hazardous object to aviation. If as a result of the aeronautical study CASA finds that a proposed wind turbine will penetrate an OLS of an aerodrome, the proposal will be must be lit in accordance with MOS-Part 139 Section 9.4. The circular advises that the hazard that an object poses to aviation can be reduced by indicating its presence by appropriate marking and/or lighting. This circular has been withdrawn by CASA pending a review of the guideline material. Despite this, CASA has advised that the circular remains of relance to proponents wishing to assess aeronautical impacts. It is understood that the review of this circular is continuing.

An assessment of aviation matters was undertaken by Aviation Projects Pty Ltd to inform this EA. The report found that *"the proposed development does not impose any significant risk to normal flying operations, provided aircraft are operated in compliance with applicable regulatory and operational control requirements and with the application of good airmanship"*.

Chapter 13 – Aeronautical Impacts provides further information on the potential for hazard to aircraft and details the proposed hazard lighting.

7.2.4 Clean Energy Act 2011

The Clean Energy Act 2011 (Cth) commenced on 2 April 2012 as part of the Clean Energy Legislative Package. The Clean Energy Legislative Package introduced a carbon pricing mechanism commencing on 1 July 2012 as follows:

- Liable entities (generally entities which control the operation of facilities that emit greater than 25,000 tonnes per annum of greenhouse gas emissions) will be required to purchase and surrender carbon units for each tonne of carbon pollution they emit.
- The carbon price commenced on 1 July 2012 at $23 per tonne of carbon dioxide equivalent, increasing to $24.15 on 1 July 2013 and $25.40 on 1 July 2014.
- The Australian Government has recently announced that the Australian carbon pricing mechanism and Europe's emissions trading scheme will be linked onwards and that the proposed $15/t price floor in the Australian mechanism will be scrapped from 1 July 2015.

The Clean Energy Legislative Package is expected to increase demand for renewable energy from projects such as from the project.

7.3 NSW State Instruments

7.3.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the primary piece of legislation governing development within NSW. The *Environmental Planning and Assessment Regulation* 2000, made under the EP&A Act also operates to regulate development within NSW.

The then Minister for Planning declared the project to be a major project under Part 3A of the EP&A Act.

In addition, in accordance with a declaration published in the NSW Government gazette on 27 November 2009 all renewable energy projects with a peak generating capacity of 30 megawatts (MW) or more were declared to be critical infrastructure projects under Part 3A. As the project has a peak generating capacity of up to 178 MW, the project is a critical infrastructure project.

The critical infrastructure provisions:

- ensure the timely and efficient delivery of essential infrastructure projects;
- allow the Government and the planning system to rapidly and readily respond to the changing needs of the State;
- provide certainty in the delivery of these projects;
- provide for rigorous scrutiny to ensure environmental outcomes are appropriate; and
- focus on delivering outcomes essential to the NSW community.

As DGRs were issued for the Project within two years before Part 3A of the EP&A Act was repealed on 1 October 2011, the project is a *transitional Part 3A project* under Clause 2(1)(c) of Schedule 6A of the Act. Accordingly, the Project will continue to be assessed and determined under Part 3A under to Clause 3(1) of Schedule 6A of the EP&A Act.

A range of State, Regional and Local environmental planning instruments (EPIs) apply to the site, including State Environmental Planning Polices (SEPPs), which include

Regional Environmental Plans (REPs), and Local Environmental Plans (LEPs). These are considered at **Chapters 7.3** and **7.4**.

The Minister for Planning and Infrastructure (or the Planning and Assessment Commission as his delegate) must take into account applicable SEPPs in determining and may (but is not required to) take into account the provisions of other applicable EPIs in determining whether to approve the project.

As the project is a critical infrastructure project, the project may be approved under Part 3A of the EP&A Act even if it is prohibited by the applicable EPIs.

Once a project has been assessed and approved under Part 3A of the EP&A Act it has the benefit of provisions in the EP&A Act which:

- remove the requirement to obtain a range of additional approvals including:
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* (NSW);
- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (NSW) to clear native vegetation; and
- a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the *Water Management Act 2000* (NSW); and
- provide that certain other approvals may not be refused and must be granted on terms consistent with the Part 3A approval including a consent under section 138 of the *Roads Act 1993* (NSW).

The DGRs require that the objectives of the EP&A Act be taken into account by the project, as detailed in the table below.

Table 8 Objectives of EP&A Act

Objective	Comment
To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,	The project will develop the natural wind resource of the Paling Yards region and conserve other resources such as soil, water and air. It will have environment benefits by displacing greenhouse emissions and reducing the impacts of climate change and global warming. See Chapter 8 for more information on the social and economic effects of the wind farm.
To encourage the promotion and co-ordination of the orderly and economic use and development of land,	The project will promote the orderly and economic use of the land by adding a new use and development to the site that can coexist with the current agricultural use.
To encourage the protection, provision and co-ordination of communication and utility services,	Chapter 15 provides assessment of the electromagnetic interference and communication impacts of the project.
To encourage the provision of land for public purposes,	The project does not involve any change to the status of public land.
To encourage the provision and co-ordination of community services and facilities, and	UFWA is exploring potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations.
To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and	Chapter 12 details the assessment of the impact of the project on flora and fauna, which has concluded that no endangered ecological communities or flora species listed under the TSC Act or EPBC Act will be significantly impacted as part of the project. The wind farm had been designed to be situated mainly on cleared grazed paddock areas, therefore avoiding as far as possible potential ecological impacts.
To encourage ecologically sustainable development, and	Please refer to the more detailed overview of the application of the ecologically sustainable development (ESD) principles to the project contained below.
To encourage the provision and maintenance of affordable housing, and	Not applicable.
To promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and	Both State and Local statutory instruments have been considered in the wind farm design and in the preparation of this EA.
To provide increased opportunity for public involvement and participation in environmental planning and assessment."	A community consultation strategy, as detailed in Chapter 22, has been implemented and will continue to be implemented as the project moves towards construction. This EA will be placed on public exhibition and comments will be considered by the Minister for Planning in decision making.

Ecologically Sustainable Development (ESD)

Australia has adopted ecologically sustainable development (ESD) as a guiding principle of environmental management. It involves the *"effective integration of social, economic and environmental considerations in decision-making processes"* (*Protection of the Environment Administration Act 1991* (NSW), Section 6).

A core principle of ESD is the 'precautionary principle'. The precautionary principle has been adopted in Australia to guide the decision-making process in relation to measures that address environmental damage.

The precautionary principle has been defined in Principle 15 of the Rio Declaration (1992) as: where 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 (United Nations, 1992).

The *Protection of the Environment Administration Act 1991* (NSW) outlines the following principles which act to achieve ESD:

- *Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment*
- *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*
    - *Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

The environmental assessment for the project has considered and adopted ESD principles and the precautionary principle. Careful evaluation of the potential impacts associated with the project has been undertaken, and measures to minimise or mitigate these impacts where possible have been incorporated into the project. These impact mitigation measures also include future actions to address areas of uncertainty.

Refer to **Chapter 24 – Statement of Commitments** for the list of measures that the proponent will implement to minimise or mitigate potential impacts of the project.

Potential ecological and biodiversity impacts of the project have been assessed in **Appendix 8a – Flora and Fauna Assessment** and **Appendix 8b – Supplementary Flora and Fauna Assessment**.

An assessment of the risk-weighted consequences of various options such as the use of the site for alternative renewable energy facilities or the 'do nothing' approach has been undertaken for this environmental assessment. The assessment concluded that a

wind energy facility is the most viable option and the project will make a valuable contribution to avoiding serious or irreversible damage to the environment caused by climate change.

The potential impacts of the project are expected to be confined to the site, transmission line route and transport route. The project is not anticipated to unreasonably inhibit use of the site for existing activities or significantly minimise options for future use of the site.

The Decommissioning and Rehabilitation Plan (DRP) at **Appendix 4** outlines measures to mitigate the potential impacts resulting from the cessation of operation of the wind energy facility.

7.3.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is the primary piece of legislation regulating pollution control and waste disposal in NSW. The POEO Act is administered by the NSW Environment Protection Authority (EPA), part of the Department of Environment and Climate Change (DECC).

The POEO Act requires an Environment Protection Licence (EPL) to be obtained in relation to certain electricity generation works. However, an EPL is not currently required for wind power generation. At the time this EA was prepared, a draft regulation was on exhibition which, if made, will re-introduce a requirement to obtain an EPL for wind farms. If the event that this draft regulation is made, an EPL will be required for the wind farm. Owing the operation of the EP&A Act, once Part 3A project approval is granted for the project, any required EPL cannot be refused and must be granted on terms consistent with the Part 3A approval.

7.3.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NSW) (NPW Act) governs the establishment, preservation and management of national parks, historic sites and certain other areas. The NPW Act also provides the basis for the legal protection and management of threatened native flora and fauna and Aboriginal sites within NSW.

Major projects subject to Part 3A of the EP&A Act do not require separate Aboriginal heritage impact permits under the NPW Act. The impacts of the project on Aboriginal heritage have been considered and assessed as part of this EA. Refer to **Chapter 18** for details.

7.3.4 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (NSW) (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. It provides a framework for the assessment of any action that may impact on threatened species.

The Assessment of Significance (Seven Part Test) is a statutory mechanism under Section 5A of the EP&A Act, for assessing whether a proposed development activity may have a significant impact on threatened species, populations or ecological communities or their habitats. The Seven Part Test does not apply to projects which are assessed under Part 3A of the EP&A Act.

However, the DGRs provide that the EA must include *"an assessment of all project components on flora and fauna and their habitat consistent with the Draft Guidelines for Threatened Species Assessment (DEC, 2005), including details on the existing site conditions and quantity and likelihood of disturbance"*.

If the results of the test of significance concludes that there is likely to be a significant impact on a listed species, population or Endangered Ecological Community protected under the TSC Act then the *Draft Guidelines for Threatened Species Assessment* (DEC, 2005) specify that a Species Impact Statement is required.

As part of this EA, a flora and fauna assessment was undertaken by Anderson Environmental. This report assessed the impact of the project on threatened species and endangered ecological communities listed under the EPBC Act. This report concluded that *"the project is not likely to result in a significant impact on any fauna species listed under the TSC Act. Accordingly, there is no requirement for a species impact statement to be prepared"*.

A full assessment of species and communities under the TSC Act is found at **Appendix 8a** and **Appendix 8b**.

See **Chapter 12** for further details of the flora and fauna impacts of the project.

7.3.5 Water Management Act 2000 and Water Act 1912

Water in NSW is regulated by the *Water Management Act 2000* (NSW) (WM Act) and *Water Act 1912* (NSW). The WM Act applies to all water sources for which a water sharing plan has been gazetted and the Water Act applies to remaining water sources.

The objective of the WM Act is the sustainable and integrated management of the State's water for the benefit of both present and future generations.

A controlled activity approval under the WMA is required for certain types of developments and activities that are carried out in or near a river, lake or estuary. Under the WMA, a controlled activity means:

- the erection of a building or the carrying out of a work (within the meaning of the EP&A Act 1979), or
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- the carrying out of any other activity that affects the quantity or flow of water in a water source.
- Controlled activity approvals are not required for projects approved under Part 3A of the EP&A Act.

Major projects approved under Part 3A of the EP&A Act still require to obtain water licences under the WM Act or Water Act for the project in the event that water from onsite bore, dam or river (e.g. concrete batching plant, etc) is required.

Refer to **Chapter 20** and **Appendix 14** for further details.

7.3.6 Native Vegetation Act 2003

In accordance with the principles of ecologically sustainable development, the *Native Vegetation Conservation Act* 2003 (NSW) (NV Act) provides for the conservation of native vegetation through the prevention of inappropriate clearing and promotion of rehabilitation practices.

The design of the wind farm sought to minimise the removal of vegetation by the careful placement of turbines and tracks.

Major projects approved under Part 3A of the EP&A Act do not require a separate approval under the NV Act for the clearing of native vegetation.

Refer to **Chapter 12** for further details of the flora and fauna impacts of the project.

7.3.7 Heritage Act 1977

The *Heritage Act 1977* (NSW) aims to protect and preserve items of non-indigenous Heritage significance. The Act provides for the protection of items of local, regional and State heritage significance.

A cultural heritage impact assessment undertaken by Anderson Environmental found that none of the non-indigenous cultural heritage items located within the site would be disturbed as part of the project. Furthermore, none of the non-indigenous heritage sites are considered to be significant and none are protected under the listed under the *Heritage Act 1977* (NSW) or any other heritage listing, including the Local Environmental Plan (LEP) for Oberon.

Refer to **Chapter 18** for details of the heritage impacts of the project.

7.3.8 Roads Act 1993

Section 138 of the *Roads Act 1993* (NSW) prohibits a number of activities, such as conducting work in, on or over a public road, unless consent has been obtained from the appropriate roads authority.

The project would require consent from the appropriate roads authority for the following items:

- installation of electrical cables under or along roads;
- access points from roads into the wind farm site.

Abercrombie Road is a State owned public road and therefore consent would be required from the NSW Roads and Traffic Authority.

If the project is approved under Part 3A of the EP&A Act then any consents required under section 138 of the *Roads Act 1993* cannot be refused and must be granted on terms substantially consistent with the project approval.

7.3.9 Crown Lands Act 1989

Part 4 of the *Crown Lands Act 1989* (NSW) provides for circumstances where Crown Land may be leased or sold and where licenses over Crown Land may be granted.

There is a network of Crown public roads in the area, and it is proposed that an electrical transmission line be installed to cross these road corridors to connect the turbines to the electricity transmission network. A number of options have been shown in **Figure 17**; however the selected and proposed option is shown in **Figure 13 – Proposed Transmission Line Plan** for electrical connections, which involve crown land public roads.

As outlined above, consents will be applied for under section 138 of the *Roads Act 1993* to authorise the carrying out of any works within the road reserves. The Department of Lands will be consulted with to ensure that all of its requirements under the *Crown Lands Act 1989* will be met in relation to these works.

7.3.10 State Environmental Planning Policies (SEPPs)

The SEPPs that are relevant to the site include:

- *State Environmental Planning Policy (Major Development) 2005 (Major Development SEPP);*
- *State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP);*
- *State Environmental Planning Policy No. 44 Koala Habitat Protection (SEPP 44);*
- *State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP);*
- *State Environmental Planning Policy (Rural Lands) 2008 (Rural Lands SEPP);*
- *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (Drinking Water SEPP); and*
- *Drinking Water Catchments Regional Environmental Plan No. 1.*

State Environmental Planning Policy (Major Development) 2005

The effect of Schedule 6A of the EP&A Act is that, because the project is a transitional Part 3A project, the now repealed clauses 6-6C and schedules 1, 2 and 5 of *State Environmental Planning Policy (Major Development) 2005* continue to apply to the project.

Clause 6 (repealed) of the Major Development SEPP provides that, development which, in the opinion of the Minister for Planning is development of a kind listed in Schedule 1 to the SEPP Major Development is a project to which Part 3A of the EP&A Act applies.

Clause 24 of Schedule 1 (repealed) lists:

"Development for the purpose of a facility for the generation of electricity …(using any energy source, including …wind power), being development that:

(a) has a capital investment value of more than $30 million…."

On 29 October 2009, the Director, Infrastructure Projects Branch of the Department of Planning, as a delegate of the Minister for Planning, confirmed that the project is one to which Part 3A of the EP&A Act applies.

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 does not apply to make the project State significant development as the project is a transitional Part 3A project under schedule 6A of the EP&A Act.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

Clause 3 of the SEPP 44 provides that it:

"aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline".

The flora and fauna assessment of the area by Anderson Environmental states that *"No koalas or signs of koalas being present were detected within the Project Site. The nearest koala recorded in the vicinity of the Project Site was recorded approximately 1.5 kilometres to the west of the proposed wind farm site within Abercrombie River National Park… Accordingly there is unlikely to be a significant impact on this species and there is no need to further consider the requirements of SEPP 44 in relation to the Project"*.

State Environmental Planning Policy (Infrastructure) 2007

Clause 2 of the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) provides that it aims to facilitate the effective delivery of infrastructure across the State by:

- *"(a) improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and*
- *(b) providing greater flexibility in the location of infrastructure and service facilities, and*
- *(c) allowing for the efficient development, redevelopment or disposal of surplus government owned land, and*
- *(d) identifying the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development), and*
- *(e) identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development, and*
- *(f) providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing."*

Part 3, Division 4 of SEPP Infrastructure is relevant to the project as it applies to 'electricity generating works'. It outlines a range of electricity generating works that are exempt development, complying development, and development permissible with consent.

Clause 34(1) of SEPP Infrastructure provides that:

"development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural, industrial or special use zone".

Clause 33 of the SEPP Infrastructure provides that *"electricity generating works' has the meaning contained in the Standard Instrument (Local Environmental Plans) Order 2006 (Standard Instrument). The Standard Instrument defines "electricity generating works" as "a building or place used for the purpose of making or generating electricity."*

The project is one for the purpose of electricity generating works.

Part 3, Division 5 of the SEPP Infrastructure is also of relevance to the proposed transmission line component of the project and relevantly provides that development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without consent on any land. The proposed transmission line is to be constructed between the on-site substation (owned and operated by UFWA) and the off-site Terminal Station (owned and operated by TransGrid). This proposed transmission line will be constructed as part of the project by the project contractor(s), and is proposed to be a privately held asset by UFWA.

State Environmental Planning Policy (Rural Lands) 2008

Clause 2 of the Rural Lands SEPP provides that the aim of the policy is:

- *"(a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,*
- *(b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State,*
- *(c) to implement measures designed to reduce land use conflicts,*
- *(d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations;*
- *(e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions."*

The project would not conflict with the continued use of the land for agricultural purposes as only 1% of the site is utilised for the project and agricultural practises, such as grazing, can successfully operate on the balance of the site and in close proximity to the wind turbine.

This policy does not contain any provisions of specific relevance to the project.

7.4 Local Instruments

7.4.1 General

The site, including the preferred electrical connections option for which approval is being sought, is zoned under the *Oberon Local Environment Plan 1998* (Oberon LEP).

7.4.2 Oberon Local Environmental Plan 1998

The particular aims of the Oberon LEP are as follows:

(a) to recognise and promote the Oberon local government area as a desirable and viable place to visit and in which to live and to invest, and

(b) to encourage the proper management, development and conservation of natural and built resources within the Oberon local government area by protecting, enhancing or conserving:

(i) prime crop and pasture land,

(ii) timber, minerals, soil, water and other natural resources,

(iii) areas of significance for nature conservation,

(iv) areas of high scenic or recreational value,

(v) places and buildings of heritage significance, including archaeological and Aboriginal relics and places,

(vi) water catchment areas, and

(c) to replace planning controls, as they applied to rural land before this plan commenced, with a local environmental plan to help facilitate growth and development of the Oberon local government area in a manner which is consistent with the aims stated in paragraphs (a) and (b) and which:

(i) minimises the cost to the community of fragmented and isolated development of rural land,

(ii) facilitates the efficient and effective delivery of amenities and services,

(iii) facilitates a range of residential and employment opportunities in accordance with demand,

(iv) facilitates farm adjustments, and

(d) to encourage tourism in the Oberon local government area in a manner which is consistent with the aims stated in paragraphs (a) and (b), and

(e) to encourage agriculture (including forestry) and protect the agricultural base of the Oberon local government area.

The site and transmission line options are zoned 'Zone No 1(a) Rural A Zone' under the Oberon LEP.Development for the purposes of generating works are permissible with consent on land zoned Zone No 1(a) Rural A Zone' under the Oberon LEP.

Table 9 identifies the relevant objectives of Zone No 1(a) Rural A Zone' under the Oberon LEP and assesses whether the project complies with the objectives.

Table 9 Objectives of Oberon Local Environmental Plan 1998

Objectives **Part 2 Zones** **Zone No 1 (a) (Rural 'A' Zone)**	**Comment**
(a) Protecting, enhancing and conserving: (i) agricultural land in a manner which sustains its efficient and effective agricultural production potential, and	The project has a small footprint relative to the site area (approximately 1%). Agricultural activities will be able to continue surrounding the turbines without disruption. The access tracks will enhance agricultural activity by providing more efficient access across the farm. The project will support the project involved landowners hosting wind farm infrastructure who wish to stay on the land through off-farm income, and thereby sustaining agricultural activities.
(ii) soil stability, by controlling and locating development in accordance with land capability, and	The project is situated to minimise the potential for erosion. Further, an erosion management plan will be developed to manage land stability and erosion during construction and operation.
(iii) forests of existing and potential commercial value for timber production, and	The subject site is largely cleared and is not known as being identified as having potential for commercial timber production.
(iv) valuable deposits of minerals, coal, petroleum and extractive materials, by controlling the location of development in order to ensure the efficient extraction of those deposits, and	The site is not known to have been identified as having valuable nor viable deposits of minerals, coal, petroleum or extractive materials.
(v) trees and other vegetation in environmentally sensitive areas where the conservation of the vegetation is likely to control land degradation or is significant to scenic amenity or the natural wildlife habitat, and	The project has been designed to generally locate turbines and other infrastructure in areas that area presently cleared. A review of the impact of the proposed design can be found in the following chapters: -Vegetation – refer to Chapter 12

	-Visual Impact – refer to Chapter 9 -Fauna – refer to Chapter 12
(vi) water resources, including groundwater, for use in the public interest, preventing the pollution of water supply catchments and water storage, and	Protection of water resources, and in particular ground water, has been given consideration in the design of the wind farm. Groundwater is not anticipated to be affected by the project as the footings are too shallow to significantly interrupt groundwater flows and large areas of vegetation would not be removed. Refer to Chapter 20 and Appendix 14 for further details.
(vii) areas of significance for nature conservation, including areas with rare plants, wetlands and significant habitats, and	The project is unlikely to result in a significant impact on any endangered ecological community or flora species or any fauna species listed under the EPBC Act or TSC Act.
(viii) items of archaeological or heritage significance, including Aboriginal relics and places.	The project is not anticipated to impact upon the identified sites of indigenous heritage, or any sites of non-indigenous heritage.
(b) Preventing the unjustified development of prime crop and pasture land for purposes other than agriculture.	The project will not unreasonably impact agricultural activities on site, as once the turbines and infrastructure are in place, farming may continue around the elements satisfactorily. Furthermore, the project will support the landowners hosting wind farm infrastructure who wish to stay on the land through off-farm income, and thereby sustaining agricultural activities.
(c) Facilitating farm adjustments.	The project consists of separate turbines and a linear transmission line. It is unlikely that these will have an impact on the potential for future farm adjustments. In the event that a farm adjustment occurs, and the farm is divided, the division of the turbines across the resulting lots can be addressed through a review of the relevant contractual arrangements, it is not anticipated that the physical infrastructure will constrain farm adjustments.
(d) Minimising the cost to the community of: (i) fragmented and isolated development of rural land, and	The project does not propose a reconfiguration of allotments, therefore will not result in the fragmentation of rural land.
(ii) providing, extending and maintaining public amenities and services.	As the project does not involve residential development, the project will not create a greater demand on public amenities and services in the area. .
(e) Providing land for rural small holdings development and for other non-agricultural uses in accordance with demand for that development and in a manner which has the least adverse impact on prime crop and pasture land.	The project aligns with this objective by providing for a non-agricultural use which is designed to have the least adverse impact on prime crop and pasture land.
(f) Controlling and locating dwelling-house development to provide buffers from adjoining agricultural land in order to provide adequate environmental safeguards to the inhabitants and not prejudice future agricultural activity in the near vicinity.	The project location does not include dwelling houses, and therefore separation of dwellings and agricultural uses is not relevant to this project.

Objectives	Comment
Part 3 Special provisions **Section 10 General considerations for development within rural zones**	
(1) The Council must not consent to development on land within Zone No 1 (a), 1 (c) or 1 (e) unless it has taken into consideration, if relevant, the effect of the carrying out of the proposed development on:	
(a) the present use of the land, the potential use of the land for the purpose of agriculture and the potential of any land which is prime crop and pasture land for sustained agricultural production, and	The project has a small footprint, equating to about 1% of the site, and therefore will have a negligible impact on agricultural activity. Further, the presence of wind turbines is compatible with the current agricultural use of the site for pastoral activity.
(b) vegetation, timber production, land capability (including soil resources and soil stability) and water resources (including the quality and stability of water courses and ground water storage and riparian rights), and	The project will have minimal impact on: -Vegetation - Chapter 12, details the impact of the project on vegetation. In summary, the design locates the majority of the turbines in cleared areas, with only small amounts of vegetation clearing required. -Timber production: the site is not currently used for timber production. The project will therefore not impact on the future viability of timber production. -Land capability: the project only utilises about 1% of the site, and therefore does not impact on land capability. -Water resources: the project design minimises impact on hydrological flows. Please refer to Chapter 20 for a summary of the hydrological assessment.
(c) the future recovery from known or prospective areas of valuable deposits of minerals, coal, petroleum, sand, gravel or other extractive minerals, and	No known valuable deposits of minerals, coal, petroleum, sand, gravel or other extractive minerals are present on the site. The project will not therefore jeopardise the future extraction of such resources as it uses only a small portion of the site.
(d) the protection of areas of significance for nature conservation or of high scenic or recreational value, and items of archaeological or heritage significance, including Aboriginal relics and places, and	The project has the following impacts: -Nature conservation: The design responds appropriately to ecological matters. The response is summarised in Chapter 12 (Flora and Fauna Assessment). -Recreational value: The site is presently used for pastoral activities and does not presently have recreational values. Its remote location also means that the future use of the site for recreation purposes is unlikely. -Heritage significance: The project will not unreasonably impact on cultural heritage. Please refer to Chapter 18 for a summary of the findings of the heritage assessment.
(e) the cost of providing, extending and maintaining public amenities and services to the site of the proposed development, and	The project will not require the extension of public amenities or services. Upgrades will be required to the road network. The cost of this is subject to agreement with Council.

(f) the future expansion of settlements in the locality.	The project will not result in the future expansion of settlements in the locality.
(2) As well as the matters referred to above, the Council must take into consideration the relationship of the development to development on adjoining land and on other land in the locality.	As there are no existing, approved or known wind farms within 25km of the site, the cumulative impacts of the project are not substantial.

Objective	**Comment**
Section 25 Access	
A person, other than the Council, must not construct a road which has access to a public road except with the consent of the Council.	The project will not involve the creation of a road which has access to a public road without the consent of Oberon Shire Council.
Section 27 Environmentally sensitive land and destruction of trees	
A person must not, except with the consent of the Council, carry out development for any purpose on environmentally sensitive land, unless as a normal incident of an agricultural use of the land.	The site is located adjacent to the Abercrombie River. Schedule 1 of the Oberon LEP identifies the Abercrombie River as a water body classified as environmentally sensitive land. The project is designed to have a minimal impact on hydrological flows (see Chapter 20), riparian vegetation (Chapter 12) and erosion (see Chapter 19). Further, vegetation and sediment control management plans can be developed and used to manage construction and operation of the wind farm to ensure that the ecological values of the Abercrombie river are maintained.
The Council must not consent to the carrying out of development on environmentally sensitive land if, in the opinion of the Council, the carrying out of the development will degrade the environment by way of: denudation of the land, or generating uncontrolled flow of water across the land, or generating uncontrolled disposal of animal, vegetable or chemical waste products on the land, or soil erosion or sedimentation, or surface water or ground water pollution.	The wind farm design responds to the matters listed in the following way: -Denudation of the land: The project design mostly utilises cleared paddocks, with limited vegetation clearing. Please refer to vegetation report in Chapter 12. -Overland water flows: The project design does not materially alter the on-site drainage patterns, therefore not generating uncontrolled overland water flows. Please refer to hydrology report in Chapter 20. -Waste: The project will not result in the generation or uncontrolled disposal of animal, vegetable or chemical waste products on the land. On site waste will be managed in an environmentally sensitive manner. A waste management plan will be preparation as part of the construction and operation environmental management plan. -Soil erosion or sedimentation: The project will not lead to significant erosion (please refer to the summary of the geotechnical report in Chapter 19). The construction and operation of the farm will be managed in accordance with an erosion and sediment management plan. -Surface water or ground water pollution: The project has been designed to minimise surface and ground water pollution. Chapter 20 includes a summary of the hydrology assessment.

Without limiting the generality of subclause (2), a person must not carry out development on environmentally sensitive land for the purpose of: intensive livestock keeping establishments, or junk yards, or liquid fuel depots, or offensive or hazardous industries, or sawmills, or stock and sale yards.	The project does not include any use of the land for these purposes.
Section 28 Flood liable land	
A person must not carry out any development on or subdivide flood liable land except with the consent of the Council. This clause does not apply to minor extensions to a dwelling-house where the total area of such extensions carried out since the appointed day is less than 30 square metres.	The project is not located on land that is identified as being flood liable.
Section 29 Bush fire hazard reduction	
Bush fire hazard reduction work authorised by the *Rural Fires Act 1997* may be carried out on any land without consent. Note: The *Rural Fires Act 1997* also makes provision relating to the carrying out of development on bushfire prone land.	The project is generally in accordance with the guiding objectives and requirements of the NSW Rural Fire Service *Planning for Bush Fire Protection 2006*.
Section 42 Development within water catchment areas (including the Sydney drinking water catchment)	
If a development application is received for land considered by the Council to be within a water catchment area, including the Sydney drinking water catchment, the Council must not grant consent unless it has considered the impact of the proposed development on the ecological integrity of the water catchment area.	The site is not located within the hydrological catchment of Sydney's drinking water supply (*Drinking Water Catchments Regional Environmental Plan No 1* (REP1)). However the project area is in the catchment of the Abercrombie River within the Lachlan Catchment Management Authority Area. A hydrological assessment of the project found that the overall potential risks to water and soils are relatively minor. Based on the nature of the project and management techniques to be implemented, it is not expected that any of the local water bodies would be unreasonably impacted by the project.

7.4.3 Relevant Development Control Plans

The project is a project to which Part 3A of the EP&A Act applies. There is no specific statutory provision requiring the Minister to consider the provisions of any development control plan (DCP) in determining an application for project approval under Part 3A. The Minister may choose to consider, as part of the general discretion to consider matters in the public interest, the provisions of a DCP in determining an application for project approval under Part 3A.

Oberon Council Development Control Plan 2001

The *Oberon Shire Council – Development Control Plan 2001* (DCP 2001) was adopted by Oberon Shire Council in February 2002.

DCP 2001, supplements the Oberon Local Environmental Plan 1998 (Oberon LEP) by providing general information and detailed guidelines and controls which relate to the decision making process.

The table below identifies the relevant provisions of DCP 2001 along with an assessment of the compliance of the project against these.

Table 10 Objectives of the Oberon Council Development Control Plan 2001

Objective	Comment
A.2 Rural Development Generally **A.2.1 General Policy**	
Non-agricultural development, including dwellings, should be located on land that is not prime crop and pasture land, unless there are no alternative suitable sites.	Although the project is a non-agricultural use, it is compatible with the ongoing pastoral use of the site. Suitable alternative sites are limited because prospective wind farm sites must meet highly specific criteria. Due to the reliability of the wind resource and low population in the locality, the site has been identified as being suitable. On this basis, the development is a suitable use of the site.
Non-agricultural development, particularly dwellings, should be sited and carried out so that it is unlikely to inhibit or give rise to complaints about normal farming and forestry practices (e.g. pine harvesting, crop and weed spraying, separation from noxious odours etc).	The project will affect normal farming practice as it occupies only approximately 1% of the site and farming and wind farms are compatible land uses.
Non-agricultural development should be carried out in a way that minimises any adverse effects on adjoining land – particularly by way of: -Land degradation. -Alteration of drainage patterns. -Pollution of ground water. -Spread of noxious plants and animals. -Increased fire hazard.	The project will have negligible impact on the matters outlined below: -Land degradation – refer to Chapter 19. Erosion is evident in the region and site, but can be managed through careful construction techniques and rehabilitation of disturbed areas. The majority of the site is not disturbed by the project, and as such the risk of further erosion is considered to be low. Where the project has the potential to cause additional erosion hazard, this would be avoided and managed through the preparation of a Soil & Water Management and an Erosion and Sediment Control Plan. These plans would implement necessary management controls and techniques during construction and operation of the project. -Alteration of drainage patterns – refer to Chapter 20. Turbines are generally located away from drainage lines. Some access tracks cross drainage lines and therefore have the potential for flow alteration and water pollution, especially where fords or small culverts are required. The design of the crossing would consider the flow pattern of the drainage lines and ensure that sufficient allowance is made for unaffected flows for most rain events. This would be managed through the

	soil and water management plan. Existing farm tracks that cross drainage lines would be upgraded as part of the development where they are needed for the project. -Pollution of ground water – refer to Chapter 20. Groundwater would not be affected by the project as the footings are too shallow to significantly interrupt groundwater flows and large areas of vegetation would not be removed. There are no known recharge zones on the subject site that would be impacted by the project. -Spread of noxious plants and animals. The movement of machinery, soil, and vehicles across the site have the potential to spread noxious weeds into and across the site. The environmental management plan will detail the mechanisms to prevent the spread of weeds and animals. This may include machinery wash downs, staff training, soil and fill screening and other commonly used techniques. The project would improve the control of noxious plants and animals by introducing coordinated management regimes managed by the wind farm developer. -Bushfire hazard – refer to Chapter 16. The site is considered to be bushfire prone land. Parts of the site that are cleared pastureland have a lower risk of fire than the forested portions. A significant majority of the turbines are located in cleared pasture, with a small number within areas of remnant vegetation. The potential risk of fire caused by wind farms is considered lower in comparison to normal power generation sites, as power transmission is located within the turbine towers and distributed underground to the transformers (CFA 2007). Due to modern manufacturing, the risk of fire at wind farms is considered 'very low' (CFA 2007, AusWind 2007). As part of the environmental management plan, a bushfire risk management plan would be developed based on the guidelines *Planning for Bushfire Protection 2006*. Further, the proponent commits to consult with the RFS during periods of high fire danger, and generally to ensure the RFS are familiar with the project.
Development which assists the process of farm build-up and the strengthening of the family farm unit, including development which enables revenue to be raised for farm build up, is encouraged.	The project provides the land holders with an opportunity to diversify income sources and increase revenue from their rural property holdings. This will strengthen the viability of farm operation, supporting farm build up and strengthening the family farm unit.
Nonagricultural development should be located and carried out in a manner that minimises the likelihood of added costs to ratepayers of the Shire as a result of the development.	The project does not require significant investment by Council in new infrastructure, and is unlikely to place an additional demand on existing infrastructure as it does not include residential development. Further, Council will benefit from the funding available through the Community Enhancement Fund. Consequently, the project is not likely to result in an increase in costs to ratepayers of the Shire.

Sustainable development that generates employment in the Shire is encouraged.	The project embodies the core principles of sustainable development. In particular, the project provides an opportunity to generate jobs within the locality. It is estimated that: -65 full-time jobs will be created during construction; and -11 full-time jobs during operation.
A.2.6 Specific Aspects	
Prime Crop and Pasture Land In considering whether development (i.e. dwelling and subdivision) would fragment or otherwise affect prime crop and pasture land, the Council will have regard to the definition in the Oberon LEP 1998.	The project is compatible with the current agricultural uses (grazing), and it anticipated that there will be negligible impact. Specifically, the development will not result in the subdivision and fragmentation of property holdings.
Concentration of Non Agricultural Use In considering a development application involving a concentration of non-agricultural uses (E.g. more than three dwellings) or which has the effect of creating such a concentration through a series of individual developments (including previous approvals and existing development), the Council will have regard to whether the concentration is likely to have the effect of:- Inhibiting or restricting farming or forestry practices in the area by way of increased complaints, land management problems or otherwise, and Increasing demands for the Council to spend ratepayer's money providing services to the land.	The project does not present the potential to negatively impact on ongoing farming or forestry activities. The project will not result in an increase in residential population in the area, and will therefore not result in increased complaints, land management problems or otherwise. The project does not require Council to provide services to the site.
Land Degradation Although applicants are encouraged to seek the advice of the Department of Land and Water Conservation in preparing proposals likely to alter landform, vegetation or drainage patterns, this section provides some basic design principles to ensure that developments are designed to minimise the potential for land degradation. In general, developments should have regard to the following principles: Try as much as possible to use natural features in any development. In particular, for subdivisions, lot boundaries should be located with regard to the topography and site conditions. This will eliminate the need for large areas of clearing, stripping or excavation. Developments should be phased so that the area exposed at any one time is confined to an area of workable size. Where areas to be worked are to be stripped of topsoil it should be stockpiled for respreading after final landscaping has taken place to help in the revegetation of the area. Drainage works should be planned and installed as one of the first steps in development. These should be designed to divert surface runoff around disturbed areas to minimise the potential for erosion and not	The project will have minimal impact on the landform, drainage patterns and vegetation. These matters are discussed in detail in: -Landform – refer to Chapter 19. Alternations to landform are minimal. Works include construction of an access track and footings for the wind tower, but these comprise only 1% of the site. A soil and water management plan will be prepared to manage these issues. -Drainage patterns – refer to Chapter 20. The landform will largely remain unaltered, and will not result in a change to drainage patterns. A soil and water management plan will be prepared to manage these issues. -Vegetation – refer to Chapter 12. The project will not require significant vegetation clearing. The project has a minimal footprint and generally avoids areas that are densely vegetated.

adversely impact adjoining premises. Sediment and erosion control structures such as sediment or retarding basins, perimeter banks etc may be necessary on larger projects to prevent possible land degradation. Where necessary, these structures should be installed before any land disturbance takes place. All sediment and erosion control structures should be revegetated or mulched as soon as they are built to prevent erosion of the structures. Similarly, all disturbed areas should be revegetated within thirty days of final landscaping.	
A.3 Hazards **A.3.1 Flooding**	
The designer must consider and Council will have regard to:- -Whether it is feasible to alter the location of the proposal to minimise the risk. -Whether it is feasible to require the elevation of floors one metre above known 1:100 year flood levels. -Whether evacuation or refuge is possible in the event of a flood. -Whether the proposal is likely to alter floodwater patterns in a way that increases risks to other land or buildings.	The project is not at risk of flood hazard, on the following basis (refer to Chapter 20 – hydrology): The site is in an elevated location, well drained, and is located in an area that is not subject to flooding. The project does not include uses that attract significant numbers of people requiring evacuation in a flood event. The project does not alter drainage patterns in a way that increases flood hazards to other buildings.
A.3.2 Bush Fire	
The whole of the Rural 1(a) zone in Oberon Shire is susceptible and or liable to bush fires and grass fires, the Council will have regard to:- -Whether it is feasible to require a perimeter road or fire radiation zone. -Whether evacuation or on-site refuge measures are feasible. -Whether any buildings are sited so as to minimise fire risk. -Measures available to ensure the property can be managed to minimise the risk to it and to other land and buildings. -Whether building materials and any proposed planting should be of a fire resistant type.	Chapter 16 provides a review of bushfire risks and management associated with the project. A wind farm in a rural area, as with any large scale development, can increase the potential risk of fire to nearby people and property. Wind turbines manufactured today incorporate the highest quality and safety standards The risk of fire is considered to be in fact minimised by wind farm developments because they introduce more intensive fire planning. Chapter 16 outlines the mitigation measures to be implemented as part of this project.

Part O Wind Power Generation 2005

Commercial wind power projects with the Oberon Council area are subject to the *Oberon Council Development Control Plan – Part O Wind Power Generation 2005* (DCP Part O 2005).

Clause 06 of the DCP Part O 2005 provides that the plan's objectives are:

- *"To provide development controls and guidelines that will assist in achieving the objectives of the Oberon Local Environmental Plan, 1998 as amended.*
- *To provide development that will relate well to its surroundings both manmade and natural.*

- *To promote and encourage a high quality of design and amenity.*
- *To restrict development to the Rural I (a) zone only.*
- *To provide for and require well considered development that is environmentally and economically sustainable.*
- *To minimize the likelihood of added costs to ratepayers of the Shire as a result of the development.*
- *To promote sustainable energy."*

The table below identifies the relevant provisions of DCP Part O 2005 along with an assessment of the compliance of the project against these.

Table 11 Objectives of the Oberon Council Development Control Plan 2001 - Part O Wind Power Generation 2005

Objective	Comment
Planning and Environmental Controls	
Development should when located on agricultural land, minimise the adverse impact on the future use of "prime crop and pasture land" (as defined in Clause 6 of the Oberon Local Environmental Plan 1998) and agricultural use in general.	The project has been designed to minimise impact on the future use of the land for agricultural purposes. The project has a footprint equating to approximately 1% of the site area, and the infrastructure has been designed to have minimal impact. The access track will be able to be used by the farmer, to more efficiently access paddocks. The site is presently being used for grazing activities, and this will be able to continue surrounding the turbines.
Development should be sited and carried out so as to minimise adverse impacts on, and not restrict, normal grazing, farming, forestry practices and tourism.	As above.
Development should be carried out in a way that minimises any adverse effects on adjoining land and the development site - particularly by way of: Land degradation. Alteration of drainage patterns. Pollution of ground water. Spread of noxious plants and animals. Bushfire hazard Effects on existing tourist operations.	Refer to Table 10 – Objectives of the Oberon Council Development Control Plan 2001.
Development that assists the process of farm build up, diversification and the strengthening of the family farm unit, including development that enables revenue to be raised for farming activities is encouraged.	The project provides a secondary income stream for the landowners. This enhances the viability of farm operation for at least the next 30 years (and potential extension of permit and operational contracts), throughout the period of the wind farm operation.

Wind power generation facilities and development should be located and conducted in such a manner, whereby there are no added costs to the ratepayers of the Shire as a result of the development.	The construction and operation of the project will not require the construction of infrastructure external to the site that will require significant maintenance. Therefore, the project is unlikely to impose a financial liability to Oberon Council; consequently, the project is unlikely to result in an increase in rates for ratepayers.
Environmentally and financially sustainable development that generates employment in the shire is encouraged.	The project inherently promotes environmentally sustainable development. The specialist reports are summarised in Chapter 8 to 21, and describe the environmental impact of wind farm construction and operation. The project also promotes economic sustainability through the provision of 65 jobs during construction, and 11 jobs during operation.
Development should not be located at sites recognised as having high scenic value or impact adversely on vista of high scenic value. The developer must assess visual impact and consult with the Council and the community on appropriate visual impact measures.	The visual impact of the project is described in Chapter 9. This establishes that the visual impact of the project will not be unreasonable on surrounding residences or from key publically accessible locations.
Development is to be located at a minimum setback of -1,500 metres (plus 10 metres for everyone (1) metre that the Wind Turbines exceed 120 metres in height) from the nearest likely affected residence not associated with the development. -1,500 metres (plus 10 metres for everyone (1) metre that the Wind Turbines exceed 120 metres in height) from any building envelope on any registered lot that has been created for the purpose of a dwelling. If the registered lot does not have an approved building envelope, then the distance is measured from the lot boundary. The above distances apply to the whole of the Oberon Local Government Area. The operation of this provision may be relaxed if the Council determines that the relaxation would not adversely affect residential amenity. In assessing whether to allow a relaxation the Council should have regard to the criteria to be addressed pursuant to Clause 7 of this Development Control Plan and the views expressed by the owners of any affected lot.	The project partially achieves the requirements outlined in the DCP. The tallest turbine currently under consideration has a tip height of 175 metres, which equates to a buffer distance of 2050 metres to the nearest likely affected residence, not associated with the project; and from any building envelope on any registered lot that has been created for the purpose of a dwelling. The distance to the closest possible dwelling that is not associated with the project (dwelling, labelled 'N' non-identified on the access and infrastructure plan) is 1.65km (from turbine P23). The nature and role of this building has been unable to be confirmed and it is possible that it is not used a dwelling. The distance to the closest dwelling that is not associated with the development (dwelling, labelled '4'on the access and infrastructure plan) is 2km (from turbine P51). Although the project does not meet the stipulated buffer distances, it is a marginal difference and the buffer distances are far greater than most comparable wind farms. The distances are also more than the noise and other impact studies suggest are needed to meet relevant standards. They also meet the suggested buffer distances in the Draft Guidelines.

Development designers should consider and refer to the Planning NSW EIA Guidelines and the NSW Wind Energy Handbook.	The project has been designed giving consideration to the Planning NSW EIA Guidelines (EIA Guidelines) and the NSW Wind Energy Handbook. The EIA Guidelines provided for the followings steps have been taken into consideration: -site selection -project feasibility -detailed assessment; -planning application; -construction; -operation; -decommissioning. The design approach is summarised in Chapter 4 of this EA report.
Developments are required to provide a well designed, serviced and safe designated public viewing and information area/s that allow safe roadside public viewing of the facility. Applications will be referred to the traffic committee for concurrence in relation to road safety.	As there is a viewing area for Crookwell 1 to the south, and for other wind farms in the wider region, it is not proposed to build a new viewing area for the project.
To maintain rural aesthetic amenity and to minimise any potential traffic conflicts, a minimum setback from public roads (building line) of the tip height of the turbine, plus 20% will apply. Where there is development adjacent to a main road location, particular consideration will be given to the number, location and design of access points to main roads. Generally, the number of accesses should be minimised, and all accesses proposed should be located and designed to avoid any conflict with other traffic.	The assessed turbine tip height of up to 175 metres, which equates to a required buffer distances from public roads of 210 metres. The number of access points along the main road has been minimised through the creation of internal access tracks. The number proposed access tracks are necessary given the ownership of the site and the need to avoid numerous waterway crossings.
As soon as the Wind Turbine Generators become redundant, they are to be fully dismantled and removed from the site and Council is to obtain a suitable legal guarantee that the developer or landholder will be able to comply with this clause.	Refer to the Decommissioning and Rehabilitation Plan found at Appendix 4. The lease arrangements entered into with the landowners include reference to access arrangement to the turbines, and mechanisms for the termination of the agreements.
Contributions	
Council will require the developer to make contributions in accordance with the Council Contributions Plan. A reasonable and adequate road and infrastructure bond will be required to be paid to Council. It will be used by Council to repair any damage to Council roads and/or infrastructure due to the construction of the development. Council will refund the bond following satisfactory inspections and full commissioning of the development.	The proponent acknowledges the requirement to provide a contribution in accordance with the Council Contributions Plan, and payment of an infrastructure bond. The proponent is exploring potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations.

It is noted that the project does not comply with some of the guidelines contained in both DCP 2001 and the DCP Part O 2005.

The *Environmental Planning and Assessment Amendment Act 2012* has been passed and is expected to commence in early 2013. This Act is aimed at ensuring that will

ensure that development that is permissible under an environmental planning instrument is not prevented, or unreasonably restricted, by a DCP. On commencement, this Act will amend the EP&A Act to provide that a provision of a DCP will have no effect to the extent that it:

- it is the same or substantially the same as a provision of an environmental planning instrument applying to the same land, or
- it is inconsistent or incompatible with a provision of any such instrument, or
- it has the practical effect of preventing or unreasonably restricting development that is otherwise permissible under any such instrument and that complies with the development standards in any such instrument.

It is also noted that:

- the buffer guidelines contained in the Council's DCP go beyond those typically found reasonable by Australian planning courts, tribunals and panels; and
- few wind farms in Australia, either constructed or planned, would comply with these guidelines.

Similar provisions were contained in the now repealed *Upper Lachlan Shire Council Development Control Plan – Wind Power Generation 2005 (2005 DCP)*. These provisions were considered by the NSW Land and Environment Court in *King & anor v Minister for Planning; Parkesbourne-Mummel Landscape Guardians Inc v Minister for Planning; Gullen Range Wind Farm Pty Limited v Minister for Planning [2010]* NSWLEC 1102 (7 May 2010) (Gullen Range Decision). In the Gullen Range Decision Moore SC and Fakes C held at paragraph 661 that:

'We have rejected, for two reasons, giving any weight to the council's DCP and the numerical prescriptions in it. First, there is no statutory requirement for us to do so. Second, although it would be possible to have regard to the document as part of the broad public interest, the evidence given concerning the adoption of the numerical limits was exposed as being inaccurate and without foundation. The numerical limits in the DCP could, therefore, only be considered to be arbitrary and certainly could not be considered as being satisfactorily derived in the fashions for either a DCP or a council policy discussed by McClellan CJ in Stockland Development v Manly'.

7.4.4 Oberon Council Development Contributions Plan and Water Management Works Plan 2004

Section 94 of the EP&A Act provides that:

If a consent authority is satisfied that development for which development consent is sought will or is likely to require the provision of or increase the demand for public amenities and public services within the area, the consent authority may grant the development consent subject to a condition requiring:

(a) the dedication of land free of cost, or

(b) the payment of a monetary contribution,

or both

The Land and Environment Court has established the following principles for testing the validity of a consent condition requiring contributions under section 94 of the EP&A Act:

- The contribution must be for, or relate to, a planning or development purpose;
- The contribution must fairly and reasonably relate to the subject development; and

- The contribution must be such as a reasonable planning authority, duly appreciating its statutory duties, could have properly imposed the contribution.

The objectives of the Oberon Development Contributions and Water Management Works Plan 2004 (Oberon Contributions Plan) are:

- to provide the basis for levying developer contributions;
- to identify the services, facilities and amenities which Council intends to provide, and those for which Council intends to require contributions towards;
- to set out contributions required by Council;
- to establish a nexus between anticipated development and contributions sought;
- to enable the timely provision of services, facilities and amenities;
- to encourage public participation in the formation of the Plan;
- to provide the development industry with early advice as to the amount of contribution which will be required for a particular development;
- to facilitate proper financial management and accountability for expenditure of contributions received;
- to develop minimum standards which will meet that demand;
- to set out the works required to meet demand of new development over the next five years;
- provide details of Council's proposed work schedules for the expenditure of contributions levied on developments;
- to ensure that Section 94 (EP&A Act) and Section 64 (LG Act) contributions levied on developments are reasonable;
- to ensure compliance with the relevant provisions of the Water Management Act 2000 (Division 5 Part 2 Chapter 6 section 306); and;
- to employ a “user pays” policy regarding the funding of amenities and services so that the existing population of the Oberon Local Government Area does not subsidise new developments.

Council may seek a development contribution from the development proponent for additional demand generated as a result of this project. In reference to the principle of establishing a “nexus” between infrastructure demand and the charges by Council, it is anticipated that the wind farm will impose a limited additional demand on the infrastructure of Oberon. The proponent anticipates that an infrastructure contribution will be limited to road charges.

The Oberon Contributions Plan does not make specific reference to wind farm development within the charges schedules; therefore the proponent anticipates that future negotiations will be undertaken with Council to determine the contribution that is required.

The proponent is exploring potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations. The door-knock survey which UFWA representatives and environmental consultants undertook asked respondents to suggest community funding projects that they would like to see occur if the project went ahead.

7.5 Other Plans and Guidelines

7.5.1 Draft NSW Planning Guidelines: Wind Farms (December 2011)

The *Draft NSW Wind Farm Planning Guidelines* (Draft Guidelines) were exhibited from 23 December 2011 to 14 March 2012.

The purpose of the guidelines is to:

- provide a clear and consistent regulatory framework for the assessment and determination of wind farm proposals across the state;
- outline clear processes for community consultation for wind farm developments; and to
- provide guidance on how to measure and assess potential environmental noise impacts from wind farms.

On 18 April 2012 the Department of Planning and Infrastructure (DoPI) issued a letter attaching a policy statement regarding the Guidelines to UFWA. The Policy Statement provides that the Guidelines will apply to the maximum extent possible to all wind farm applications for which DGRs have been issued, but an environmental assessment has not yet been exhibited. The DoPI also included a checklist of the key provisions of the Guidelines which are relevant for applications which have not yet been exhibited. This EA addresses the key provisions of the Guidelines which are relevant to wind farm applications 'yet to be exhibited'.

Of particular note is that the Guidelines require additional assessment where a proposed turbine lies within 2km of existing residences. The 2km distance specified in the Guidelines is met in this project, as the closet non-project involved dwelling is 2km from the nearest turbine. There is a non-identified building within 1.65km; however, the nature and role of this building has been unable to be confirmed and it is possible that it is not used a dwelling.

Refer to **Appendix 1** for a discussion on how this EA addresses the guidelines.

7.5.2 Draft National Wind Farm Development Guidelines (Environment Protection and Heritage Standing Committee (EPHC), July 2010)

EPHC has prepared a set of Draft National Wind Farm Development Guidelines which aim to outline best practice for industry and planning authorities in areas including, heritage, threatened species and turbine noise.

It is not the intention of these guidelines to be mandatory or change existing jurisdictional statutory processes, but to provide a basis for further consultation and consideration of the role of national guidelines in existing state approval processes.

These guidelines have been considered in the preparation of this EA.

7.5.3 Best Practice Guidelines for Implementation of Wind Energy projects in Australia (Australian Wind Energy Association (AusWEA), 2006)

These guidelines outline general principles to guide wind farm development, such as consultation, mitigation measures, biodiversity and visual impact. They also highlight the information required to be supplied by the proponent in a development application for a wind farm.

These guidelines have been considered in the preparation of this EA.

7.6 Conclusions

The chapter has found that the project is compatible with the existing land uses of the area and substantially complies with the relevant environmental planning instruments applicable to the site and surrounding area.

Some further approvals and authorisations from other governmental agencies would be required for the purposes of the project, as detailed above.

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CHAPTER 8

ECONOMIC & SOCIAL IMPACTS

8 Economic and Social Impacts

8.1 Introduction

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by UFWA to conduct a socio-economic impact assessment of the project. The potential impacts and benefits of the project are summarised within this chapter. The full report prepared by ERM is found at **Appendix 5**.

8.2 Methodology

The preparation of the socio-economic impact assessment involved the following tasks:

- Attendance at an on-site inception meeting organised by UFWA to obtain an overview of the project, an appreciation of the site, its setting and location, timetables for planned activities and preliminary identification of anticipated issues and impacts.
- Reporting of the UFWA consultation strategy and activities undertaken by UFWA, ERM and other members of the UFWA environmental assessment team.
- Reporting of surveyed community attitudes.
- A baseline review of publicly available information to gain an understanding of existing socio-economic conditions in the 'Study Area', and the potential challenges for developing the project.
- Analysis of the baseline data to determine the potential project impacts and to systematically assess their significance.
- Reporting of the findings of this research and assessment.

The 'Study Area' is defined as the site, the area covered by the four transmission line route options, the smaller communities around the site, the larger towns of Oberon and Goulburn townships and the local government areas (LGA) of Oberon, Upper Lachlan and Goulburn Mulwaree.

8.3 Economic impacts

Economic impacts as a consequence of the project may arise from three phases during the life cycle of the project:

- planning and construction related impacts;
- operational impacts; and
- decommissioning impacts.

The project is likely to stimulate the Oberon Shire economy as a result of greater income generation and subsequent expenditure in the region. The project has the potential to deliver direct and indirect benefits for host communities and the local and regional economies.

It is also anticipated that the project would provide flow on economic benefits including:

- increased employment opportunities;
- commercial opportunities from the economic investment;
- up-skilling of the local workforce within a growing energy market; and

- project involved landowners with lease agreements are expected to benefit directly from additional income.

The economic impacts are discussed in more detail below.

8.3.1 Direct Impacts

There would be a number of direct economic impacts as a result of project, arising from:

- design and development of the project;
- construction of the project;
- construction and commissioning of the project; and
- expenditure and employment associated with the management, operation and maintenance and decommissioning of the project.

Below is a discussion of the key direct economic impacts on the local economy.

Employment

The socio-economic assessment found that:

- In the Study Area, the dominant industry in 2006 was agriculture (50.4%), followed by manufacturing.
- In 2006, the highest proportion of occupational competencies in the Study Area was managers (21.5%), technicians or trades workers (14.3%) and labourers (13.7%).
- In comparison to the State, the Study Area has an overrepresentation of technical, trade based and labour based skills and an under representation of professionals within the Study Area.
- In 2006 the unemployment rate for the Study Area was 4.8%.
- Median individual and household incomes in all LGAs and the Study Area are below the State average.

The project has the potential to directly create new employment opportunities in the Study Area for the local community. The socio-economic assessment found that the construction phase of the project has the potential to create approximately 65 full time jobs during the construction phase and 11 full time jobs once the project is operational.

These full time jobs include management staff during normal working hours and on-call services out-of-hours. In addition, up to 10 additional contractors could be working on the site once every 10 to 15 years as part of schedule major site overhauls.

It is possible that some of these jobs could be carried out by workers from the local community. The socio-economic assessment of the population figures and the industry and employment profile of the local community in the Study Area indicate that the local and wider region have the capacity and skill diversity to potentially staff for the project.

There is the potential for further temporary employment arising out of future decommissioning or re-powering of the project.

The increase in employment opportunities has a direct benefit to the local economy.

Capital Investment

The socio-economic assessment found that the estimated total capital investment for the project would be approximately $275 million. Capital investment spending which will benefit the local community will arise out of:

- construction and operation phase wages; and
- the purchase of local materials and services where available.

The socio-economic assessment notes the level of capital investment into the local, regional, state and national economies would depend upon the sourcing of materials and services.

Although it cannot be accurately calculated, there would be a level of direct economic benefit for the Study Area and the Oberon Shire as a result of the project's capital investment.

In addition, UFWA is exploring potential options to support the local community surrounding the site, including through the establishment of the Oberon Community Enhancement Fund for community groups and organisations.

Land Use and Revenue

Additional income stream provided to the project involved landowners hosting project infrastructure from the leases may slightly raise the average household income in the area. The additional income would diversify the base of the local economy and further support landowners who wish to stay on the land through off-farm income.

Once the project is operational, the additional areas of land that would be temporarily unavailable for farming during the construction phase can be used once again. These areas can be used to grow crops and graze livestock close to the base of the wind turbines during the operational phase.

In relation to subdivision, concerns have been raised by the public about the impact on adjoining landowners' ability to subdivide land or build dwellings where this land is in close proximity to turbines. However, the current rural zoning and the rural location of the properties already constrains the subdivision of land for residential purposes.

8.3.2 Indirect impacts

The project is likely to provide a range of flow-on effects and noticeable boosts to the local economy through various income and expenditures.

People employed during the construction phase may contribute to the local economy through spending some proportion of their salaries on local goods and services, and therefore supporting existing jobs or creating new ones.

Further indirect economic impacts of the project are outlined below.

Indirect employment opportunities

ERM found that there would be indirect employment benefits to the rural community, Oberon Shire and the broader region, as a result of the project.

The employment of labour for the construction, operation and decommissioning of the project has the potential to increase demand for local goods, services and infrastructure. In turn, local retail, accommodation and entertainment businesses would experience a greater demand. While the impact would be highest in the construction phase, it would continue during the operational phase.

Tourism impacts

The project has the potential to increase local tourism and correspondingly increase expenditure on local services.

Large numbers of tourists visit wind farms every year in Australia, including:

- *"50,000 visitors per year to Codrington Wind Farm in Victoria,*
- *30,000 visitors in three months to the Windy Hill Wind Farm in the Atherton Tablelands, and*
- *400-500 people to an open day at the existing Crookwell Wind Farm" (AusWEA, 2003).*

Crookwell 1 Wind Farm in NSW is advertised by both Oberon Tourism and NSW Tourism websites as one of the 'top tourist activities' in Crookwell.

Changes to land value

It is not anticipated that the project would adversely impact land values of neighbouring, non-project involved properties to the project.

ERM emphasise that the value of rural land in the area surrounding the site is determined by a range of economic factors such as commodity prices, interest rates, and the supply of land and /or availability of similar land for sale. Therefore, the establishment of the project on rural lands would be only one consideration in determining land value.

The value of properties on which there will be wind turbines should increase, as the registered leases will run with the land ensuring that the rights to rental income for the turbines are transferable with the sale of the property (Community Affairs References Committee, June 2011).

In relation to neighbouring properties and properties with views of the turbines, there is little evidence to suggest that the land values are detrimentally affected by the project. Generally, impacts to the property values are primarily experienced during construction and commissioning of projects, and once a project is established, the prices recover with little to no adverse impacts on land prices (Offor Sharp & Associates, 2003).

The social-economic assessment refers to key findings of the *Preliminary Assessment of the Impact of Wind Farms on Surrounding Land Values in Australia* (2009) which was provided to the NSW Valuer General. The key finding of that study was that *"wind farms do not appear to have negatively affected property values in most cases"*. That study noted that *"a property's underlying land use may affect its sensitivity to price impacts"* and found that, of the properties studied, *"no reductions in sale price were evident for rural properties or residential properties located in nearby townships with views of the wind farm"*.

The Australian Senate established a Community Affairs References Committee (the Committee) to investigate:

- any adverse health effects for people living in close proximity to wind farms; and
- the economic impact of rural wind farms such as impacts on land values.

The report Committee's report, *The Social and Economic Impacts of Rural Wind Farms* was released in June 2011 (Community Affairs References Committee, 2011).

The Committee understood that that values of some properties that are close to turbines may be adversely affected but noted that, in most cases, planning processes such as setbacks are designed to avoid such situations.

The Committee's report referred to the findings of the 2009 assessment for the NSW Valuer General that found no reductions in sale prices, as well as a study of 78 property sales around the Crookwell 1 Wind Farm from 1990 to 2006. The study found that there were *"no measurable reduction in values for those properties that have a sight line to the [wind turbine] development*" and "*factors such as soils, improvements and access to services are more important drivers in determining value then the visual amenity of the wind farm*" (Henderson & Horning 2006 cited in Windlab 2011).

ERM highlights that *"international reports and surveys show that proximity to wind farms has not had a material effect on property values"*.

There are also international examples, such as, *The Effect of Wind Development on Local Property Values*, a report prepared for the US Government in 2003 which examined the values of land where wind turbines are visible (up to 8km) associated with every US wind farm installation between 1989 and 2001 (Windlab 2011). Over 25,000 records of property sales were subject to statistical analysis. This report concluded that:

"The statistical evidence does not support a contention that property values within the view shed of wind developments suffer or perform poorer than in a comparable region. For the great majority of projects in all three of the Cases studied, the property values in the view shed actually go up faster than values in the comparable region" (Beck et al 2003 cited in Windlab 2011).

Community investment

UFWA is committed to supporting local community organisations in the local area. The activities of UFWA are not limited to wind farm planning and development but extend to operating the wind farms with a view to becoming a long-term member of the community.

UFWA's parent company, Gas Natural Fenosa, is committed to the community in which it operates, where it actively engages with the community as part of its long term commitment to community investment. Gas Natural Fenosa received the 2011 Platts Global Energy Award in New York for the most outstanding community development programme for its Cuartel V gasification project located in Buenos Aires, Argentina. The award winning initiative was focused on improving access to public services for the neediest groups and addressing poverty in local communities where the company operates.

UFWA's goal is to use state of the art green technologies and provide sustainable sources of energy that can assist in developing rural communities.

As part of its ongoing commitment to supporting local community organisations UFWA is exploring potential options to support the community surrounding the site, including through the establishment of an Oberon Community Enhancement Fund for community groups and organisations.

Potential Future Road Upgrades

The construction of up to 55 wind turbines on agricultural land would require the mobilisation of heavy vehicles in the region to deliver materials to the development site.

A detailed traffic assessment has been undertaken as part of the EA for the project. Please refer to **Appendix 10** for the Transport Impact Assessment.

There are sections of the existing road network that provide access to the site which may require upgrading to accommodate the construction vehicles and equipment that is required to be transported to the site. The traffic report notes that the Transport

Management Plan (to be completed prior to construction) will propose any intersection and road upgrades along over-dimensional routes to safely accommodate the manoeuvrability of these vehicles, as required.

The upgrading of the roads would provide an indirect economic benefit for the region. The road upgrades would increase road safety and reduce vehicle maintenance costs.

8.4 Social impacts

8.4.1 Draft NSW Wind Farm Guidelines (December 2011)

The project is compliant with the Draft Guidelines, which address the following specific matters:

- factors to be considered in the location of a wind farm;
- issues relevant to the environmental assessment of wind farms; and
- community and stakeholder consultation to provide for an informed and transparent process.

UFWA is highly committed to understanding the full-range of community perspectives in the local area. UFWA has engaged the community in the project, through a community consultation and engagement program. An important component of the consultation program was the door-knock surveys carried out by UFWA representatives on 30 and 31 May and 1 June 2011, and again on 5 and 6 July 2011. The key issues raised by the community and stakeholders have been summarised in **Chapter 22** and are addressed in **Chapters 8 – 23** of this EA. Refer to **Chapters 22 – Consultation and 24 – Statement of Commitments** for further details.

The site is in a generally isolated location and there are no non-project involved dwellings within the 2km buffer zone from any of the proposed wind turbines. Therefore, no neighbour agreements are required for the project.

In accordance with the Draft Guidelines, UFWA are in the process of establishing a Community Consultative Committee (CCC). The purpose of the CCC is to provide a forum for discussion between the proponent, the community, Council and other stakeholders about the project. If the project is approved, the CCC will provide a forum for ongoing communication with the community during the construction, operation and decommissioning of the project.

The CCC will comprise, in accordance with the Draft Guidelines:

- an independent chairperson;
- five to seven representatives of the local community and other stakeholders;
- one representative of the local council; and
- two representatives of the proponent.

UFWA has sought nominations from local community members and/or affected stakeholders to represent the community for the CCC through a media release and advertisements in local newspapers.

To date, no nominations have been received from the community to be a member of the CCC. On 9 October 2012 Oberon Council sent a letter to UFWA nominating the council representatives for the CCC.

Following the submissions closing date, the Director-General will appoint the local community and other stakeholders' representatives.

UFWA will encourage CCC members to discuss issues and disseminate information about the project with the wider community. UFWA will keep minutes of all CCC meetings, to be presented to the Council, CCC members, and published on the website.

8.4.2 Identification of Potential Social Issues

The project is being proposed in a complex and challenging public policy context.

The project is aligned with state and federal policy commitments to shift Australia's energy supply to a greater percentage of renewable energy power sources such as wind. Reductions in electricity sources that generate greenhouse gas emissions are anticipated to have beneficial social and economic outcomes through supporting national and international efforts to reduce the potential impacts of global warming and climate change. Please refer to **Chapter 6** for more information.

Several potential social issues arising out of the proposed development have been identified in the economic and social impact assessment by:

- an analysis of the community responses during the consultation program to date;
- a literature review of similar renewable energy projects; and
- discussions with project managers and representatives of the Oberon Shire Council.

UFWA acknowledges and understands the need to effectively communicate with residents and all relevant stakeholders through a program of consultation.

UFWA has developed a community consultation and engagement program aimed at providing the community with factual information about the project and gathering feedback from the community and stakeholders about their concerns and interests. The community feedback obtained to date has been taken into account in the design of the project.

In order to meet the information needs of the community, a range of consultation strategies were adopted and undertaken, including:

- Consultation with government departments and agencies, non-government agencies, community groups and individuals.
- Direct contact with identified community groups.
- Door-knock consultation undertaken within 5km of the proposed wind farm site and along the corridor of all proposed transmission line routes.
- Community newsletter distributed to the local area and to anyone registering interest in the project.
- Community information session (to be held during the public exhibition of the wind farm application) within the project locality and advertised through the newsletter and local press.

Please refer to **Chapter 22 – Consultation** for the overview of the consultation strategy and outcomes.

The community consultation strategy and potential social impacts raised are further discussed in the socio-economic impact assessment found at **Appendix 5.**

8.4.3 Recommendations for future activities

The socio-economic impact assessment recommends measures to mitigate potential socio-economic impacts and/or enhance the benefits of the projects for the community, under the following social factor/impact headings:

- Demographics/ Economy and Livelihoods:
    - It is predicted there will be sufficient capacity in the existing local services to accommodate the 65 full-time construction jobs generated by the project and the project should therefore employ local and regional workers.
- Economy and Livelihoods:
    - Assess the viability of conducting aerial agricultural operations on properties adjacent to the site, particularly by the use of helicopters.

Refer to **Chapter 13 – Aeronautical Impacts** for details.

- Infrastructure:
    - Carry out a pre-construction road survey to determine existing conditions of local roads.
    - Carry out any upgrades and strengthening works, as required by the Transport Management Plan to be prepared before works commence, along the access road network to provide safe construction access for the project.
    - Prepare and implement a Transport Management Plan to ensure local roads are not adversely impacted by heavy vehicles.
    - Notify the local community of changed traffic conditions and proposed road works via a newsletter or information line.

Refer to **Chapter 14 – Transport Impacts** for details.

- Community Amenity – Noise Impacts:
    - To minimise potential noise impacts associated with night-time deliveries, prior notification should be provided to the affected public where night-time convoys are scheduled, and restrict use of exhaust/engine breaks in built up areas.

Refer to **Chapter 10 – Noise Impacts** for details.

- Community Amenity – Visual Impacts/Shadow Flicker/Loss of Privacy:
    - Minor adjustments to wind turbine locations or landscape screening may be required to ameliorate any identified visual impacts.
    - Transmission lines should be sited sensitively to reduce visual impacts to residents where possible.
    - Clearing for transmission lines should be kept to a minimum for safety requirements.

Refer to **Chapter 9 – Landscape and Visual Impacts** for further details.

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CHAPTER 9

LANDSCAPE & VISUAL IMPACTS

9 Landscape and Visual Impacts

9.1 Introduction

Green Bean Design was engaged by UWFA to assess the potential landscape and visual impacts of the project. The full landscape and visual impact assessment (LVIA) can be found at **Appendix 6**. The LVIA was updated by Green Bean Design to respond to the adequacy review comments provided by DoPI on 9 May 2013.

The LVIA involved a comprehensive evaluation of the landscape character in which the project and ancillary structures would be located, and an assessment of the potential landscape and visual impacts that could result from the construction and operation of the wind farm, and explores mitigation measures to reduce any negative impacts.

The proponent is considering a number of alternative wind turbine models and therefore the LVIA has adopted a theoretical wind turbine 'tip' height of up to 175 metres and a rotor height of up to136 metres in order to assess the 'worst case scenario' with the longest blade currently available to this market. Therefore the LVIA should be considered conservative in nature. As new turbines come onto the market, it is possible that the final turbine selected may exceed, in minor respects, the assessed maximum turbine envelope.

The LVIA considered the *Draft NSW Wind Farm Guidelines* (Draft Guidelines), which sets out a comprehensive framework for the assessment of landscape and visual impacts including residential dwellings within a 2km distance of any proposed wind turbines. It is important to note that there are no non-project involved, identified residential dwellings within 2km of the proposed wind turbines.

9.2 Methodology

The LVIA methodology included the following activities:

- Desktop study addressing visual character and identification of view locations within the surrounding area;
- Desktop study for the identification of any population centres within 10km of the site boundary;
- Fieldwork and photography;
- Preparation of ZVI diagrams;
- Assessment and determination of landscape sensitivity;
- Assessment and determination of visual impact;
- Preparation of photomontages and illustrative figures; and
- Preparation of a shadow flicker and blade glint assessment (refer to **Chapter 17**).

This LVIA involved desktop studies and site inspections to collect and analyse information to describe and define the characteristics of the landscape in which the project would be located.

The fieldwork involved:

- two days of general site inspections to determine the potential extent of visibility of the project and ancillary structures, and to identify landscape characteristics surrounding the wind farm site, and along the proposed transmission line corridors;
- one day detailed site inspection to determine associated residential dwelling window locations and orientations for a detailed shadow flicker assessment;

- one day of site photography for the photomontages locations;
- Confirmation of the various view location categories and locations from which the project structures could potentially be visible; and
- Preparation of a record for each view location inspected and assessed.

The criteria used to determine the significance of the visual impact of the project on surrounding view locations is detailed in Chapter 8.1 of the LVIA and includes:

- The category of the viewer (static or dynamic)
- The number of viewers
- The view distance
- Number of turbines visible
- Period of view

The LVIA identifies that the significance of visual impact resulting from the wind farm development would result primarily from a combination of:

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

The level of sensitivity of the receptors has been determined by assessing:

- The location and context of the viewpoint
- The occupation of activity of the receptor
- The overall number of people affected

The scale or magnitude of the visual effects has been determined by assessing:

- The distance between the view location and the turbines
- The duration of the 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)

In terms of the number of viewers that make a view location sensitive, the level of sensitivity is determine based on the following criteria:

- 'High number of viewers': >400 people per day
- 'Medium to High number of viewers': 100-399 people per day
- 'Medium number of viewers': 50-99 people per day
- 'Low number of viewers': 10-25 people per day
- 'Very low number of viewers': <10 people per day

In terms of the sensitivity of the view location, the level of sensitivity is represented in the figure below.

Figure 28 View Location Based on Sensitivity



Source: Information derived from Table 13 (Page 50) in the LVIA at Appendix 6

The table below outlines the 'sensitivity and magnitude assessment criteria' used to determine the visual impact at each view location.

Table 12 Sensitivity and Magnitude Assessment Criteria

Criteria	Definition
Distance	
Very Short	<1km
Short	1-3km
Medium	3-5km
Long	5-10km+
Duration of effect	
High	>2 hours
Medium	30-120 minutes
Low	10-30 minutes
Very Low	<10 minutes
Extent of visibility	
High	81-122 wind turbines visible
Medium	41-80 wind turbines visible
Low	21-40 wind turbines visible
Very Low	1-20 wind turbines visible

The table below outlines the criteria used to assess the 'high', 'medium', 'low' and 'very low' sensitivity of the visual receptor (the view locations), in order to determine the scale or magnitude of change in view due to the proposed development.

Table 13 Visual significance

			Scale or magnitude of change caused by proposed development			
			High	Medium	Low	Very Low
			Very short distance view over a long duration of time. A high extent of wind turbine visibility would tend to dominate the available skyline view and significantly disrupt existing views or vistas.	*Short to medium distance views over a medium duration of time. A moderate extent of wind turbine visibility would have the potential to dominate available views with visibility recessing over increasing distance.*	*Medium to long distance views over a low to medium duration of time. Wind turbines in views, at long distances or visible for a short duration not expected to be significantly distinct in the existing view.*	*Visible change perceptible at a very long distance, or visible for a very short duration, and/or is expected to be less distinct within the existing view.*
Sensitivity of visual receptor	High	*Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users or visitors to attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape*	High	Medium to High	Medium	Low to Medium
	Medium	*Medium numbers of residents and moderate numbers of visitors with an interest in their environment e.g. visitors to State Forests, such as bush walkers and horse riders etc. Larger numbers of travellers with an interest in their surroundings*	Medium to High	Medium	Low to Medium	Low
	Low	*Low numbers of visitors with a passing interest in their surroundings e.g. those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape e.g. workers, commuters.*	Medium	Low to Medium	Low	Very Low to Low
	Very low	*Very low numbers of viewers or those with a passing interest in their surroundings e.g. those travelling along minor roads.*	Low to Medium	Low	Very Low to Low	Very Low

It is important to note that a conservative approach was adopted during the field assessments where there was no opportunity to confirm the exact extent of view at the view location. At the majority of view locations, the assessment was undertaken from

the closest publically accessible location. Therefore, it is considered that some of the actual visibility impacts would be less than the impacts stated in the LVIA.

The LVIA notes that *"the term 'visual impact' does not necessarily imply or represent an individual's negative response toward the visibility of wind turbines, and that perceptions of wind farms amongst individuals within any community can be positive, negative or neutral"*.

On behalf of UFWA, Garrad Hassan Pacific Pty Ltd (Garrad Hassan) prepared Zone of Visual Influence (ZVI) Diagrams to illustrate the potential visibility of the wind turbines within the project 10km viewshed. ZVI Diagrams included visibility from tip of blade and hub height.

In addition, Green Bean Design and Garrad Hassan prepared eight photomontages to illustrate the potential visibility of the wind farm from/within the vicinity of residential dwellings as well as publically accessible areas. The photomontages include views (between 800 metres and 4.6km) toward the proposed turbines and the proposed northern 500 kV transmission line.

The photomontage locations are summarised in the table below.

Table 14 Photomontage descriptions

Photomontage location	Location name and view matrix reference (R)	Status
PM1 Levels Road	N/A	Unsealed road corridor (minor local road)
PM2 Rock Orchard (south of residential dwelling)	R128	Non-project involved residential dwelling
PM3 Abercrombie Road	N/A	Abercrombie Road
PM4 Hilltop residence (south of dwelling from driveway)	R6A	Non-project involved residential dwelling
PM5 Jerrong Road	N/A	Jerrong Road
PM6 Mount Hutton private land	N/A	Hilltop on project involved property View north to south along Abercrombie Road
PM7 Abercrombie Rd	N/A	Abercrombie Road View toward 500kV transmission line
PM8 Hilltop residence (south of dwelling from driveway)	N/A	Non-project involved residential dwelling View toward 500kV transmission line

9.3 Wind Farms and Landscape Values National Assessment Framework (2007)

The LVIA has been prepared in accordance with the Australian Wind Energy Association and Australian Council of National Trust's publication *Wind Farms and Landscape Values National Assessment Framework* (2007) (NAF).

The LVIA methodology followed the majority of techniques and has tested and determined outcomes for the principal issues that have been raised in the NAF.

9.4 Draft NSW Wind Farm Guidelines (December 2011)

The Draft Guidelines set out key considerations for the upfront assessment of landscape and visual impact for residential dwellings within a 2 km radius of proposed wind turbines and specific assessment requirements that may be set out in the NSW DoPI DGRs on a project by project basis. Refer to Table 2 in **Appendix 6** for the Landscape and Visual Amenities checklist for addressing the Draft Guidelines.

The Draft Guidelines set out a comprehensive framework for the assessment of landscape and visual impacts including residential dwellings within a 2 km distance of any proposed wind turbines.

It is important to note that there are no non-project involved, identified residential dwellings within 2km of the proposed wind turbines; nonetheless, an assessment in relation to likely impacts on landscape values that may apply to the site, and photomontages showing specifically how the turbines will appear from residences and public viewing places have been prepared as part of this LVIA in accordance with the Draft Guidelines.

9.5 Local environmental factors

9.5.1 Climate

The climate of the New South Wales South Eastern Highlands Bioregion is characterised by a temperate climate of warm summers and no dry season, with elevated areas in the north and south of the bioregion experiencing milder summer conditions in montane climate zones.

The Bureau of Meteorology has collected meteorological data over the past 107 years at Oberon (Springbank) which indicates that there are:

- 81 clear days (annual mean average);
- 101 cloudy days (annual mean average); and
- 84.5 days of rain (annual mean average).

Rainfall would tend to reduce the level of visibility from a number of view locations surrounding the project with the degree of visibility tending to decrease over distance. Cloud cover would also tend to reduce the level of visibility of the project and lessen the degree of contrast between the wind turbine structures and the background against which the wind turbines would be visible.

On clear or partly cloudy days, the position of the sun would also have an impact on the degree of visibility of the project. Late afternoon and early evening views toward the west would result in the wind turbines silhouetted above the horizon line, and with increasing distance would tend to reduce the contrast between the wind turbine structures and the surrounding landform.

9.5.2 Topography and drainage

The topography of the landscape within the New South Wales South Eastern Highlands Bioregion covers a broad area of the dissected ranges and plateaus of the

Great Dividing Range. The project would be located on portions of plateau remnants above steep sided valleys cut by drainage lines, including the Abercrombie River.

The elevation of the wind farm site falls gently from the north-east toward the south-west, and falling more steeply south toward the Abercrombie River valley. A number of ephemeral drainage lines occur across the site, draining to broader valleys north-west and south-east of the site, as well as south toward the Abercrombie River valley.

9.5.3 Vegetation

In general, the landscape within the site contains vegetation associated with woodland, drainage lines, small ponds/dams and cleared land for pasture and agricultural crop cultivation.

Stands of remnant woodland occur within the wider context of a modified landscape which continues to be managed through a variety of farming activities.

9.6 Population Centres

The Australian Bureau of Statistics 2011 Census identifies two 'state suburbs' within the vicinity of the site, which are:

- Porters Retreat, 86,800 hectares (population 255 with 112 private dwellings); and
- Wombeyan Caves, 93,400 hectares (population 263 with 242 private dwellings).

The site is located within and near the southern boundary of Porters Retreat. Wombeyan Caves is located immediately south and south-east of the site. These 'suburbs' are linked by Abercrombie Road, which bisects the site.

The LVIA identified a total of 78 residential dwellings within a 10 km viewshed which make up approximately 22% of the combined private dwellings within Porters Retreat and Wombeyan Caves. There are no townships or villages within the 10km viewshed. The closest township to the site is Taralga, which has a population of approximately 285, and is located approximately 25km to the south of the site.

9.7 Results

9.7.1 Landscape Character Areas and Sensitivity Assessment

This LVIA has identified five Landscape Character Areas (LCAs), which occur within the project 10 km viewshed. The five LCAs represent *"areas that are relatively consistent and recognisable in terms of their key visual elements and physical attributes"* which include *"topography/landform, vegetation/land cover, land use and built structures"*.

The five LCAs have been identified through a desk top assessment and described during the landscape assessment fieldwork carried out for the LVIA. The five LCAs are illustrated in Figure 16 of **Appendix 6**. The LCAs should not be considered as discrete areas, and characteristics within one LCA may occur within adjoining or surrounding LCAs. For the purpose of this LVIA the five LCA are:

- LCA 1 – Undulating pastoral farmland;
- LCA 2 – Abercrombie River Valley;
- LCA 3 – Abercrombie River;
- LCA 4 – Forested hills and ridgelines; and
- LCA 5 – Rural dwellings.

An overview and description of each LCA is presented in Section 7.1 'Landscape and character areas' at **Appendix 6**.

The criteria used to determine the sensitivity of each of the LCAs to the project was based on the following landscape and visual characteristics:

- Landform and scale: patterns, complexity and consistency.
- Landcover: patterns, complexity and consistency.
- Settlement and human influence.
- Movement.
- Rarity.
- Intervisibility with adjacent landscapes.

The criteria is further detailed in Chapter 7.2 'Landscape sensitivity assessment' of the LVIA at **Appendix 6** and was used to evaluate the sensitivity of each of the LCAs using a gradated score between 1 and 5 to represent levels of sensitivity from low to high. The sensitivity grades include high, medium to high, medium, low to medium and low landscape sensitivity.

The assessment found that the LCAs have the following landscape sensitivity to accommodate change:

- LCA 1 (gently undulating pastoral farmland): Medium.
- LCA 2 (steep sided valleys): Medium to High.
- LCA 3 (drainage lines): Medium to High.
- LCA 4 (forested hills and ridgelines): Medium to High.
- LCA 5 (rural dwellings): Medium.

Therefore, the LVIA determined that the landscape surrounding the project has an overall 'medium to high sensitivity' to accommodate change, and that the LCAs within the 10 km viewshed represent a landscape characteristics that are reasonably typical that in the New South Wales Central Tablelands and the NSW/ACT Border Region Renewable Energy Precinct.

The report noted that large portions of the NSW/ACT Border Region Renewable Energy Precinct landscape have been heavily modified by agricultural improvement post-European settlement.

Green Bean Design notes that some recognisable characteristics of the landscape will be altered by the project and that visually prominent elements will alter some perceived landscape characteristics. However, the main characteristics of the landscape, patterns and combinations of landform and land cover will still be evident.

9.7.2 Visual Impact Assessment

During the desktop assessment the LVIA identified a total of 85 potential residential dwelling locations within the 10km viewshed. However, seven of those potential residential structures were determined to be non-residential structures or could not be located during the field assessment and therefore a total of 78 residential dwellings were included and assessed in the LVIA. Refer to **Figure 29 – Residential locations**.

The LVIA assessed the potential visual impact of the Paling Yards Wind Farm for 78 identified residential view locations within the 10 km viewshed, as well as impacts for motorists travelling along roads surrounding the wind farm. The visibility of the wind farm within the 10km radius is illustrated on the ZVI diagrams (refer to **Figures 30** and **31**), and also represented on eight photomontages (**Figures 32** – **39**).

The ZVI diagrams demonstrate the influence of topography on the visibility of the wind farm, and identify areas from where the wind farm would and would not be visible.

The ZVI diagrams illustrate that views toward the site from the Abercrombie River National Park (to the north and west of the wind farm site) are significantly influenced by topography. Views from the larger proportion of the National Park are physically screened by rising landform. Views may extend toward the site from east and south east facing slopes and ridgelines in the south portion of the National Park; however these areas are also densely timbered.

As outlined in the Methodology summary in **Chapter 9.2** of this report, the potential significance of visual impacts resulting from the wind farm includes a combination of the following factors:

- *"The extent to which the proposed wind farm structures would be visible from surrounding areas;*
- *The degree of visual contrast between the wind farm structures and the capability of the surrounding landscape to visually accommodate the wind farm;*
- *The category and type of situation from which people could view the wind farm (such as residents or motorists);*
- *The distance effect between the view location and the wind farm turbines;*
- *The potential number of people with a view toward the wind farm from any one location;*
- *The duration of time people could view the wind farm from any static or dynamic view location; and*
- *The visual sensitivity of view locations surrounding the wind farm".*

Refer to **Chapter 9.2** of this report (Methodology) for further details on the criteria for assessing and determining visual impact, and refer to **Figure 40** for an example of how distance affects the visual impacts between the view location and the turbines.

The table below summarises the assessment of visual impact on residential view locations within the Paling Yards Wind Farm 10km viewshed.

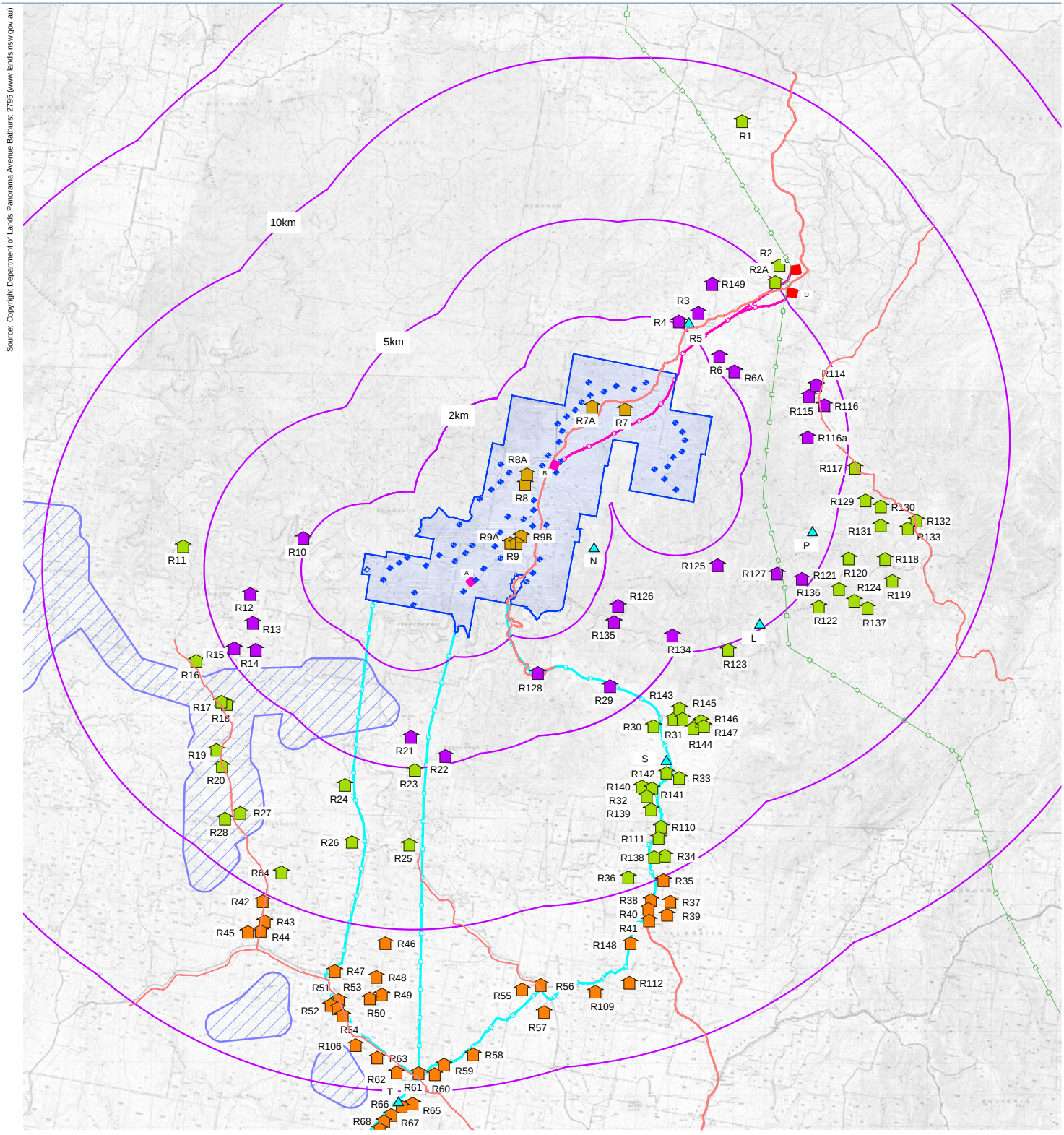
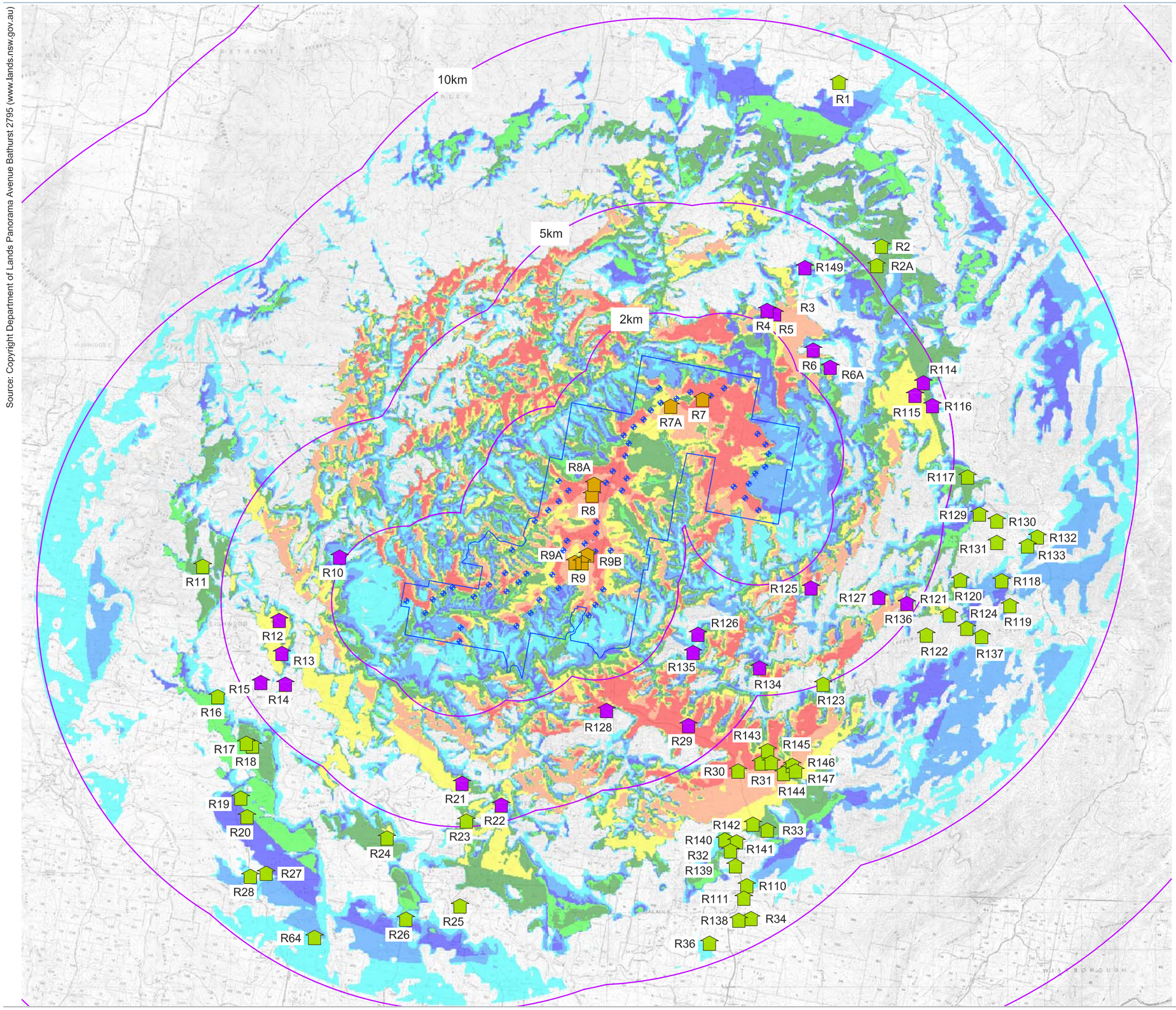


Figure 29 Residential Locations

Source: *Green Bean Design*

UNION FENOSA WIND AUSTRALIA | gasNatural fenosa

Source: Copyright Department of Lands Panorama Avenue Bathurst 2795 (www.lands.nsw.gov.au)



Legend

ZVI - Tips Visible

- 1 to 5 turbines
- 6 to 10 turbines
- 11 to 15 turbines
- 16 to 20 turbines
- 21 to 30 turbines
- 31 to 40 turbines
- 41 to 50 turbines
- 51 to 59 turbines

- Associated residential dwelling
- Non associated residential dwelling between 2 and 5km of Paling Yards wind turbine
- Non associated residential dwelling between 5 and 10km of Paling Yards wind turbine

Note: there are no non associated residential dwellings within 2 km of the proposed wind turbines

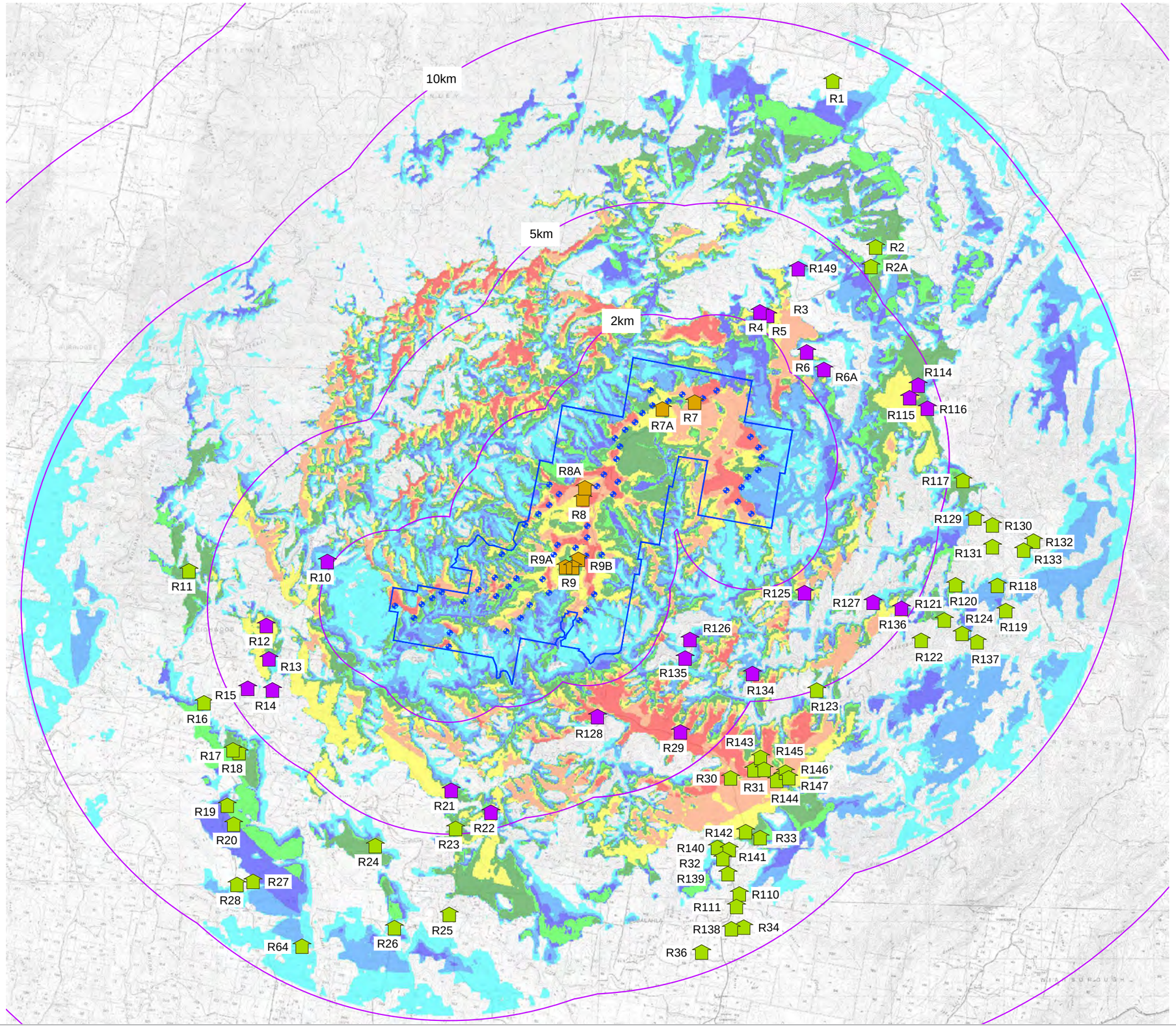
- Proposed Paling Yards wind turbine indicative layout
- Proposed Paling Yards Wind Farm site boundary
- Distance from proposed wind turbine

0km 4km

Figure 30 ZVI Diagram 1 - Tip of Blade

Source: *Green Bean Design*

Source: Copyright Department of Lands Panorama Avenue Bathurst 2795 (www.lands.nsw.gov.au)



Legend

ZVI - Hubs Visible

- 1 to 5 turbines
- 6 to 10 turbines
- 11 to 15 turbines
- 16 to 20 turbines
- 21 to 30 turbines
- 31 to 40 turbines
- 41 to 50 turbines
- 51 to 59 turbines

Associated residential dwelling

Non associated residential dwelling between 2 and 5km of Paling Yards wind turbine

Non associated residential dwelling between 5 and 10km of Paling Yards wind turbine

Note: there are no non associated residential dwellings within 2 km of the proposed wind turbines

Proposed Paling Yards wind turbine indicative layout

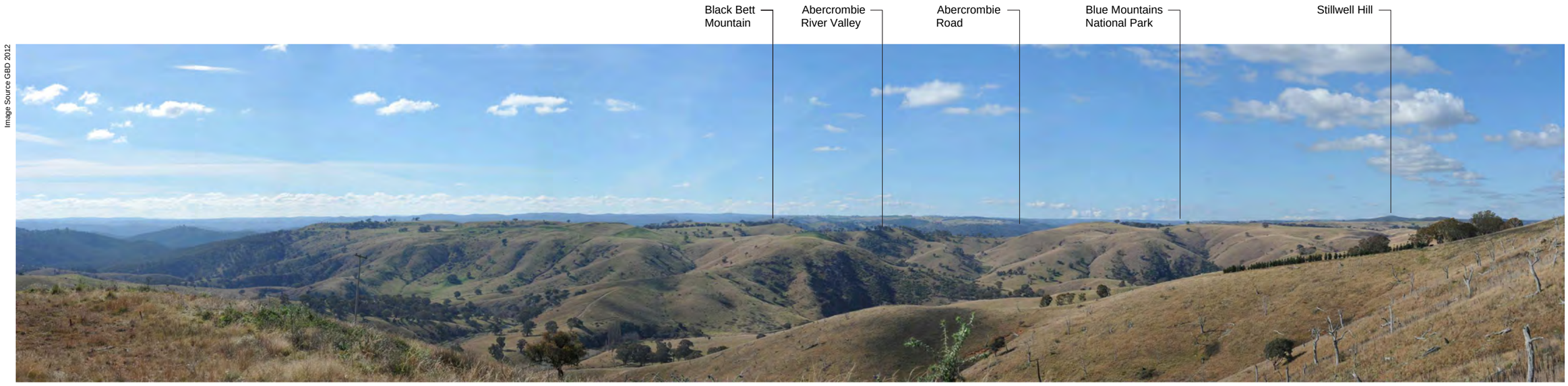
Proposed Paling Yards Wind Farm site boundary

Distance from proposed wind turbine

0km 4km

Figure 31 ZVI Diagram 2 - Hub Height

Source: *Green Bean Design*



Photomontage Location PM 1 Levels Road - Existing view, panorama north to east (Bearing 350° to 110°)



Photomontage Location PM 1 Proposed view, Levels Road, Extended panorama north to east (Bearing 350° to 110°)

Refer Figure 19 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 742978 Northing 6210924 (MGA 94z55H). Approximate distance to nearest visible turbine 6 km

Figure 32 Photomontage Location 1

Source: *Green Bean Design*

Image Source GBD 2012



Photomontage Location PM 2 Rock Orchard (residential dwelling) Existing view, extended panorama north west to east north east (Bearing 300° to 70°)

Image Source GBD 2012



Photomontage Location PM 2 Rock Orchard (residential dwelling) Proposed view, extended panorama north west to east north east (Bearing 300° to 70°)

Refer Figure 19 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 753207 Northing 6211629 (MGA94z55H). Approximte distance to nearest visible turbine 2.6 km

Figure 33 Photomontage Location 2

Source: *Green Bean Design*

Abercrombie Road

Image Source GBD 2012



Photomontage Location PM 3 Abercrombie Road (south) Existing view, extended panorama south to west north west (Bearing 170° to 290°)

180° S 190° 200° SSW 210° 220° SW 230° 240° 250° WSW 260° 270° W 280° 290°

Image Source GBD 2012



Photomontage Location PM 3 Abercrombie Road (south) Proposed view, extended panorama south to west north west (Bearing 170° to 290°)

Refer Figure 19 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 753068 Northing 6215581 (MGA94z55H). Approximate distance to nearest visible turbine 900 m

Figure 34 Photomontage Location 3

Source: *Green Bean Design*

Abercrombie Road

Image Source GBD 2012



Photomontage Location PM 4 Hilltop (non associated residential dwelling - driveway) Existing view, extended panorama south south east to west (Bearing 150° to 270°)



Image Source GBD 2012



Photomontage Location PM 4 Hilltop (non associated residential dwelling - driveway) Proposed view, extended panorama south south east to west (Bearing 150° to 270°)

Refer Figure 19 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

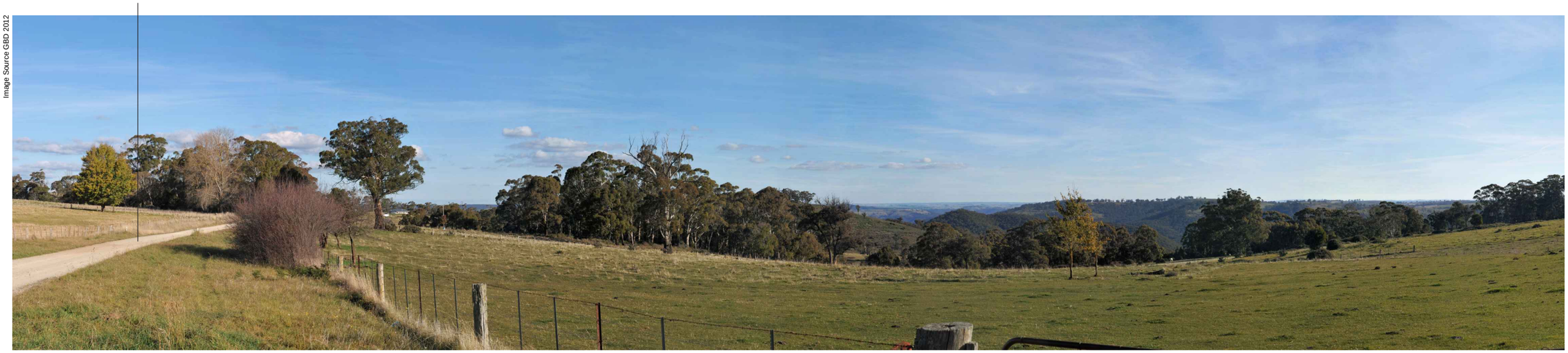
Photo coordinates: Easting 758731 Northing 6221170 (MGA94z55H) Approximate distance to nearest visible turbine 2.4km

Figure 35 Photomontage Location 4

Source: *Green Bean Design*

Jerrong Road

Image Source GBD 2012



Photomontage Location PM 5 Jerrong Road, Existing view, extended panorama south south east to west (Bearing 150° to 270°)

160° SSE 170° 180° S 190° 200° SSW 210° 220° SW 230° 240° WSW 250° 260° 270° W

Image Source GBD 2012



Photomontage Location PM 5 Jerrong Road, Proposed view, extended panorama south south east to west (Bearing 150° to 270°)

Refer Figure 19 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 761861 Northing 6219775 (MGA94z55H) Approximate distance to nearest visible turbine 4.6 km

Figure 36 Photomontage Location 5

Source: *Green Bean Design*

Abercrombie River valley

Abercrombie Road

Image Source GBD 2012



Photomontage Location PM 6 Hutton Hill Existing view, extended panorama south south west to north west (Bearing 195° to 320°)

200° SSW 210° 220° SW 230° 240° WSW 250° 260° W 270° 280° WNW 290° 300° NW 310°

Image Source GBD 2012



Photomontage Location PM 6 Hutton Hill Proposed view, extended panorama south south west to north west (Bearing 195° to 320°)

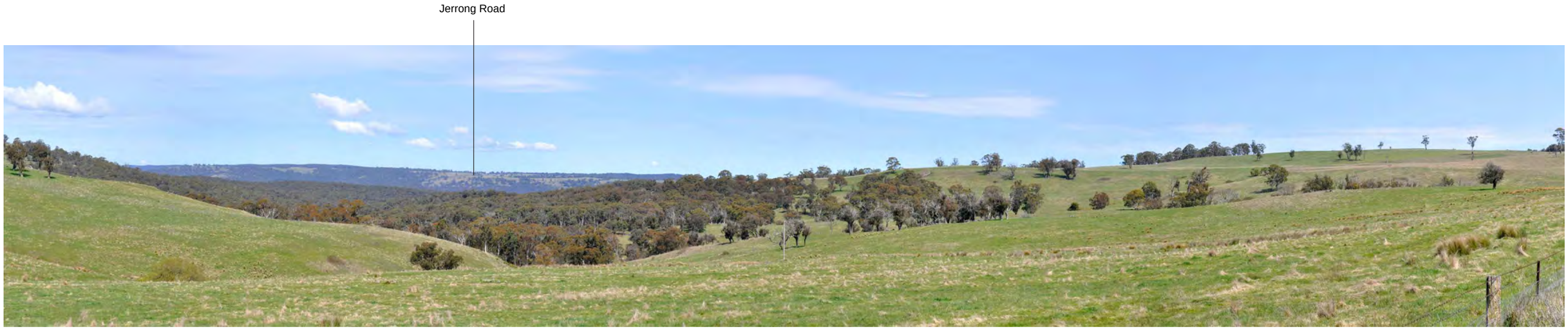
Refer Figure 19 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 755957 Northing 6220228 (MGA94z55H) Approximate distance to nearest visible turbine 800 m

Figure 37 Photomontage Location 6

Source: *Green Bean Design*



Photomontage Location PM 7 Abercrombie Road - Existing panorama view south east to south, south of Mingary Park (associated residential dwelling)



Photomontage Location PM 7 Abercombie Road - Proposed panorama view, south of Mingary Park (associated residential dwelling)

Figure 41
Photomontage PM 7

Typical view toward proposed 500 kV transmission line from Abercrombie Road

Refer Figure 19 for photomontage PM7 location. Wind turbines not shown.

Figure 38 Photomontage Location 7

Source: *Green Bean Design*



Photomontage Location PM 8 Hilltop (non associated residential dwelling - driveway) Existing view, extended panorama south south east to west.



Photomontage Location PM 8 Hilltop (non associated residential dwelling - driveway) Proposed view, extended panorama south south east to west.

Figure 42
Photomontage Location PM 8

Typical view toward proposed wind turbines and assessed and proposed 500 kV transmission line from Hilltop non associated residential dwelling driveway.

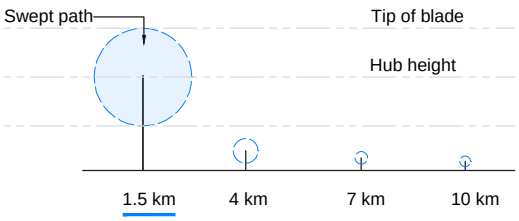
Refer Figure 19 for photomontage PM 8 location.

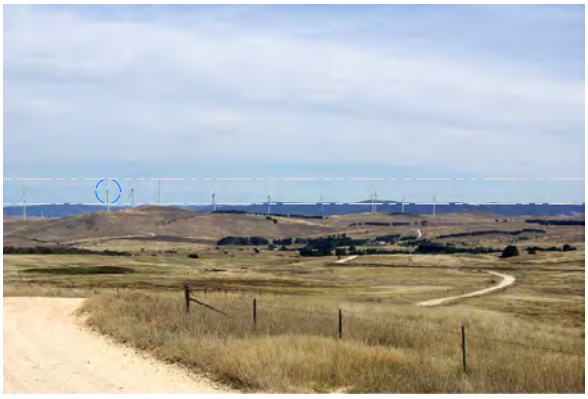
Figure 39 Photomontage Location 8

Source: *Green Bean Design*

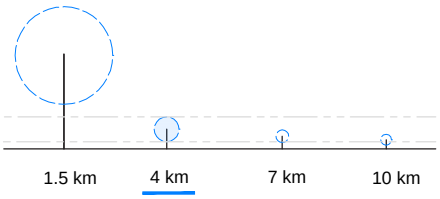


Capital Wind Farm - View distance 1.5 km



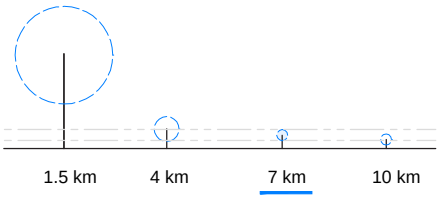


Capital Wind Farm - View distance 4 km





Capital Wind Farm - View distance 7 km





Capital Wind Farm - View distance 10 km

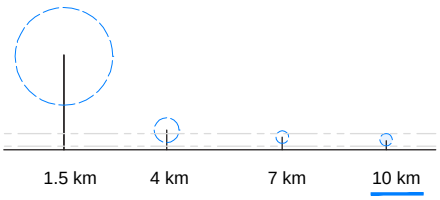


Figure 40 Visibility & Distance Example

Source: *Green Bean Design*

Table 15 Summary of visual impact ratings within the 10km viewshed

Visual impact rating within the 10km Paling Yards viewshed (Total from 78 residential dwellings)					
Nil	**Low**	**Low to Moderate**	**Moderate**	**Moderate to High**	**High**
37 (47%)	11 (14.5%)	19 (24%)	5 (6.5%)	6 (8%)	0 (0%)

An assessment of each potential residential view location indicated that:

- 37 of the 78 residential view locations would have a *Nil* visual impact;
- 11 of the 78 residential view locations would have a *Low* visual impact;
- 19 of the 78 residential view locations would have a *Low to Medium* visual impact;
- 5 of the 78 residential view locations would have a *Medium* visual impact; and
- 6 of the 78 residential view locations would have a *Medium to High* visual impact.

However, it is important to note that the six residential dwellings determined to have a *Medium to High* visual impact are project involved residences.

Therefore, the LVIA found that the majority of residential view locations within the Paling Yards Wind Farm 10km viewshed would experience a *Nil to Low* or *Low* visual impact.

The LVIA notes that existing residential dwellings in the vicinity of the site are located below surrounding ridgelines and/or include windbreak planting or tree planting around dwellings to provide shelter from prevailing winds, which assists in limiting the extent of available views across the surrounding landscape and to the proposed wind turbines.

Opportunities to view the Paling Yards wind turbines from publically accessible locations will be largely restricted to a small number of surrounding road corridors which are predominately limited to Abercrombie Road and the more distant Jerrong Road. The design layout will offer short distance and direct views from the road corridor toward wind turbines. The majority of turbines (41 out of the 55) would be located to the west of Abercrombie Road, which would reduce the potential for individual or groups of wind turbines interrupting or obstructing views from the road corridor over middle and long distant views. Furthermore, the duration of views towards the turbines along Abercrombie Road is reasonably short, with the average vehicular travel time being 6 to 10 minutes at 100km per hour; however, this duration would increase for those making return trips.

Any significant views toward the turbines from vehicle-based camp sites and water-based recreational activity areas within the surrounding national parks will be predominantly screened by a combination of topography and dense tree cover.

The potential transmission line corridors were assessed, and it was determined that the northern 500kV transmission line option would result in an overall *Low to Moderate* visual impact, while the southern 330kV transmission line options would result in an overall *Moderate* visual impact, with potential for high impact in certain locations. The southern transmission line options are no longer proposed and the northern

transmission line option has been identified as preferred. Accordingly approval is now being sought for the northern 500 kV transmission line corridor option only.

9.7.3 Proposed transmission line route visual impacts

The LVIA found that the proposed 500 kV transmission line to the north of the site (refer to **Chapter 5.8** for details) would not be significantly visible from any surrounding project involved or non-project involved residential dwellings within or beyond the site due to a combination of topography and scattered tree cover.

Some sections of the transmission line would be visible to motorists travelling along Abercrombie Road. However, there would be partial screening provided by roadside scattered tree cover.

The LVIA confirmed that the proposed transmission line route would result in a lesser degree of visual impact than the formerly considered and assessed 300 kV transmission line corridors to the south due to:

- *a shorter distance of constructed and visible transmission line;*
- *a significantly lower number of surrounding residential dwellings located within the vicinity of the transmission line; and*
- *a reduced requirement for vegetation clearing to establish a transmission line easement.*

The northern transmission line has been selected for this reason as the preferred and proposed option. The photomontages presented at **Figures 38 and 39** provide an indication of the visual impact that would occur.

9.7.4 National Parks and State Forests

There are a number of National Parks and State Forests in the vicinity of the project. The significant parks and forests include the Abercrombie National Park, the Blue Mountains National Park and the Gurnang State Forest. The national parks in the vicinity of the project are shown on **Figure 41**.

The Abercrombie National Park adjoins the western section of the site boundary. Covering an area of just over 19,000 hectares, the park includes walking tracks to take in low open forests, creeks and pools. Vehicle based camping facilities are provided at four locations within the park. The main section of the park is approximately 15,000 hectares and is located mainly on the north side of the Abercrombie River and to the north and west of the site. Approximately 4,000 hectares is located to the west of the main section of the park and greater than 10 km from the site. A smaller third section of around 200 hectares is located to the south of the main section.

The project is approximately 5 km from the southern portion of the Blue Mountains National Park, which is also part of the Greater Blue Mountain World Heritage Area. This park comprises approximately 267,000 hectares. The irregular boundary of the park is broken up by areas of urban development, road networks and broader landholdings.

The Gurnang State Forest is approximately 5km north-east of the project. There are no formal recreational or camping areas within the Gurnang State Forest.

Views toward the majority of the Paling Yard wind farm turbines from recreational areas (for example, camp sites, trails and amenities) within the surrounding National Parks, will be screened by a combination of topography (undulating and complex landforms following drainage lines) and dense tree cover crossing hillsides and ridgelines.

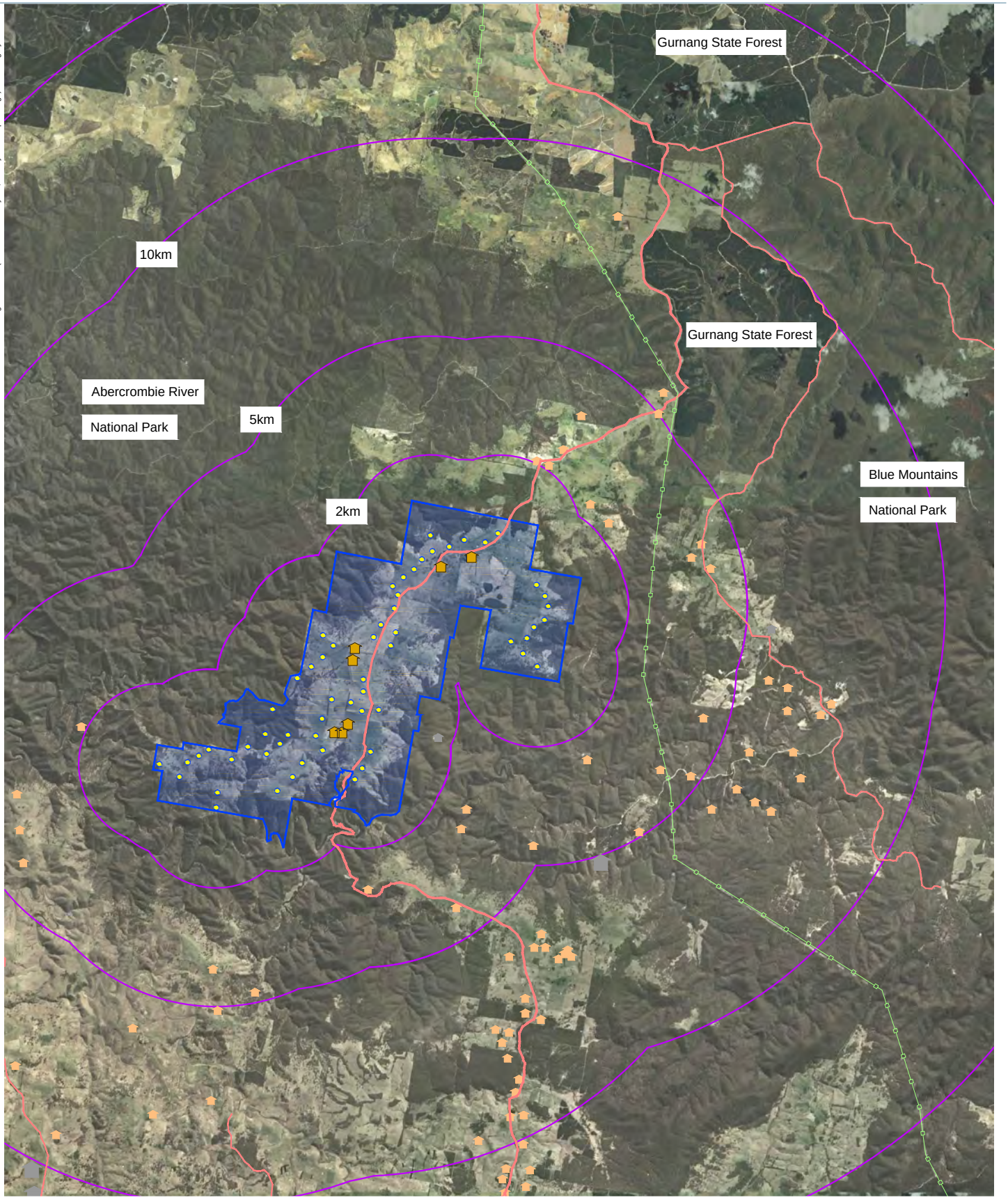


Figure 2 National Parks & State Forests

Figure 41 National Parks In The Vicinity Of The Project

Source: *Green Bean Design*

Through the influence of distance, land cover and topography, the project is unlikely to be visible from designated camping or recreational areas within any of the regional National Parks or State Forests. Therefore the project is not anticipated to have an unreasonable landscape or visual impact on the surrounding National Parks and State Forests

The Abercrombie River National Park supports a number of recreational activities which, for the most part, include water based activities such as fishing, canoeing, swimming, as well as vehicle based camping sites which include:

- Bummaroo Ford (on the Abercrombie River);
- Silent Creek;
- The Beach (on the Abercrombie River); and
- The Sink (on the Retreat River).

The locations of vehicle based camping sites are illustrated on Figure 2 of **Appendix 6**. Whilst there are no formal walking tracks within the park, bushwalking is permitted throughout the park. The most popular walking routes are along the Abercrombie River and its tributaries.

Any significant views toward the site from the vehicle based camp sites, as well as water based recreational activity areas will be predominantly screened by a combination of topography and dense tree cover.

Whilst subject to a very high annual visitation by tourists and sightseers, the project would not be visible from any of the key towns and associated attractions along the Great Western Highway.

9.7.5 Cumulative Impact Assessment

It is acknowledged that a cumulative landscape and visual impact may result from a wind farm being constructed in conjunction with other wind farm developments (existing and proposed) in the same area.

A cumulative visual impact assessment was undertaken by Green Bean Design which included the approved Taralga and proposed Golspie Wind Farms to the south and south-west of the project. None of the approved Taralga Wind Farm turbines are located within the Paling Yards Wind Farm 10 km viewshed. A small portion of the proposed Golspie Wind Farm project area is located within the Paling Yards 10 km viewshed; however the locations of wind turbines proposed as part of the Golspie project are not yet known.

The LVIA determined that there would be limited intervisibility between the project and other approved wind farm developments and that any potential cumulative impact is likely to be 'low'.

9.7.6 Night time lighting

Green Bean Design determined that obstacle lighting may be necessary, subject to a risk assessment to be prepared once the final turbine layout and height are known. The LVIA notes that obstacle lighting has been removed from the Cullerin Wind Farm adjoining the Hume Highway to the west of Yass in New South Wales as well as wind farms in Victoria.

Refer to **Chapter 13 – Aeronautical Impacts** for further details.

9.7.7 Pre-construction and construction

Temporary works associated with the construction of the wind farm that may be visible during construction and operational phases include:

- crane hardstand areas; and
- mobile concrete batching plant and rock crushing facilities.

Green Bean Design notes that the majority of pre-construction and construction activities are temporary in nature and are restricted to various discrete areas within or beyond the immediate wind farm project area. Therefore, it is unlikely to result in an unacceptable level of visual impact considering their duration and temporary nature.

9.7.8 Future residential dwellings

The LVIA notes that any future planning for residential dwellings would be able to respond to the layout design for the wind farm project and determine the optimal location for the dwellings on individual properties to minimise views towards wind turbines if desired. The design of future dwellings may also take advantage of topographic features in order to minimise views, or implement the mitigation measures listed in **Chapter 9.8** of this report.

Future dwellings that are constructed on land immediately adjacent to the site are likely to experience a visual impact and should implement in advance the mitigation measures listed in **Chapter 9.8** if desired.

9.8 Mitigation

The mitigation measures outlined in the LVIA are intended to reduce the potential visual impacts of the project in one of two ways:

- *firstly by reducing the visual prominence of the wind turbines and associated structures by minimising the visual contrast between the wind turbines and the landscape in which they are viewed; and*
- *secondly by screening views towards the wind turbines from specific view locations.*

One of the options available for mitigation of visual impacts to residences is planting vegetation close to the view locations (between the viewing location and the source of intrusion). Similarly, roadside tree planting can screen potential views of turbines from particular sections of road provided the turbine is not located some distance from the road.

The location and design of screen planting used as a mitigation measure is very site specific and requires detailed analysis of potential views and arrangements to be made between an affected land holder and the proponent following the grant of project approval.

The LVIA provides a number of measures to mitigate potential visual impacts of the project. A summary of the mitigation measures available for the wind farm and transmission line infrastructure is presented in the tables below.

Table 16 Visual impact mitigation measures

Safeguard	Implementation			
	Design	Site Preparation	Construction	Operation
Consider options for use of colour to reduce visual contrast between project structures and visible background.	✓			
Avoid use of advertising, signs or logos mounted on turbine structures, except those required for safety purposes.			✓	✓
If necessary, design and construct site control building and facilities building sympathetically with nature of locality.	✓		✓	
If necessary, locate substations away from direct views from roads and residential dwellings.	✓		✓	
Enforce safeguards to control and minimise fugitive dust emissions.		✓	✓	✓
Restrict the height of stockpiles to minimise visibility from outside the site.		✓	✓	
Minimise construction activities that may require night time lighting, and if necessary use low lux (intensity) lighting designed to be mounted with the light projecting inwards to the site to minimise glare at night.		✓	✓	✓
Minimise cut and fill for site tracks and revegetate disturbed soils as soon as possible after construction.		✓	✓	
Maximise revegetation of disturbed areas to ensure effective cover is achieved.			✓	
Consider options for planting screening vegetation in vicinity of nearby residences and along roadsides to screen potential	✓	✓	✓	

views of turbines. Such works to be considered in consultation with local residents and authorities.				
Undertake revegetation and off-set planting at areas around the site in consultation and agreement with landholders.	✓	✓	✓	

Table 17 Substation and transmission line mitigation measures

Safeguard	Implementation			
	Design	Site Preparation	Construction	Operation
A careful and considered route selection process to avoid sensitive view locations and loss of existing vegetation where possible.	✓		✓	
Wherever possible, select angle positions in strategic locations to minimise potential visual impact (e.g. avoiding, where possible, skyline views) and to provide a maximum setback from residential dwellings and road corridors.	✓		✓	
Selection of suitable component materials with low reflective properties.	✓		✓	
Selection of suitable storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.			✓	
Design for strategic tree or shrub planting between view locations and the transmission line.	✓		✓	

Subject to any conditions of approval, the proponent would commit to implementing landscape treatments to screen and mitigate the potential visual impact of the project for individual neighbouring properties within an appropriate distance from the site, subject to consultation and agreement with individual property owners.

Feasibility, effectiveness and reliability testing of the proposed visual mitigation measures will be undertaken after the measures have been implemented for the project, in order to assess and identify any residual impacts.

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CHAPTER 10

NOISE IMPACTS

10 Noise Impacts

10.1 Introduction

UFWA engaged SLR Consulting Australia Pty Ltd (*SLR*) to assess the potential noise impacts of the project. The noise impact assessment report can be found at **Appendix 7**.

The report analyses:

- the acoustic criteria;
- the background noise measurements;
- the predicted noise level at all potentially impacted receivers from the operation of the project; and
- the acoustic impact of the project during the construction phase, including blasting and traffic noise.

10.2 Methodology

The methodology and criteria used in the noise impact assessment was based on the South Australian Environmental Protection Authority *Environment Noise Guidelines for Wind Farms* (February 2003) (SA EPA Guidelines), the World Health Organization (WHO) limits, construction noise guidelines (*DECC Interim Construction Noise Guideline* 2009) and blasting impact guidelines.

The methodology and acceptability limit criteria that were applied in the noise assessment are based upon the SA EPA Guidelines. The principal acceptability limit criteria in the SA EPA Guidelines are that the project LA90 (10 min) noise should not exceed the greater of:

- an amenity limit of 35 dBA; or
- the pre-existing background noise by more than 5 dBA (for any given wind speed).

The WHO noise guidelines have also been used in the noise impact assessment in order to ensure that the project does not result in an 'unreasonable interference' with the amenity of these areas or cause any adverse health effects, as outlined in the WHO guidelines.

The appropriate WHO guideline noise limits are listed in the table below.

For the assessment of the project involved residences, the adopted external criteria of 45 dBA or the level given by the SA EPA Guideline criteria, where higher, will be adopted. Effectively this becomes 45 dBA or background + 5 dBA, whichever is the higher.

Table 18 WHO Guideline values for environmental noise in specific environments

Specific environment	Critical health effect(s)	LAeq (dBA)	Time base (hours)	LAMax (dBA, Fast)
Outdoor living area	Serious Annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	
Dwelling indoors	Speech Intelligibility & moderate annoyance, daytime & evening	35	16	
	Sleep disturbance, night-time	30	8	
Inside bedrooms				
Outside bedrooms	Sleep disturbance – window open, night-time	45	8	60

The noise impact assessment has considered the requirements of the *Draft NSW Wind Farm Planning Guidelines* (Draft Guidelines) which were released in December 2011, particularly Appendix B: NSW Wind Farm Noise Guidelines. This included consideration of separate daytime and night-time periods and alternative methods of evaluation for Special Audible Character.

The noise impact assessment conducted noise monitoring and wind monitoring at eight locations during the period between 7 June 2011 to 24 June 2011 to determine baseline conditions and establish criteria for surrounding residential receivers. The names and locations of all the identified residential receivers are listed in the report.

The noise emission model used to predict project noise levels at sensitive receptors is based on ISO 9613, as implemented in the SoundPLAN computer noise model.

In general, the assessment procedure was based on the following steps:

- Predict and plot the L Aeq 35 dBA noise level contour from the project under reference conditions.
- Establish the pre-existing background noise level at each of the relevant assessment receivers within the L Aeq 35 dBA noise level.
- Predict project noise levels at all relevant assessment receivers for the wind range from cut-in of the turbines to approximately 10 m/s.
- Assess the acceptability of project noise at each relevant assessment receiver to the established limits.

Noise predictions were made for receptors within a 6km radius of the indicative location of each wind turbine model currently proposed for the project.

Where modelling was conducted for the purposes of the noise impact assessment, the modelled hub height represents the maximum height in the range being considered.

Should an alternative selection of turbines be ultimately made and/or the final layout of the project differ from that assessed in the noise impact assessment, then a revised

noise impact assessment prediction will be completed prior to construction commencing.

The predicted noise levels are considered to be conservative due to the noise modelling assuming 'hard ground', average downwind propagation from all turbines to each receiver or a well-developed moderate ground based temperature inversion.

In addition, the noise assessment included an assessment of turbines P2, P6 and P7 which are no longer proposed as part of the project (although they may form a subsequent stage which will be subject to separate approval at that time), increasing the conservatism in the assessment.

10.3 Results

10.3.1 Operation noise levels

A three-dimensional computer noise model was used to predict LAeq noise levels from all turbines at all surrounding residential dwellings.

For the purposes of the noise impact assessment, the turbine noise levels from the proposed turbine layout was calculated for a wind condition of 8 m/s at 10m AGL.

Furthermore, noise levels from the proposed wind farm were calculated for all integer wind speeds in the range of 5 to 10 m/s (at 10m AGL) at all surrounding assessment receivers within 6 km of a turbine.

Whilst the rated wind speed of the turbines is typically 13 to 14 m/s, published manufacturers sound power level test data has only been generated as high as 10 m/s.

It should be noted that noise produced by turbines begins to 'plateau off' at higher wind speeds.

10.3.2 Background levels and noise limits

The locations for the background noise measurements were selected based on the potential for acoustic impact to the nearest receivers. The SA EPA Guidelines recommend that the measurement locations should be located at least 5 metres from a reflecting surface (other than the ground) and within 20 metres of a residence.

Background noise monitoring has been conducted at one representative location and was considered indicative of other similar locations, due to the relative proximity of some receiver locations to one another and their similar wind exposure and surrounding environment.

Accordingly, background noise monitoring was commenced at eight locations around the site.

It is important to note that that further baseline background noise monitoring is anticipated to be conducted before the project is commissioned in order to obtain further comprehensive data.

At each location, the noise monitoring equipment was placed in the vicinity of the residence and the position and location of the equipment was photographed.

A reduced data set was created for the night period analysis (10:00 pm to 7:00 am).

10.3.3 Acoustic impact assessment

Once the existing background noise levels and noise limits were assessed and determined in accordance with the relevant guidelines, an assessment of the predicted project noise levels was undertaken for all receivers located within a distance of 6km of a wind turbine.

Turbine noise was predicted using the indicative turbine layout and the turbine models currently being considered and assessed against relevant criteria prescribed by the SA EPA Guideline and WHO based noise criteria where appropriate.

SLR Consulting found that predicted noise levels at all non-project involved receptors (including all locations of buildings not identified as an official dwelling) were found to be below the relevant noise criteria.

Accordingly, the adopted noise limits will be met for all non-project involved receptors.

Furthermore, all receptors (including the project-involved receivers) would achieve their respective criteria with consideration to the night-time only regression line based limits. Refer to **Figure 42 – Predicted Noise Levels Contour Map**.

The noise impacts on some project-involved secondary dwellings are predicted to slightly exceed the WHO noise criteria. These secondary dwellings are used for a very limited part of the year only. It is proposed to enter into a noise agreement regulating the use of these secondary dwellings so that they will not be used should post construction noise testing show an exceedance of the criteria.

The table below shows the predicted noise exceedances at the project-involved residences.

Table 19 Project involved residences' predicted noise exceedances

Location	Exceedance of WHO Noise Criteria at Hub Height Wind Speed										MAX
	4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2	
7A				2.4	3.4	3.3	3.1	3.0	2.0	0.6	3.4
9A					0.8	0.6	0.4	0.4	0.4	0.1	0.8
9B					0.7	0.5	0.4	0.3	0.3	0.1	0.6
8					0.3						0.3
8A					0.2						0.2
9					0.1						0.1
7					0.1						0.1

For locations 7, 8 and 9, the exceedance occurs only at one wind speed and is less than 0.5 dB in magnitude. The noise impact assessment found that this is a minor exceedance and unlikely to cause any additional effect on the amenity of the area or health of the residents.

Locations 7A, 8A, 9A and 9B are project-involved secondary dwellings and the proposed noise agreements will make specific provision for these dwellings to ensure that no adverse noise impacts to any person.

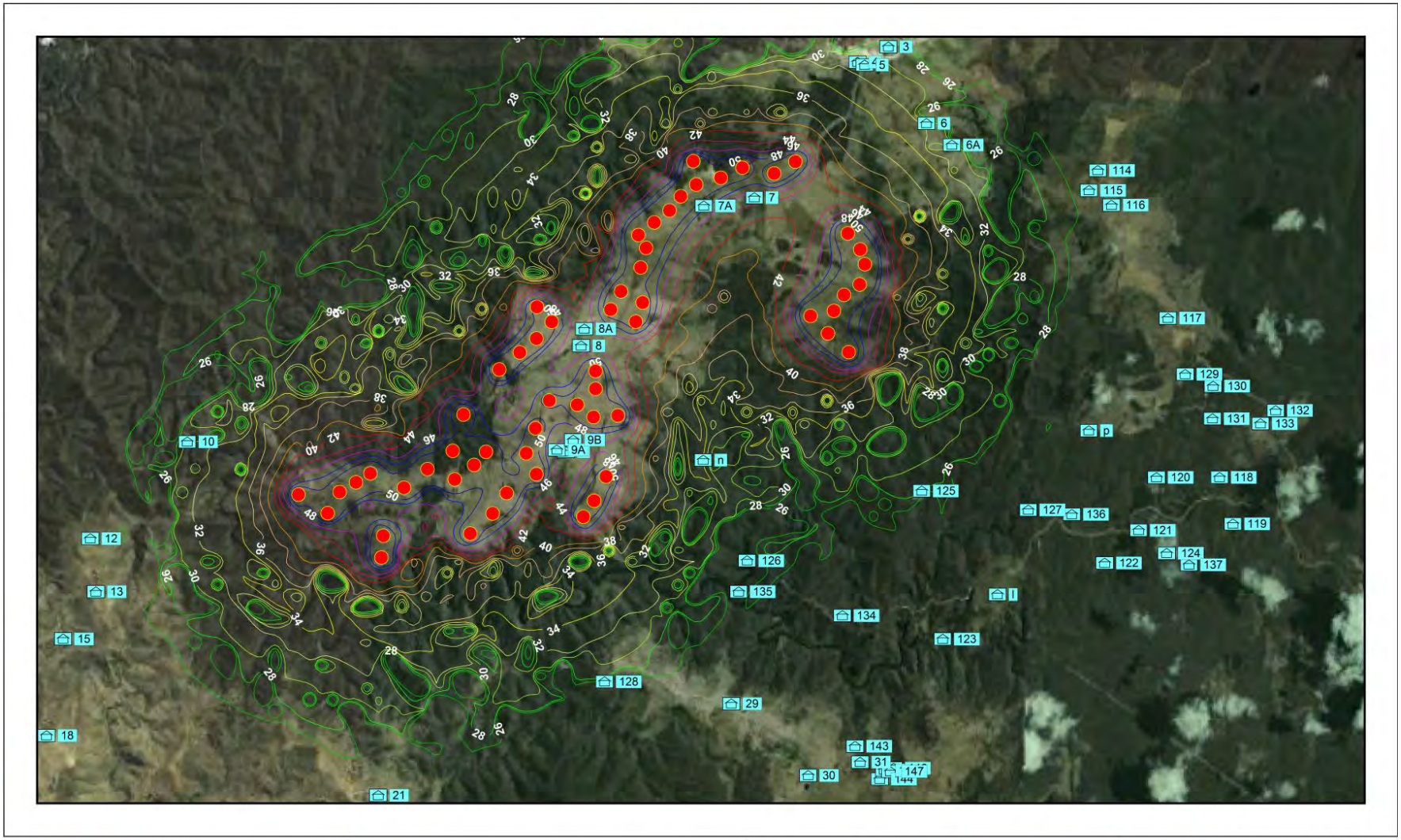


Figure 42 Predicted Noise Levels Contour Map

Source: *SLR Consulting Australia*

Under the SA EPA Guidelines, project involved residences are not required to comply to the 35 dBA or 'background + 5 dBA' limits. However, in order to ensure that the project does not result in an 'unreasonable interference' with the amenity of these areas or cause any adverse health effects, the noise limits outlined in the WHO guidelines will be met for project involved residences.

Accordingly, external criteria of 45 dBA (as per the WHO guidelines) or the level given by the SA EPA Guideline criteria, where higher, will be adopted. Effectively this becomes 45 dBA or background + 5 dBA, whichever is the higher.

The noise agreements with these project involved residences will be entered into prior to construction.

Upon finalising the layout and turbine models a revised noise prediction and assessment will be completed to demonstrate compliance with the project noise criteria.

It should be further noted that *"all predicted noise levels are considered to be conservative with the model assuming 'hard ground', average downwind propagation from all turbines to each receiver or a well-developed moderate ground based temperature inversion, a scenario which is not able to be re-created in reality"*.

Predicted external noise levels will be further mitigated by the shielding effects of the building, with the anticipated internal noise levels similarly reduced by the façade of the dwelling.

10.3.4 Construction noise

The construction noise and vibration impacts assessment conducted by SLR Consulting found that the 'worst case' scenarios modelled were found to be generally acceptable.

10.3.5 Blasting

The blasting impact assessment conducted by SLR Consulting concluded that noise impact was found to be acceptable. The airblast overpressure is anticipated to be below the acceptable level of 115 dB Linear for all existing residences, and vibration levels are anticipated to be well below the acceptable criteria.

10.3.6 Traffic noise

The construction traffic noise impact assessment undertaken by SLR Consulting found that the 'worst case' maximum construction traffic generated scenario would increase existing traffic noise levels along local roads by up to 4-7 dBA. However, due to the typically large setback of dwellings from the road network, SRL concluded that the predicted traffic noise impacts would be acceptable.

10.3.7 Substation noise

Australian Standard AS 60076 Part 10 2009: *"Power Transformers – Determination of sound levels"* has found that a 200 MVA substation may produce sound power levels up to 99 dB.

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, which found that the predicted noise levels are within the noise limits.

10.3.8 Transmission line noise

Transmission line noise, also known as 'corona noise' is *"caused by the partial breakdown of the insulation properties of air surrounding the conducting wires"*. It generally only occurs in humid conditions, as provided by fog or rain.

It is noted that *"a minimum line potential of 70 kV or higher is required to generate corona noise depending on the electrical design"*.

It is expected that the proposed transmission line will traverse largely remote and uninhabited land.

It is anticipated that sufficient buffer distances between the transmission line and receivers will result in the occasional corona noise being inaudible at residential receivers.

10.4 Draft NSW Wind Farm Planning Guidelines (December 2011)

SLR Consulting has addressed a number of additional requirements of the Draft Guidelines. Refer to Chapter 10 of the noise assessment found at **Appendix 7** of this report for full details and results of the assessment.

10.4.1 Daytime and night-time background noise

The background noise data was reprocessed to define background noise curves for the daytime period (7.00am to 10.00pm) and night-time period (10.00pm to7.00am), in accordance with the Draft Guidelines.

The new background noise curves were used to update the noise limit curves for all receptors and all predicted results were assessed against these criteria. The set of assessment graphs are presented in the noise assessment at **Appendix 7**.

The assessment found that there were no exceedances of the daytime-only or night-time-only criteria for non-project involved receivers.

The maximum exceedance for project-involved receivers was determined by the 45 dBA criteria, rather than the Background+5 criteria.

The table below shows the exceedances for project involved locations for the night-time criteria.

Table 20 Noise exceedances at project-involved households for the night-time criteria

Location	Exceedance at Hub Height Wind Speed										MAX
	4.3	5.7	7.2	8.6	10.0	11.5	12.9	14.3	15.8	17.2	
7A				2.4	3.4	3.3	3.1	3.0	3.0	1.4	3.4
9A					0.8	0.6	0.4	0.4	0.4	0.4	0.8
9B					0.7	0.5	0.4	0.3	0.3	0.3	0.6
8					0.3						0.3
8A					0.2						0.2
9					0.1						0.1
7					0.1						0.1

As discussed in **Chapter 10.3** above, the proposed noise agreements will make specific provision for these project-involved dwellings to ensure that no adverse noise impacts to any person.

Overall, the assessment found the predicted noise exceedances to be acceptable.

10.4.2 Special Audible Characteristics

SLR Consulting assessed the predicted levels of levels of swish, modulation, discrete tones and low frequency noise, otherwise known as 'Special Audible Characteristics', for the project.

The noise impact assessment found that:

- *"The results from the SoundPlan model [low frequency noise] predict that wind turbine noise would only exceed 60 dBC for one receiver location, Location 7A, the predicted exceedance was 0.8 dBC. This is a relatively small exceedance of the criteria, however, as post-construction monitoring is already planned for this location."*
- *"The tonality tests showed no presence of tonality in the predicted results."*
- *"There currently is no means to predict the eventuality, severity or frequency of occurrence of excessive amplitude modulation… excessive amplitude modulation has only been confirmed at a small number of wind farm sites and when it occurs it is relatively infrequent."*
- *"Nevertheless, should excessive amplitude modulation be found to be a problem with the wind farm, it would be possible to limit the impact on the residents through adaptive management techniques."*

Therefore, it is found that the predicted Special Audible Characteristics for the project are acceptable and manageable.

10.5 Mitigation

If undue turbine noise impacts are identified during operations due to temperature inversion, atmospheric stability or other reasons, then adaptive management' measures may be implemented to mitigate or remove the impact. This process may 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 undue impacts.
- Operating turbines in a reduced 'noise optimised' mode during identified times and conditions (sector management).
- Providing acoustic upgrades (glazing, façade, masking noise etc) to affected dwellings.
- Turning off turbines that are identified as causing the undue impact during identified times and conditions.

Upon finalising the layout and turbine models a revised noise prediction and assessment will be completed in which the noise impact mitigation techniques will be investigated thoroughly in order to ensure a fully noise compliant turbine layout.

10.5.1 Agreements

The noise impact assessment notes that UFWA proposes to enter into noise agreements with the owners of the project-involved properties prior to construction. These agreements would specify that:

- *UFWA would ensure that the properties met the World Health Organisation noise guidelines; and,*
- *UFWA would implement an adaptive management approach which could include the use of building treatments and turbine operation/management strategies if operational noise causes significant impact to the amenity of involved residents.*

In addition, it is proposed that the noise agreements will make specific provision for the project involved secondary dwellings so as to ensure that no adverse health impacts result to any person as a result of turbine noise impacts.

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CHAPTER 11

HEALTH IMPACTS

11 Health Impacts

11.1 Introduction

Health concerns are often cited by the public in relation to wind farm development, including concerns as to potential adverse impacts on the health and wellbeing of people in the immediate vicinity of the wind farms. These health concerns relate to a range of issues including noise pollution (including infrasound noise), vibrations, shadow flickering, electromagnetic interference, blade glint, blade throws, ice shedding, tower failure, and the risk of fire due to the introduction of electrical devices and mechanical components.

The World Health Organisation (WHO) defines health as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"*.

This chapter draws on Australian and international research to detail the potential impacts on human health associated with the construction and operational phase of wind farm developments, and assesses the likely health related risks arising from the project, including those on residents within 2km of a turbine. In particular, this chapter draws on the landmark study published by the National Health and Medical Research Council in July 2010, *Wind Turbines and Health* (NHMRC Report), which presents a current review of the evidence from literature on wind turbines and any impacts on human health.

The NHMRC Report tested the hypothesis 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"*, and found that *"there is no published scientific evidence to support adverse effects of wind turbines on health"*.

This chapter also outlines key mitigation measures that should be employed for wind farms to reduce the risk of any adverse physical and mental impacts occurring.

UFWA recognises that it is important to address any health concerns held by local residents at the early stages of a wind farm proposal, regardless of whether any impacts eventuate.

11.2 Key Claims

11.2.1 Wind Turbine Syndrome

US paediatrician Dr Nina Pierpont has conducted research into the impacts of wind farms on human health. Her study is based predominantly on survey and anecdotal data, as well as existing research. Dr Pierpont refers in her 2006 paper, *Health Effects of Wind Turbine Noise*, to a 'Wind Turbine Syndrome' that incorporates a number of health impacts claimed to be the result of wind farms sited in close proximity to dwellings and public spaces. The symptoms of this syndrome include:

- *"Sleep problems: noise or physical sensations of pulsation or pressure make it hard to go to sleep and cause frequent awakening;*
- *Headaches which are increased in frequency or severity;*
- *Dizziness, unsteadiness, and nausea;*
- *Exhaustion, anxiety, anger, irritability, and depression;*
- *Problems with concentration and learning; and*
- *Tinnitus (ringing in the ears)" (Layton 2009 cited in Pierpont 2006).*

Pierpont (2006) found that chronic sleep disturbance is the most common symptom of the 'Wind Turbine Syndrome', and that exhaustion, mood problems, and problems with concentration and learning are natural outcomes of poor sleep. She emphasizes that *"sensitivity to low frequency noise is a potential risk factor"* from wind farms. Pierpont found that *"some people sense low-frequency noise as pressure in the ears rather than heard as sound, or experience a feeling or vibration in the chest or throat"* (Moller & Pedersen 2004 cited in Pierpont 2006).

11.2.2 Annoyance and sleep disturbance

The NSW Legislative Council Report (No.5, 2009) notes that research has shown that 'noise annoyance' is an *"adverse health effect that can result from wind farms, as it can result in effects such as negative emotions and sleep disturbance"* (NSW Legislative Council 2009).

Van den Berg (2003), a prominent researcher of health impacts associated with wind farms and a critic of wind farm developments in close proximity to dwellings, contends that wind farm noise is a serious issue requiring further understanding. He argues that *"the wind speed at hub height [towards the top of a wind turbine] at night is up to 2.6 times higher than expected"*, causing *"up to 15 dB higher sound levels"* (NSW Legislative Council 2009, Van den Berg 2003).

11.2.3 Diseases

Pierpont also raises the concern of humans developing diseases due to close proximity to wind farms. Pierpont makes reference to vibroacoustic disease (VAD), arguing that the disease is caused by long-term exposure to low-frequency noise, most of which cannot be heard.

Aside from noise impacts, other perceived health concerns associated with wind farms include:

- shadow flicker;
- blade glint;
- blade throw;
- exacerbation of pre-existing health conditions and mental illnesses; and
- diminished wellbeing, such as depression and anxiety, due to the above impacts, as well as community division and other social impacts.

Pierpont raises the concern of exacerbated illnesses due to shadow flickering. Shadow flicker refers to the strobing effect caused by wind turbine blades blocking the sun as the blades rotate. Pierpont believes this to cause some people to become dizzy, lose their balance, or become nauseated. Furthermore, Pierpont states that *"people with a personal or family history of migraine, or migraine-associated phenomena such as car sickness or vertigo, are more susceptible to these effects... and has the potential, like other flashing lights, to trigger seizures in people with epilepsy"* (Pierpont 2006). Refer to **Chapter 17** for further details and mitigation measures relating to shadow flicker.

Concern is also given to the indirect health and safety impacts caused by wind farms, such as 'dizziness and spatial disorientation' from shadow flicker and blade glint that are 'hazardous while driving' (Pierpont 2006).

Blade throw is a potential public safety hazard involving a rotor blade dropping or being thrown from the nacelle of the wind turbine.

11.2.4 Stress-related issues

Issues surrounding local communities' sense of helplessness, powerlessness and stress from the development process of the wind farm project and/or the presence of wind farms in rural communities have also been noted in the literature and raised in wind farm planning hearings. These concerns are linked with depression and disruption to place-related identity (NSW Legislative Council 2009, Pierpont 2006).

The Public Health Association of Australia (PHAA) recommends *"effective early community consultation and engagement as the key to preventing misinformation and community division in deployment of renewable energy developments..."*

11.3 Review of the evidence

11.3.1 National Health and Medical Research Council Report 2010

The National Health and Medical Research Council (NHMRC) published a landmark study, *Wind Turbines and Health* (2010) (the NHMRC Report), which tested the hypothesis 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"* (NHMRC 2010). The NHMRC is Australia's peak body for supporting health and medical research; for developing health advice for the Australian community, health professionals and governments; and for providing advice on ethical behaviour in health care and in the conduct of health and medical research. The Federal Health Council (the precursor to the National Health and Medical Research Council) was established in 1926 following a Royal Commission's recommendations.

The NHMRC conducted a comprehensive investigation of the current literature and scientific data on wind farm-related effects on human health, and found that the hypothesis was tested positive. A key finding of the NHMRC Report was that:

"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 health" (NHMRC 2010).

This contention is supported by the WHO, which states that *"Wind energy is associated with fewer health effects than other forms of traditional energy generation and in fact would have positive health benefits"* (WHO 2004). Furthermore, WHO, in its Energy, Sustainable Development and Health study, also found that: *"In relation to all sources of energy, the health effects associated with wind energy are negligible"* (WHO 2004).

The ExternE Project referenced in this study considers wind energy *"to have the lowest level of impacts (health and environmental), of all the fuel cycles considered"* (CIEMAT 1998 cited in WHO 2004).

11.3.2 The Social and Economic Impacts of Rural Wind Farms Senate Inquiry 2011

A Community Affairs References Committee (the Committee) was established by the Australian Senate to investigate any adverse health effects for people living in close proximity to wind farms and the economic impact of rural wind farms. The Committee received more than 1,000 submissions, many letters and other documents, and had reviewed published information on the topic. Public hearings were held in 2011 in Canberra on 25 March and 17 May, Ballarat on 28 March 2011, Melbourne on 29 March and Perth on 31 March. The Committee conducted site visits to the Waubra and Hepburn wind farms in Victoria on 28 March 2011. The report, *The Social and Economic Impacts of Rural Wind Farms* was released in June 2011 (the report).

The Committee was unable to establish a direct link between the noise generated by wind farms and negative impacts on human health. However, the report recommends that the NHMRC should continue to review the research into wind farm health effects.

The Committee did not support a mandatory setback distance around wind farms, instead labelling it 'arbitrary' and preferred to apply setback distances using scientific measurements of sound effects.

11.3.3 Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill Inquiry 2012

The Commonwealth Senate was introduced to the *Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012* (the bill) in June 2012. The Senate referred the provisions of the bill to the Environment and Communications Legislation Committee (the Committee) for inquiry and report in October 2012.

The bill seeks to amend the Renewable Energy (Electricity) Act 2000 (Act) to give powers to the Clean Energy Regulator that *"ensure that accredited power stations that are wind farms, either in whole or in part, do not create excessive noise"*(Environment and Communications Legislation Committee, 2012).

Although the Committee recommended that the bill not be passed, it made a number of conclusions and recommendations in relation to the information presented on wind farms and health impacts, discussed in the following chapters.

The Committee acknowledged the concerns of residents, who need to understand whether there may be health impacts of existing wind farms in their area, or of a proposed wind energy facility in their district.

Individual witnesses, and some organisations, reported to the committee a range of symptoms they said were being experienced by people living up to ten km away from wind farms. The most common reported complaint was sleep disturbance.

A key finding was that there is no scientific evidence to suggest that noise created by wind turbines affects human health. The Committee concluded however that it is premature to introduce regulatory changes such as those in this bill prior to the release of the NHMRC's further assessment in 2013 on wind farms and health impacts.

11.4 Findings

11.4.1 Noise impacts on health

A key issue amongst the health concerns associated with wind farm developments is impacts relating to noise. Wind turbines produce mechanical noise from the motor or gearbox, as well as aerodynamic noise, produced by wind passing over the blade of the wind turbine. As well as the general range of sound emissions, older wind turbines also generate infrasound (NHMRC 2010).

The NHMRC Report noted that, "*there is no reliable evidence that sounds below the hearing threshold produce physiological or psychological effects"* (Berglund 1995 cited in NHMRC 2010). The Minnesota Department of Health (2009) found that *"if functioning correctly, mechanical noise from modern wind turbines should not be an issue"* (MDH 2009 cited in NHMRC 2010). Dr Mark Diesendorf, the Deputy Director of the Institute of Environmental Studies at the University of NSW, states that *"infrasound was a problem with older wind turbine technology"* (NSW Legislative Council 2009), and that infrasound is *"virtually undetectable at a range of 400 metres"* (NSW Legislative Council 2009).

Recently, the NSW Health Department was consulted regarding the proposed Bodangora and Collector Wind Farm projects. Both of these projects are now approved. The Department's comments were noted in the NSW Government Planning Assessment Commission's Determination Reports for Bodangora and Collector Wind Farms on 30 August 2013 and 2 December 2013 respectively.

In relation to the Bodangora Wind Farm (33 turbines) and the Collector Wind Farm (55 turbines), the NSW Health Department stated that:

- *"there is no published scientific evidence to link wind turbines with adverse health effects"*
- *"noise from turbines may cause some disturbance to people living in close proximity (less than 700 metres from the turbines)… but that the 2km buffer distance provided in [each] instance was considered to be very conservative and precautionary from a health perspective"*
- *"there is no reliable evidence that sound below the hearing threshold produces physiological or psychological effects"*, which is consistent with the advice of the World Health Organisation, refer to **Chapters 11.4.2** – **11.4.4** below (NSW Health Department cited in NSW Planning Assessment Commission 2013a and NSW Planning Assessment Commission 2013b)

The Senate's Communications Legislation Committee (2012) *"did not find a causal link between the relatively low levels of noise that are produced by wind farm noise and the symptoms reported by those living near wind turbines"*.

The Community Affairs References Committee recommended in their report (June 2011) that the noise standards adopted by the states and territories for the planning and operation of rural wind farms should include appropriate measures to calculate the impact of low frequency noise and vibrations indoors at impacted dwellings.

The Public Health Association of Australia (PHAA) released a position statement, *Human Health Effects of Wind Turbines* (2011), in response to acoustic health effects of wind turbines that have been raised as an issue in the media. The key statements made by the PHAA are:

- *Renewable forms of energy, such as solar and wind, appear to be associated with relatively low adverse health effects.*
- *Reviews of the literature to date have failed to identify any adverse physiological effects attributed to exposure to wind turbines, with the exception of those mediated by noise in a small proportion of exposed people, in whom symptoms may be related to perception, annoyance and pyscho-sociological factors.*
- *There is no evidence to date to suggest that infrasound has significant effects on human health via physiological mechanisms at the low pressure levels generated by wind turbines.*

Importantly, it is noted in the Communications Legislation Committee's report (2012) that health effects from wind farm noise result from the same mechanisms as from other sound sources such as aviation noise, road traffic noise or nightclub or neighbourhood noise.

11.4.2 Infrasound impacts on health

A survey (Jakobsen 2005) of all known published results of infrasound from wind turbines found that *"wind turbines of contemporary design, where rotor blades are in front of the tower, produce very low levels of infrasound"* (Jakobsen 2005 cited in NHMRC 2010).

The Communications Legislation Committee (2012) concluded that, while it is possible that the human body may detect infrasound in several ways, there is no evidence to suggest that inaudible infrasound is creating health problems.

It should be noted that infrasound is constantly present in the environment, caused by various sources such as ambient air turbulence, ventilation units, ocean waves, distant explosions, volcanic eruptions, traffic, aircraft and other machinery (Rogers, Manwell & Wright, 2006 cited in NHMRC 2010).

Indeed, Van den Berg (2003) acknowledges that the level of infrasound generated by wind turbines does not cause serious problems for human health. He found that *"even though wind turbines did produce an appreciable amount of infrasound, the level was so far below the average human hearing threshold that it could not be a large scale problem"* (Van den Berg 2003, p.4).

Similarly, an Independent Expert Panel recently established by the Massachusetts Department of Environmental Protection (MDEP) and the Massachusetts Department of Public Health (MDPH) found that *"There is insufficient evidence that the noise from wind turbines is directly (i.e. independent from an effect on annoyance or sleep) causing health problems or disease)"* (MDEP & MDPH 2012). The report findings showed that the levels of infrasound produced by modern wind turbines at distances as close as 68 metres are well below the levels required for non-auditory perception (feeling of vibration in parts of the body, pressure in the chest, etc.).

11.4.3 Infrasound Measurements from Wind Farms and Other Sources study

An Australian study, *Infrasound Measurements from Wind Farms and Other Sources* (November 2010), was commissioned by Pacific Hydro to measure and compare infrasound levels from wind farms and common environment infrasound sources, both natural and man-made. The noise measurements were recorded for Pacific Hydro by an independent acoustic consulting firm, Sonus Pty Ltd.

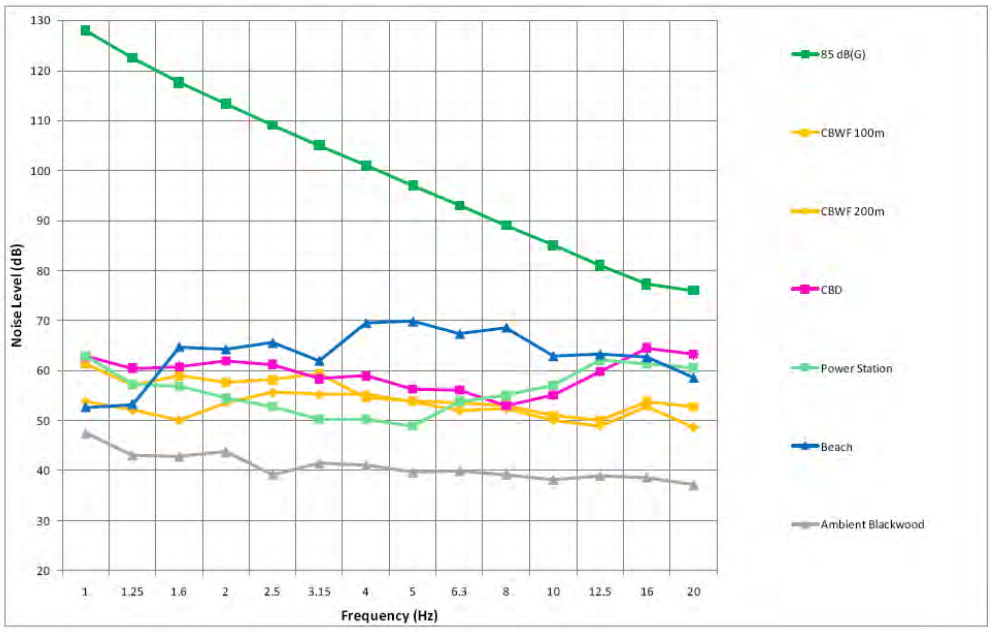
Infrasound was measured at two of Pacific Hydro's Australian wind farms, Clements Gap in South Australia and Cape Bridgewater in Victoria (both while operating and while the turbines were switched off). Infrasound was also measured at a beach, a cliff top along the coastline, in the Adelaide CBD close to two busy roads, and in an Adelaide suburb in close proximity to a gas-fired power station.

The methodology involved measurements being conducted below the ground surface in a test chamber. Testing confirmed that the levels of infrasound above the ground and within the chamber were the same in the absence of surface winds as when measuring a known source of infrasound.

The results determined that infrasound is not unique to wind farms. Furthermore, the levels of infrasound produced by wind turbines is well below perception thresholds and is also below levels produced by other natural and man-made sources (Pacific Hydro 2010). One of the highest levels of infrasound that was recorded was at a beach.

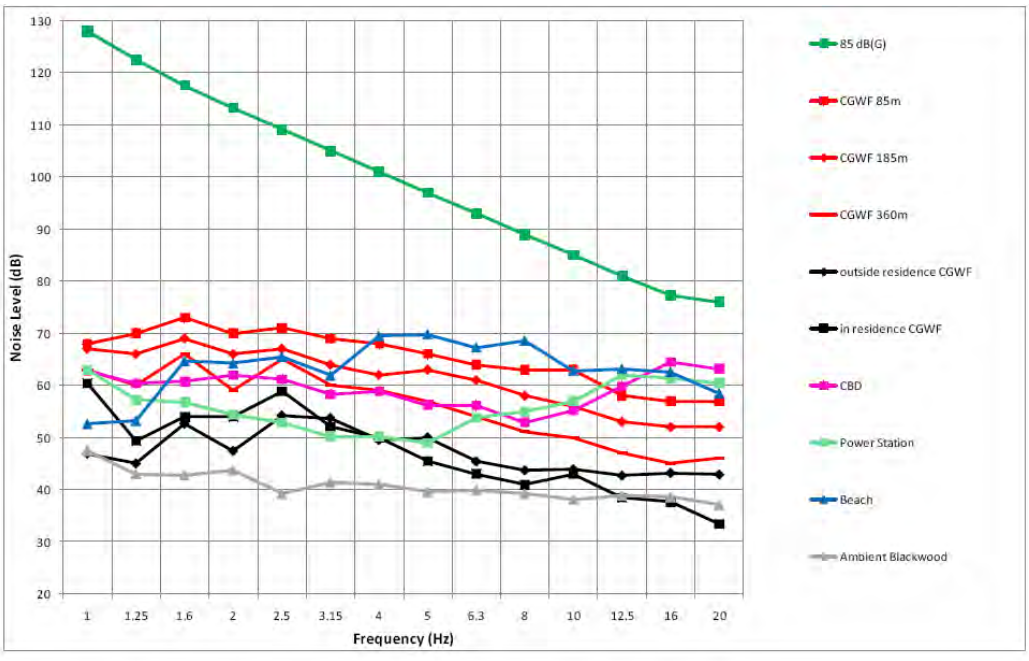
A summary of the results of the infrasound measurement results at the wind farms and at different sources are shown below against the perception threshold for infrasound established in international research as 85 dB(G) (refer to **Figures 43** and **44**)

Figure 43 Summary of Measurements Cape Bridgewater Wind Farm



Source: Infrasound Measurements from wind farms and other sources, Pacific Hydro 2010

Figure 44 Summary of Measurements Clements Gap Wind Farm



Source: Infrasound Measurements from wind farms and other sources, Pacific Hydro 2010

The study found that infrasound was recorded at higher levels on the beach and in the Adelaide CBD than near a wind turbine. The results at all of the sites came under the internationally recognised levels a human can perceive infrasound, which is 85 decibels - on a "G-weighted" scale standardised for the infrasound frequency range.

Pacific Hydro's study reinforces several international studies that infrasound emissions from wind farms are well below the hearing threshold and are therefore not detectable to humans. Further they are less than other areas where people spend extended periods of time, such as the beach or CBD.

11.4.4 Other recent infrasound research

Another recent study, *Wind turbines: does infrasound affect health?* published by the Bavarian Environment Agency in Germany in 2012, has found that wind turbines do not generate infrasound at a level that would damage human health (EWEA 2012). The study concludes that *"Wind energy structures generate infrasound which is far below normal human hearing and perception, which is why it cannot cause any damage to people"* (EWEA 2012).

Noise produced by wind turbines has significantly decreased over the last decade as turbine technology has advanced (NWCC 2002 cited in ODH 2008). The NHMRC study identifies that noise levels from a modern 10-turbine wind farm falls in the 35-45 dB range at a close distance of 350 metres both day and night. This represents sound levels similar to a quiet bedroom (35 dB), and only slightly higher than night time background noise levels in the countryside (20-40 dB) (SDC 2005 cited in NHMRC 2010). Infrasound is problematic to humans only if dB levels are high (greater than 115 dB) (ODH 2008).

In another study, the University of Auckland examined whether infrasound generated by wind turbines causes adverse health effects. They described their method as follows:

"A sham-controlled double-blind provocation study, in which participants were exposed to 10 minutes of infrasound and 10 minutes of sham infrasound, was conducted. Fifty-four participants were randomised to high- or low-expectancy groups and presented audiovisual information, integrating material from the Internet, designed to invoke either high or low expectations that exposure to infrasound causes specified symptoms" (Crichton, 2013).

They concluded that:

"Healthy volunteers, when given information about the expected physiological effect of infrasound, reported symptoms that aligned with that information, during exposure to both infrasound and sham infrasound. Symptom expectations were created by viewing information readily available on the Internet, indicating the potential for symptom expectations to be created outside of the laboratory, in real world settings. Results suggest psychological expectations could explain the link between wind turbine exposure and health complaints" (Crichton, 2013).

Please refer to **Chapter 10 – Noise Impacts** for a more detailed discussion on noise.

11.4.5 Vibroacoustic impacts on health

Scientific evidence details Vibroacoustic Disease as *"the clinical manifestation of a systemic disease that develops after long-term exposure to noise (≥1 0 yr) which is characterized by large pressure amplitude (≥90 dB SPL) within the lower frequency bands (≤500 Hz)"* (Branco & Rodriguez 1999).

In relation to concerns regarding Vibroacoustic Disease, the NSW Legislative Committee (2009) found that *"there does not appear to be any evidence to support the proposition that vibrations from wind turbines can cause this disease"* (NSW Legislative Committee 2009). As discussed above, noise produced by wind turbines is less than 90 dB.

11.4.6 Wind turbine syndrome

The existence of 'Wind Turbine Syndrome' is debatable and insufficient evidence has been presented to justify its existence as a health issue (NSW Legislative Committee 2009). While Nina Pierpont's research has been heavily drawn upon, the credibility of her work is questioned by scientists, particularly by acoustic specialists (NHMRC 2010).

Pierpont's reports were not published in peer-reviewed journals, the sample sizes used in the research are particularly small, and the conclusions are largely drawn from anecdotal evidence. The latter is known to be particularly unreliable and holds very little weight in medical circles. In addition, it is noted that *"many of the participants in Dr Pierpont's study had pre-existing medical conditions that may distort her findings"* (NSW Legislative Council 2009).

The Independent Expert Panel for MDEP and MDPH recently reviewed the literature surrounding this Syndrome and found that "*there is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a 'Wind Turbine Syndrome'"* (MDEP&MDPH 2012).

The Communications Legislation Committee (2012) concurred that recurring claims of a wind turbine syndrome, for which there is no peer-reviewed evidence, are "*obscuring the focus on assisting properly the small number of people whose cases do need attention"* (Communications Legislation Committee, 2012).

11.4.7 Shadow flicker and electromagnetic impacts on health

The NSW Legislative Committee (2009) also states that no experience of unreasonable or dangerous shadow flicker occurring in NSW as a result of wind farms has been presented. Shadow flicker occurs only in some places for a few days of the year, and occurs usually at sunrise or sunset for a few days of the year when the sun is in that position (NSW Legislative Council 2009). The report recommends that "*because shadow flicker can be predicted… wind turbines could simply be switched off for the period it was expected to occur"* (NSW Legislative Council 2009).

Please refer to **Chapter 17 – Shadow Flicker Impacts** for more information on the potential shadow flicker impacts arising out of the project.

The EPHC *Draft National Wind Farm Development Guidelines* maintain that risks such as epileptic seizures and the distraction of drivers as a result of shadow flicker are 'negligible' (EPHC 2009 cited in NSW Legislative Council 2009), for the following reasons:

- *Less than 0.5% of the population are subject to epilepsy at any one time, and of these, approximately 5% are susceptible to strobing light;*
- *Most commonly (96% of the time), those that are susceptible to strobe lighting are affected by frequencies in excess of 8 Hz and the remainder are affected by frequencies in excess of 2.5 Hz. Conventional horizontal axis wind turbines cause shadow flicker at frequencies of around 1 Hz or less;*
- *Alignment of three or more conventional horizontal axis wind turbines could cause shadow flicker frequencies in excess of 2.5 Hz; however, this would require a particularly unlikely turbine configuration (EPHC 2009 cited in NHMRC 2010).*

The electromagnetic fields produced by the wind farm also do not pose a threat to public health, as *"the closeness of the electrical cables between wind turbine generators to each other, and shielding with metal armour effectively eliminate any EMF"* (AusWEA cited in NHRMC 2010).

11.4.8 Impacts on psychological wellbeing

The Panel hearing for the Oaklands Hill Wind Farm (Victoria) proposal addressed the effects that *"unwanted proposals and the approval processes can have on stress levels and psychological wellbeing"* (DPCD 2008). The Panel concluded that they were not presented with any substantive evidence of a public health risk.

The Victorian Bald Hills Wind Farm Panel acknowledged that, *"it is almost impossible to propose a project of the scale of a wind farm, and not cause some polarisation of views and disruption in the affected community*" (DPCD, 2004).

Both Panels consider that the social harm generated would not be of a significantly adverse or lasting nature such that it was required to be considered in an assessment of environmental effects or a planning decision.

The impact of wind farms on the well-being of communities in NSW *"may be compounded by other issues raised, such as concerns associated with the planning process and the perception that community consultation is a tokenistic exercise that does not genuinely incorporate community concern"* (NSW Legislative Council 2009). The NSW Legislative Council (2009) acknowledges that there is an *"increased chance of being annoyed by wind farms in rural areas and if there is a pre-existing negative attitude to wind farm noise or the visual aspects of wind farms"*.

People who are opposed to wind farm projects in their local area may become anxious, causing stress related illnesses, which are genuine health effects arising from their worry (NHMRC 2010). However, these are not direct impacts of the wind turbine itself (NHMRC 2010). The NHMRC found that people who benefit economically from wind turbines were *"less likely to report annoyance, despite exposure to similar sound levels as people who were not economically benefiting"* (NHMRC 2010).

The NHMRC (2010) and NSW Legislative Council Report (No.5, 2009) indicate that a thorough and high-quality public consultation process may help to address the concerns of the relevant communities, as well as help to gain confidence and support for wind farm projects and avoid stress and anxiety in the process.

The Independent Expert Panel for MDEP and MDPH (2012) found that *"Most epidemiologic literature on human response to wind turbines relates to self-reported "annoyance," and this response appears to be a function of some combination of the sound itself, the sight of the turbine, and attitude towards the wind turbine project"*. The Panel recommends that measures taken to directly involve residents who live in close proximity to a wind turbine project serve to reduce the level of annoyance.

A recent scientific study has further examined the link between wind farms and health impacts.

The University of Sydney in March 2013 released a public health study that examined the historic (1993 – 2012) incidences of health complaints associated with all 49 Australian wind farms. They noted that "*florid allegations about health problems arising from wind turbine exposure (were) now widespread in parts of rural Australia and on the internet"* (Chapman, 2013). They found that 63% of Australian wind farms including 50% of those with a turbine size of greater than 1MW have never been subject to noise or health complaints and that Western Australia has no reported complaints Chapman, 2013).

The study further found that:

"Only 120 individuals across Australia representing approximately 1 in 272 residents living within 5km of wind farms appear to have complained, with 81 (68%) of these being residents near 5 wind farms which have been heavily targeted by anti-wind farm groups. About 1 in 107 of those living near turbines >1MW have ever complained. The large majority (82%) of health and noise complaints commenced after 2009 when anti-wind farm groups began to add health concerns to their wider opposition. In the preceding years, health or noise complaints were rare despite large and small turbined wind farms having operated for many years".

They study concluded that *"In view of scientific consensus that the evidence for wind turbine noise and infrasound causing health problems is poor, the reported spatio-temporal variations in complaints are consistent with psychogenic hypotheses that health problems arising are 'communicated diseases' with nocebo effects likely to play an important role in the aetiology of complaints"*.

The study therefore suggests that wind farms may be harmless, and it is the expectation of harm from those living in proximity of the project that causes actual harm.

This study adds weight to an evolving view that the health impacts historically associated with wind farms have more to do with an opponent's worry and negative thoughts associated with the project and planning process, rather than any direct impact from the wind farm itself.

This phenomenon was evident in a famous planning dispute in Paris where residents blamed three installed mobile phone antennas in their area for causing headaches, nosebleeds, a metallic taste in their mouths, and a variety of other ills (Hamilton, 2009). The complaints continued until it was pointed out that the antennas were never activated (Hamilton, 2009).

11.4.9 Blade throw

DoPI refers to blade throw in the *Draft NSW Wind Farm Planning Guidelines*, and requested wind farm proponents to have regard to this potential safety hazard.

In relation to blade throw, the draft Guidelines state:

The risk of 'blade throw' – involving a wind turbine's blades breaking or being ejected during operation – should be considered. Relevant considerations may include (but are not limited to):

- *whether the proposed turbines are certified against relevant standards such as IEC 61400-23 Wind turbine generator systems – Part 23: Full-scale structural testing of rotor blades or other equivalent standards - evidence of any such certification should be provided,*
- *overspeed protection mechanisms including 'fail safe' mechanisms (e.g. back up (battery) power in the event of a power failure),*
- *operational management and maintenance procedures including any regular maintenance inspections,*
- *provisions for blade replacement in the event a blade fault is identified (e.g. during a periodic inspection),*
- *the separation distance between turbines, neighbouring dwellings and property boundaries, and*
- *the probability of blade throw occurring.*

Perceived safety issues surrounding blade throw relate specifically to the quality of the infrastructure. In extremely rare incidents, where improper design, manufacturing or installation has combined with strong wind gusts exceeding the design load of the turbine structure, turbine blades have collapsed and fell from the turbine.

The occurrence of blade throw can be defined as two types of infrastructure failure:

- The whole blade detaching from the rotor and falling away from the turbine; or
- Part of the blade breaking off and falling away from the turbine;

Occurrences of these two scenarios could be caused by the factors below:

- Design or manufacturing defect;
- Poor maintenance regime;
- Excessive winds during a storm;
- Exceeding maximum design loads;
- Rotor over-speed; or
- Lightning or fire.

Technological improvements and mandatory safety standards in turbine design, manufacturing, and installation as well as more frequent maintenance have made the occurrence of blade throw 'extremely rare' (NYSERDA 2005). Modern wind turbines are designed to international engineering standards which include ratings for weather events and hurricane-strength winds (AWEA 2012).

The risk of human injury or fatality by a wind turbine blade or debris at any range from a wind turbine is extremely low compared to other commonly accepted risks in the society. Even if a blade was to detach from the turbine, the chance of a person being underneath the turbines in what is a rural area, at that exact point in time, is extremely low.

The proponent seeks to protect the safety of the local area by utilising turbines models that meet the aforementioned standards in order to ensure that the wind farm operates safely in proximity to people and buildings.

The data from the preferred turbine manufacturer for this project shows that the probability of an individual being impacted by debris from a wind turbine in any given year at a distance of 1.1 x tip height, assuming 24 hour occupancy (i.e. a residence), is 1 in over 1 million (Vestas Wind Systems 2012). The probability of this occurrence decreases exponentially as the distance from the turbine increases (Vestas Wind Systems 2012).

Turbine setback distances of 1.1 x tip height is well within the setback distances required to achieve compliance for the quantitative predictions such as noise and shadow flicker. Therefore CDPL has ensured that through the design of the proposed turbine layout there are no dwellings within 1.1 x tip height of any wind turbine.

The probability of blade throw occurring to modern turbines by reputable turbine manufacturers are extremely low as manufacturers have improved their designs to incorporate over speed protection and built-in redundancies, fire detection, more effective maintenance regime, protection against lightning, and more consistent manufacturing processes. Turbines automatically shut down at certain wind speeds and terminate operation if significant vibrations or rotor blade stress is sensed by the monitoring system. In the rare occurrences where blades have failed, the failure typically results in components falling straight to the ground.

The Victorian Oaklands Hill Wind Farm Panel found that while there have been instances of structural failure in turbine blades and structures, a tower or blade collapse is extremely rare, given technological advances and *"the small amount of time that any person would spend at an unlucky spot within the range of potential debris from a rare structural failure, the risk of human impact would be miniscule"* (DPCD 2008).

Refer to **Chapter 11.6** below for the proposed measures to mitigate potential health risks caused by blade throw.

11.5 Conclusions

Following a review of the current literature and scientific data, the NHMRC, Australia's preeminent medical research body, found as recently as 2010 that *"there is currently no published scientific evidence to positively link wind turbines with adverse health effects"* (NHMRC 2010). Based on current evidence, modern wind farms do not pose a threat to human health and safety as long as current planning guidelines are followed (NHMRC 2010).

The scientific findings from measured levels of sound and infrasound demonstrate that impacts upon residences within close proximity of a wind turbine are negligible and that a buffer of 2km between sensitive receptors and a wind turbine is not justified in terms of potential health impacts.

As a result of this evidence, the project is not considered to have any likely adverse health impacts on the local community and neighbouring residents. Moreover, UFWA is committed to undertaking an appropriate level of community consultation at all stages of the project, in order to appropriately inform and involve the public in the development of the project, and respond to any gaps in knowledge or misinformation regarding wind farms and the project.

11.6 Mitigation

The following measures are recommended to mitigate and negate any health related impacts of the project:

- Provide accessible information on wind farm impacts including the benefits, and project details, process and updates.
- Install warning signs to alert the public against unauthorised site entry.
- Restrict access to the wind turbines and associated infrastructure to reduce personal injury and public hazards, including locked access to towers and electrical equipment, warning signs with postings of 24-hour emergency numbers, and fenced storage yards for equipment and spare parts.
- The wind generator blades, tower and nacelle are to be treated/painted with a non-reflective white or off white colour to reduce glare and minimise blade glint.
- Noise levels should comply with the applicable noise guidelines, unless an agreement is in place with the effected landowner(s), and in any case should not be more than the 45dB(A) noise limit (for indoors) recommended by the World Health Organisation (WHO) publication *Guidelines for Community Noise*.
- Shadow flicker at any dwelling should not exceed 30 hours per year unless an agreement is in place with the effected landowner(s).
- Wind turbines to be equipped with sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
- Regularly maintain and service all wind turbines.

In relation to blade throw, a number of measures are proposed for the project. Each turbine model considered for this project would be certified against the relevant standards including:

- IEC 61400-23 [Wind turbine generator systems, Full-scale structural testing of rotor blades]; and
- IEC 62305-1 / 3 / 4 [Protection Against Lightning].

Lighting protection systems are incorporated into the blade designed to reduce the risk of damage from lightning strikes to the blades. The safety systems are designed to initiate a shutdown of the turbine upon detection of failure.

The operational and maintenance contracts of the turbines provide incentives to maximise the output of the wind farm. The maximum output is achieved through rigorous maintenance regime to ensure the turbines are operating at full efficiency, and this includes mitigating and repairing any degradation to the blades to keep generation at optimum levels.

Additionally, the use of fencing and signage will discourage unauthorised access to the wind turbines, which would further reduce the risk of blade throw incidences.

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WIND AUSTRALIA

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PALING YARDS WIND FARM

CHAPTER 12

FLORA & FAUNA IMPACTS

12 Flora and Fauna Impacts

12.1 Introduction

Anderson Environmental Consultants Pty Ltd was engaged by UFWA to assess the potential flora and fauna impacts of the project. The flora and fauna impact assessment report can be found at **Appendix 8a**. Following the preparation of Anderson Environmental's report, Environmental Management Resources Australia Pty Ltd (ERM) was engaged by UFWA to undertake additional field surveys and assessments and prepare a supplementary flora and fauna impact assessment report in May 2013 to address adequacy review comments from DoPI. The flora and fauna impact assessment report by ERM can be found at **Appendix 8b**. These reports should be read in combination, and where the same issues are addressed, the ERM report should be considered as the most up to date information which has informed the mitigation measures and requirements, including offset requirements.

The relevant sections of the Anderson Environmental report are summarised in **Chapter 12.2** and the ERM supplementary report is summarised in **Chapter 12.3** below.

The original assessment by Anderson Environmental was undertaken to determine the presence or potential presence within the site, particularly within the development footprint, of any threatened species, populations or endangered ecological communities as listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act) and the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) (EPBC Act) and to address the DGRs relating to flora and fauna. The survey and results of the survey for the Targeted Threatened Species Assessment was undertaken for a range of threatened species as outlined in Appendix E of the flora and fauna report at **Appendix 8a**.

ERM's supplementary flora and fauna assessment of the project was undertaken to specifically address the adequacy review comments from DoPI in May 2013 in relation to methodology, avoidance measures, assessment of impacts, bird and bat impacts, mitigation and offset requirements. The comments have been addressed in the full report at **Appendix 8b** and are summarised in **Chapter 12.3** below.

12.2 Anderson Environmental Assessment

12.2.1 Methodology

A literature review was carried out by Anderson Environmental Consultants Pty Ltd in order to assist in the identification of threatened flora and fauna species and endangered ecological communities listed under the TSC Act and the EPBC Act which have the potential to occur in the area of the site. The literature review was based on database searches of:

- NPWS Wildlife Atlas for the Oberon and Upper Lachlan Local Government Areas;
- EPBC online Protected Matters database search tool for the Oberon and Upper Lachlan Local Government Area; and
- NPWS (2000) Forest Ecosystem Classification and Mapping for the Southern CRA region, Volumes I and II.

The field surveys were based on the following methodology;

- Initial site familiarisation to determine potential ecological issues in relation to turbine cluster sitings, access tracks and access roads.
- Field surveys to identify habitat types, condition and potential level of impacts.

- Field surveys to identity vegetation types, condition and potential level of impacts including targeted threatened plant surveys. This entailed a modified random meander approach of transects through the vegetation and paddock areas. This approach allows for the easy identification of vegetation community types and boundaries and is particularly suited to areas where the quality of vegetation varies. The four Transmission Routes were assessed based on the mapping provided with regard to minimising the ecological impacts.
- Mapping of vegetation community units on aerial photographs. This was undertaken concurrently with the field surveys to identify the vegetation types.
- Mapping of habitat types on aerial photographs. This was undertaken concurrently with the field surveys to identify the vegetation types.

The approach used by ERM in the supplementary flora and fauna impact assessment varies from the methodology outlined above. Refer to ERM's methodology at **Chapter 12.3.1** below, which addresses DoPI comments and the Threatened Species Survey and Assessment Guidelines.

12.2.2 Existing conditions

The assessment by Anderson Environmental Consultants Pty Ltd found that the site is generally cleared for sheep and cattle grazing with remaining native vegetation located mostly on the slopes where the soil condition and quality has no value for grazing activities.

The site contains a combination of good quality agricultural and poorer quality agricultural soils. The type and quality of vegetation present on site and the areas of land cleared for farming reflects these soil types. All of the better quality lands have been cleared and used for agriculture and have been pasture improved. The surrounding poorer quality land has been either cleared with little or no pasture improvement or has been retained as timbered country.

The site is bordered by National Parks and uncleared land to the south-east, all of which are heavily vegetated. The area surrounding the proposed wind farm site consists predominantly of large rural properties and National Parks.

12.2.3 Results

The results of the literature review and background searches by Anderson Environmental Consultants Pty Ltd revealed that a number of endangered ecological communities and threatened flora and fauna species listed under the EPBC Act and/or TSC Act that have the potential to occur at the site.

Refer to the flora and fauna report at **Appendix 8a** for the full list of species with the potential to occur on site.

Each threatened species which was considered likely to have the potential to occur on site and to be potentially impacted by the project was further assessed in accordance with:

- the criteria contained in the EPBC Act in the case of species listed under the EPBC Act; and
- the 7-Part Tests of Significance criteria in the case of species listed under the TSC Act.

The results are outlined in the sections below.

12.2.4 Flora results

The results of the field surveys detected no Endangered Ecological Communities or individual threatened flora species listed under either the EPBC Act or the TSC Act within the site apart from the State 2 (Box Gum Grassy Woodland State and Transition Model) which is protected by the conservation agreement applying in the Paling Yards property.

In order to avoid impacts on the State 2 (Box Gum Grassy Woodland State and Transition Model), it is no longer proposed to construct turbines P2, P6, P7 and their associated access tracks and crane hard stand.

The wind farm has been designed to be situated mainly on cleared grazed paddock areas, therefore avoiding as far as possible potential ecological impacts to the extent practicable.

Refer to the summary of ERM's flora findings at the site, including the Biometric Vegetation Types, in **Chapter 12.3.2** below.

12.2.5 Remnant native vegetation

The areas of native forest vegetation remaining within the site are described in the report at **Appendix 8a** and summarised under the following headings.

Refer to **Figure 45 – Vegetation Site Plan** and **Figure 46 – Vegetation Plan - Changed Area** for the locations of the different remnants, the project infrastructure, and the changes to the project in order to avoid and minimise impacts on flora and fauna. The mapping of remnant native vegetation by Anderson Environmental Consultants Pty Ltd focused on forested and bushland areas, and other areas of recognised flora communities. Refer to the summary of ERM's additional flora findings at the site, including the Biometric Vegetation Types, in **Chapter 12.3.2** below.

Remnant A

Remnant A comprises tracts of bushland to the southeast and west of the Abercrombie River. No removal or disturbance of this vegetation is proposed.

This remnant represents the Box Gum Woodland which is the subject of the conservation agreement and is located in the south-west of the 'Paling Yards' property within the site. The Box Gum Woodland is listed as a Critically Endangered Ecological Community under the EPBC Act.

It was initially proposed to construct turbines P2, P6 and P7 within this remnant. However, in order to minimise impacts on the Box Gum Woodland, it is no longer proposed to construct turbines P2, P6 and P7 and these no longer form part of this application.

Accordingly, the project will not impact on Remnant A or any land subject to the conservation agreement.

Remnants B and C

Remnant B extends along the southern portion of the 'Paling Yards' property boundary within the site to the Abercrombie River. This area generally contains a poor quality soil type. The vegetation within this area is generally dominated by Red Stringybark (E. macrorhyncha), Long-leafed Box (E.goniocalyx), Brittle Gum (E.mannifera ssp maculosa) and Scribbly Gum (E.rossii with occasional E.sclerophylla). This vegetation community is not listed as an Endangered or Threatened vegetation community under either the EPBC Act or the TSC Act.

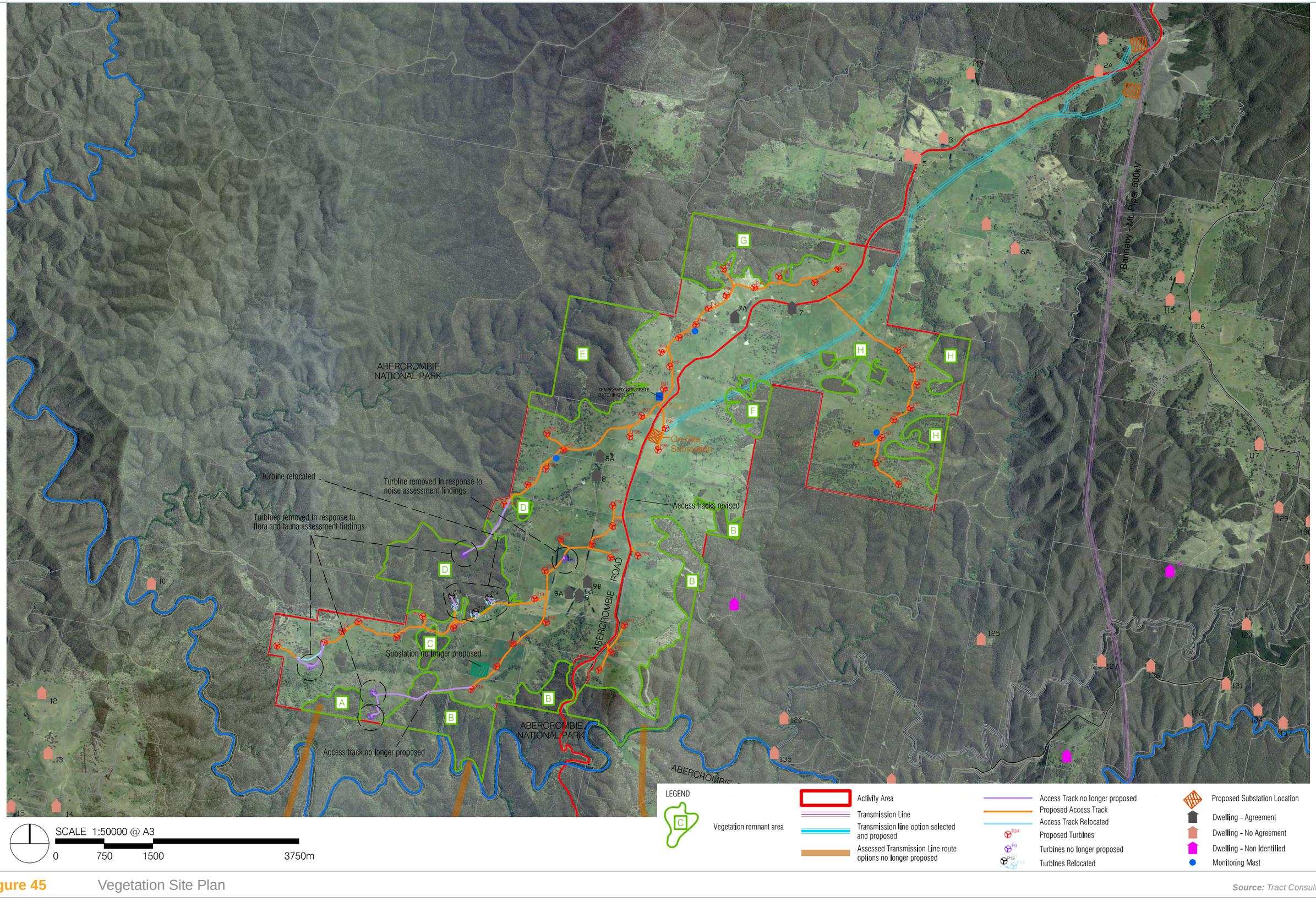


Figure 45 Vegetation Site Plan

Source: *Tract Consultants*

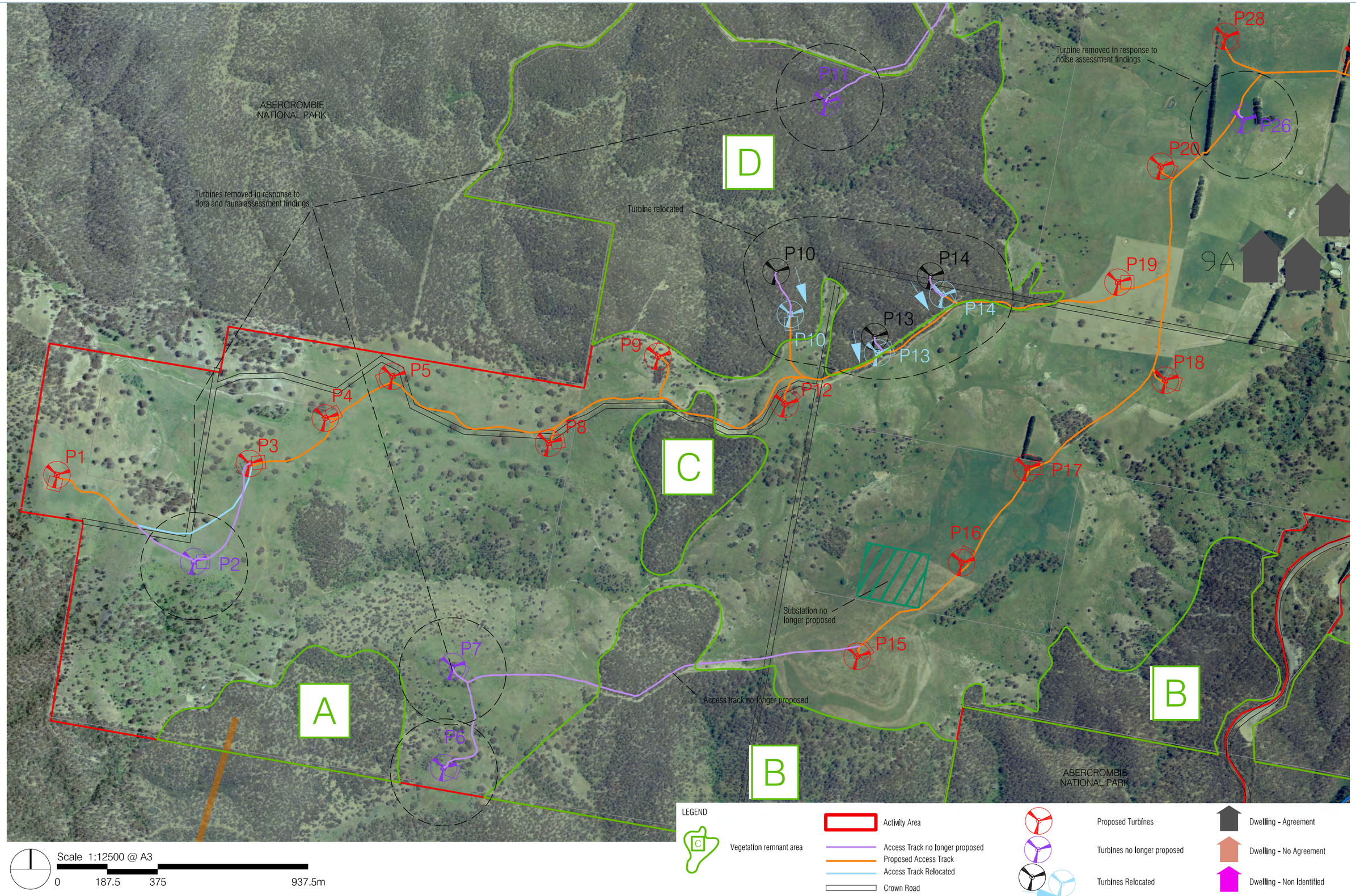


Figure 46 Vegetation Plan - Changed Area

Source: *Tract Consultants*

Remnant C contains the same vegetation type as Remnant B and would not be impacted significantly by the project. An access track would disturb a small part of the northern side of this remnant where there is an existing farm track traversing through the remnant area.

Remnant D

Remnant D comprises one area of vegetation located along the western boundary of the site extending to the west.

Most of this remnant is located on the 'Licking hole Soil Landscape'. This soil type is quite limiting to farming practices as it is extremely poor. It is not often cleared as it is not particularly conducive to agricultural use.

It contains Western Tablelands Dry Forest comprising Red Stringybark (Eucalyptus macrorhyncha), Broad-leafed Peppermint (Eucalytus dives), Brittle Gum (Eucalyptus mannifera), and Candlebark (Eucalyptus rubida).

This vegetation is not representative of an Endangered or Threatened vegetation community listed under either the EPBC Act or the TSC Act.

Turbines P10, P13 and P14 have been relocated from their original proposed locations within this remnant to now occur on the edge of this remnant area. Turbine P11 and its associated access track and temporary crane hard stand have been deleted from the layout. This redesign has considerably reduced the impacts on this vegetation.

Surveys of the proposed turbine location and access tracks detected no listed threatened species or endangered ecological communities. Turbine P11 had potential to cause impact to this remnant however this turbine has been deleted from the proposal and therefore the potential impact has been avoided.

Remnants E, F, G and H

Remnants E and G are one continuous remnant occurring along the western boundary of the property. These will not be impacted by the project. Remnants F and H occur on the eastern side of the property. Remnant F comprises tracts of vegetation to the east. Remnant H comprises several small polygons of vegetation left in the paddock areas.

None of these remnants would be impacted by the proposal.

12.2.6 Native vegetation removal

The extent of vegetation removal on the site required to facilitate the construction of the project infrastructure (including turbines, access tracks, crane hard stands, and substations) would be small relative to the size of the site. The mapping of remnant native vegetation by Anderson Environmental Consultants Pty Ltd focused on forested and bushland areas, and other areas of recognised flora communities.

Native vegetation disturbed as a temporary measure during construction would be rehabilitated as part of a Vegetation Management Plan. Anderson Environmental considers that the impacts of the project are not significantly higher than the levels of impact from the existing farm management practices of sheep grazing, cattle grazing, weed spraying, pasture improvement and low level timber collection. Refer to **Figure 45 – Vegetation Site Plan** and **Figure 46 – Vegetation Plan - Changed Area**.

The native vegetation removal and offset requirements were revised by ERM and are outlined in the supplementary Flora and Fauna report found at **Appendix 8b**. The native vegetation removal and offsets are summarised in **Chapter 12.3** of this report.

12.2.7 Transmission line impacts

The northern transmission route (option 4) represents the shortest path and would create the least ecological impacts of any of the options and is accordingly the proposed option for the construction of the transmission line. This option traverses predominantly cleared farming land which is maintained and consistent with the cleared grazing land found also on the site. Refer to **Figure 45 – Vegetation Site Plan**.

12.2.8 Fauna results

The results of the field surveys detected no threatened fauna within the site apart from the Gang Gang Cockatoo (Callocephalon fimbriatum) which is listed under the TSC Act as Vulnerable.

This species was detected in the woodland area near turbine P14. The Wedge-tailed Eagle (Aquilia audax) was also detected during the surveys (around the area of turbines P1-P8 and flying over the Abercrombie River) and, while not a protected listed species under the TSC Act or the EPBC Act, it represents a significant species.

The targeted surveys and detailed habitat assessment for the Gang Gang Cockatoo indicate that the area represents potential habitat and it is recommended that potential impacts be mitigated by avoiding potential nest hollows where practicable. However, no actual nests were located during the targeted survey.

The targeted surveys and detailed habitat assessment for the Wedge-tailed Eagle did not *identify any nest. Accordingly, this species is unlikely to be impacted by any clearing required for the wind farm and its associated infrastructure. Generally this species* was observed soaring well above the maximum turbine height, and often over the forested area to the north and the Abercrombie River area to the south which are not proposed to be impacted by the project.

The project is not considered to result in the breaking of any biodiversity or wildlife corridors and there will be no interruption to gene flow or wildlife movements.

The proposed use of many of the existing farm access tracks significantly reduces the levels of impact and there would be no impacts on riparian or instream habitats. As the land is already cleared where most of the infrastructure is proposed, there are considered to be no biodiversity corridor impacts. An Ecological Restoration Plan will be developed as part of the CEMP and will address the post-construction works to be undertaken to rehabilitate the areas that are disturbed as part of the construction works once construction is finalised.

Refer to the summary of ERM's additional fauna findings at the site in **Chapter 12.3.2** below.

12.2.9 Bird and bat strike

Andersen Environmental acknowledges that there is potential for bird and bat strike to turbine blades as part of any proposed wind farm development.

There are generally only two threatened bat species with potential to be impacted. These are the Common-bent Wing Bat and the Yellow-bellied Sheath-tailed Bat. Due to the characteristics of these species, the potential losses of bats as a result of impacts with turbines are likely to be 'extremely low'.

In relation to potential bird strike the main species with the potential to be impacted are high flying species such as raptors, waterbirds, owls and migratory species. There are no significant habitats for waterbirds present on site and only low quality potential habitat for migratory birds.

Therefore, the risk of collisions to waterbirds and migratory species is unlikely to be significant. No significant flocks of waterbirds were seen during the surveys undertaken.

The turbine blade movements result in lower air pressure being created around the blades, which can potentially cause Barotrauma to the lungs of the migratory bats in the vicinity of this sudden change in air pressure (Baerwald et al, 2008 cited in Anderson Environmental report).

Raptors, such as the Whistling Kite and Wedge-tailed Eagle, and owls have potential to be impacted as they spend time at similar heights to the rotor swept area. These raptors and owls have excellent sight and can detect the smallest of movements at ranges of up to 500 metres, and therefore the likelihood of these species not detecting large movements such as those of turbine blades is considered 'extremely low'.

Refer to the summary of ERM's assessment of potential bird and bat impacts at the site in **Chapter 12.3.2** and **12.3.3** below.

12.2.10 Conclusion

Anderson Environmental concluded that:

- The project is not likely to result in a significant impact on any endangered ecological community or species listed under the EPBC Act. Accordingly, the Project is not considered, for this reason, to require referral or approval under the EPBC Act.
- The project is not likely to result in a significant impact on any species listed under the TSC Act. Accordingly, there is no requirement for a species impact statement to be prepared.

The conclusions of the supplementary flora and fauna report prepared by ERM are summarised at **Chapter 12.3.3** below.

12.2.11 Mitigation

The following recommendations are made in the flora and fauna impact assessment report in relation to the implementation of the project.

Refer to **Chapter 12.3.6** below for the additional mitigation measures proposed by ERM in the supplementary Flora and Fauna report.

Bat Monitoring and Habitat Tree Inspections

Once the access roads and access tracks are pegged by surveyors potential hollow habitat trees (that require removal) should be identified by ecological survey. These trees should be stag watched at dusk using infra-red spotlights and anabat detectors to determine usage by any threatened microchiropteran bats. Accessible tree hollows that require removal should be inspected for fauna by infrared telescopic camera prior to removal to ensure that no species present in the hollow are harmed during removal.

Bird Monitoring and Bat Strike Monitoring

An additional baseline pre-commissioning survey should be undertaken at each turbine site during the spring/summer season. This would provide baseline data for the bird and bat strike monitoring study which should be undertaken during the first year of the operation of the wind farm.

The recording of calls utilising Anabat recorders would enable information such as time of flybys and also if any feeding buzzes are recorded. This would allow area usage

data to be gained (by species) and also active use data through feeding buzz recording. Activity levels can then be used to modify wind farm management if required.

Ecological Restoration Plan

A vegetation/ecological restoration management plan should be undertaken for the areas that are disturbed as part of the construction works so they can be rehabilitated once construction is finalised.

This would include details for the management of any areas of native vegetation to be disturbed and the method and timing for their restoration along with specifics of habitat restoration for fauna and weed management.

The areas should have detailed surveys before any vegetation is removed. This should record any microhabitat features and provide a detailed plan outlining areas of impacts at a micro level. This will allow for placing of sediment and erosion control fence designs to reduce any indirect impacts on vegetation.

Erosion and Sediment Control Plan

To avoid and reduce disturbance to drainage lines within the site, runoffs from work sites should be managed by appropriately designing the wind farm access tracks and other infrastructure by incorporating erosion and sediment control methods during the construction and operational stages. This would be undertaken as part of the engineering design for the implementation of the access and construction tracks. The erosion and sedimentation control plan would consider the soil types and potential for erosion.

Native Vegetation Management Plan

A native vegetation management plan should be prepared to ensure minimal removal of native vegetation for the construction of the wind farm infrastructure, and measures to ensure native vegetation in the vicinity of the development footprint are not affected.

All environmental controls should be audited for compliance regularly during construction and after commissioning.

This would include micro mapping of vegetation around each turbine to avoid any un-necessary removal of vegetation and also the access tracks. This would also allow for vegetation planting species when the wind farm is decommissioned.

Weed Management Plan

A weed management plan should be prepared to ensure that the construction and operation of the project does not contribute or cause an increase in the weed species within the site. The plan should put in place control measures for minimising weed during and after construction.

Generally there are high levels of weeds on the site area however as a precaution wash bays should be sited so trucks and machinery can be washed down to prevent weed seed being spread both onto and off site.

Bat and Avifauna Management Plan

A bat and avifauna management plan should be prepared to manage and mitigate any bird and bat strikes resulting from the operation of the project. Carcass search protocol should be implemented to identify more accurately the mortality rates of the bats and birds within the site.

Identification of any species lost along with the data gained from Anabat recording would enable adaptive management of the project if required.

12.3 ERM Supplementary Assessment

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by UFWA in May 2013 to undertake a Supplementary flora and fauna Assessment. The intent of this work was to build on the investigations into flora and fauna carried out by Anderson Environmental Consultants. It has been prepared in response to elements of the NSW Department of Planning and Infrastructure's adequacy review letter dated 9 May 2013.

In relation to some elements of the ecological investigations, ERM have used different methods and assumptions than Anderson Environmental Consultants, leading to more conservative results.

12.3.1 Methodology

ERM undertook a five day site visit during 20 – 24 May 2013. This section outlines the methods used to undertake the flora and fauna assessment during the site visit and subsequent data analysis and reporting. Surveys included the northern transmission line route, which had not been mapped in detail in the previous surveys.

Vegetation mapping

To prepare the vegetation mapping, ERM undertook the following tasks:

- Review of existing available mapping products
- Review of the NSW Biometric Vegetation Types (BVTs) Database
- Qualitative field observation and plot/transect data collection according to the BioBanking Assessment Methodology (BBAM) (December 2009)
- A total of 15 plot/transects were completed with at least one completed in each of the different vegetation types
- 'Vegetation Zones' were created to represent the diversity of vegetation condition across the site, which was achieved by assigning primary and secondary condition classes to each area of BVT in the site (see **Table 21** below for details on the condition classes)
- Where relevant the Vegetation Zones were equated to Threatened/Endangered Ecological Communities listed under the EPBC Act and TSC Act

The table below provides descriptions of the primary and secondary condition classes for the site, based on the BBAM (December 2009).

Table 21 Condition Class Definitions

Condition Class * (Primary _ Secondary)	Definition
Mod-Good_Poor-Weedy	Native over-story percent foliage covers between 25% of the lower benchmark value and within benchmark value. Groundcover greater than 50% area covered by introduced species
Mod-Good_Poor-Grassland	Over-story percent foliage cover less than 25% of the lower benchmark value, however groundcover greater than 50% area covered by indigenous species
Mod-Good_Shrubby	Over-story percent foliage cover less than 25% of the lower benchmark value; and although shrubby, mid-story below benchmark value however groundcover greater than 100% of benchmark value appearing as a response to recent clearing
Mod-Good-Mod	Over-story percent foliage cover greater than 50% of the lower benchmark value; and Mid-story and groundcover affected by grazing or other agricultural impact however benchmark community structure and species composition partially represented
* Primary condition class definition is that for woody vegetation types in the BBAM (DECC 2009)	

Flora

A floristic inventory was collected through the identification of all flora species encountered in the BBAM plot/transects or incidentally in the field, either in-situ or by collecting a sample for later identification.

ERM undertook the flora surveys in accordance with the Threatened Species Survey and Assessment Guidelines and the BBAM, in terms of the techniques used the level of effort and the information recorded. The quadrats were not undertaken during the appropriate season for optimal detection of threatened species and therefore, ERM assessed the potential for threatened species to occur based on the available habitat and the information provided in previous studies of the area.

Habitat

The site was firstly assessed through interpretation of satellite imagery, and then areas supporting native vegetation and potential fauna habitat were located and surveyed by vehicle and on foot.

Fauna habitats were quantified using biometric plots, which were undertaken in each BVT.

Fauna

Bat surveys were undertaken using static Songmeter bat detectors to sample the echolocation calls of free-flying bats at the site. These Songmeter surveys were conducted at five locations (of varying habitat conditions) between 20 and 24 May 2013. All Songmeter units were placed in close proximity to the proposed turbines, and commenced operation approximately 30 minutes before dusk and ceased approximately 30 minutes after dawn. The total survey equated to 18 Songmeter nights in total. It is noted that there were timing restrictions for the field surveys and the late

autumn survey was not optimal for microbats, and therefore it is anticipated that the abundance and diversity of the microbats detected will be lower than during spring and summer months.

ERM's fauna surveys included habitat survey, targeted surveys for birds and bats and opportunistic sightings. ERM undertook these surveys in accordance with *Threatened Species Survey and Assessment Guidelines*, however, not all the techniques outlined in the Guidelines were considered appropriate for the site or the season (late autumn). Harp trapping was not conducted for several reasons including the season and cold temperatures. ERM notes that *"Due to the cold temperatures and late autumn survey period, it was anticipated that fauna activity would be low and any captured fauna would be subjected to an elevated chance of mortality due to the cold"*. During ERM's surveys, temperatures dropped below freezing on two of the survey nights, with the minimum temperature at Taralga at -5^{0}C. *These issues were discussed with David Geering (OEH Dubbo, 16/05/13)"*.

The analysis of bat cells was undertaken by Narawan Williams (consultant ecologist, Clarence Town, NSW). Bat species were given a 'Definite', 'Probable' or 'Possible' status, depending on the identification during the analysis.

Bird Utilisation Surveys (BUS) were undertaken on 20 and 21 May 2013 to assess species prone to rotor strike. All birds observed incidentally throughout the field surveys were also identified and it was noted if they were flying within the Rotor Swept Area (RSA) height range (between 25 and 200 metres).

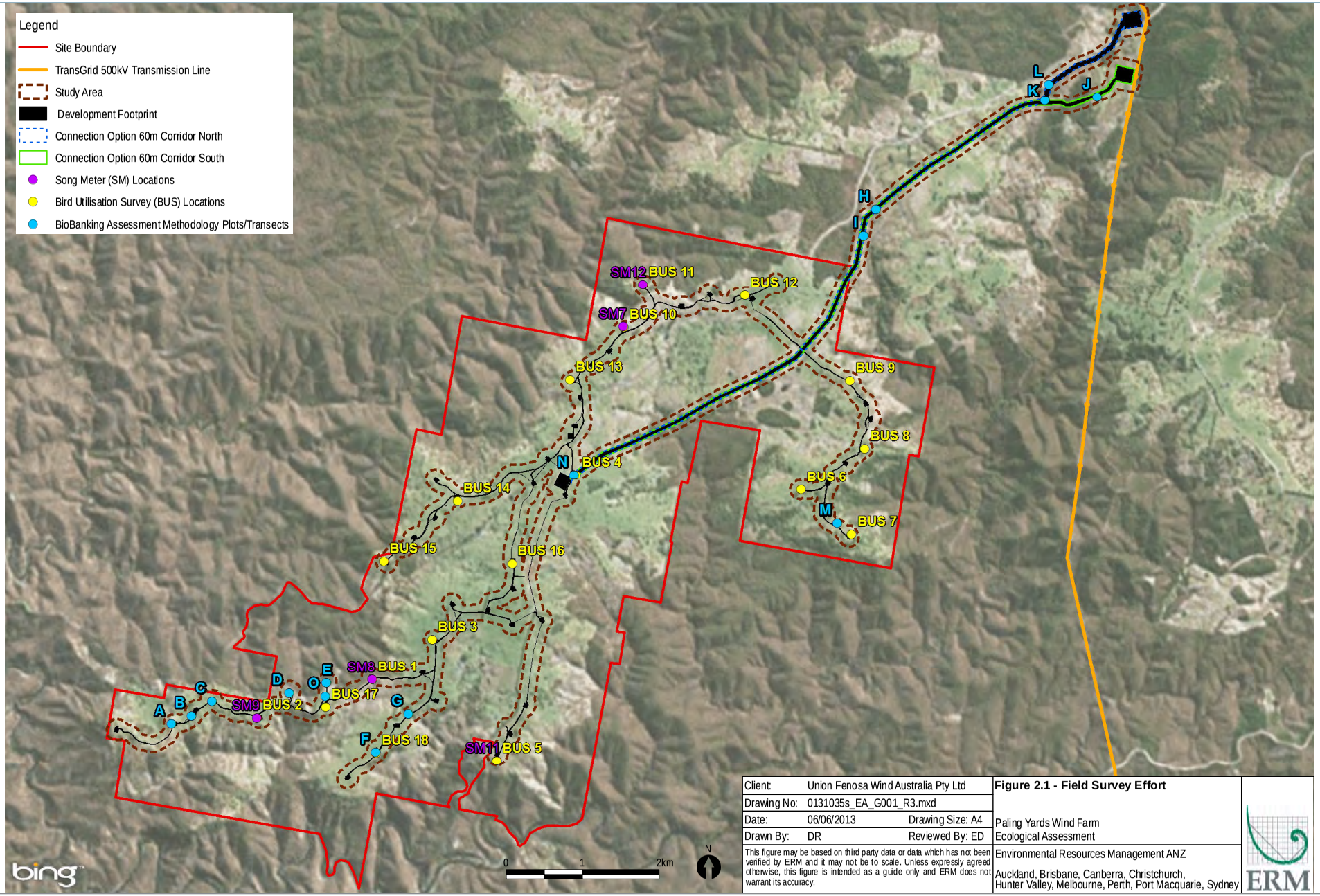
The methods adopted for the BUS were consistent with the requirements for a "Level One" bird risk assessment endorsed in the AusWEA (2007) Best Practice Guidelines. Eighteen survey points were established across the site at proposed wind turbine locations (refer to **Figure 47 – BUS Survey Effort**). The BUS method involved two observers stationed at a fixed survey point for 15 minutes, recording the abundance of all large bird species observed within 800 metres and all small birds within 100 metres. Using a conservative approach, bird flight heights were identified and classified as: 'below RSA height' (less than 30 metres), 'at RSA height' (30 to 175 metres), or 'above RSA height' (above 175 metres).

It is noted that the BUS surveys represent a snapshot of activity during late autumn, rather than a seasonal variation of bird utilisation within the site. The BUS survey data (undertaken over two days in May 2013) represents a small sample size, and varying activity levels or changes in the abundance of birds seasonally is therefore not taken into account. Increased survey effort in a variety of seasons may pick up other species of birds flying at RSA height which could then be assessed using the model.

ERM undertook bird and bat field surveys and habitat assessments in relation to bird and bat collision risk. The data collected was input into a collision risk model for birds and informed consideration of the potential impacts to bats. Mitigation measures have been provided to reduce the potential impacts to birds and bats.

Offsets

The area of offset required (as well as vegetation types) for the project was determined through a BioBanking Assessment, undertaken by an accredited BioBanking assessor Evelyn Craigie (Accreditation Number 0089). It was largely undertaken in accordance with the BBAM and Credit Calculator Operational Manual (DECC 2009), however, a simplified approach was adopted, with one 1,000 ha assessment circle and one 100 ha assessment circle used. This covered an area that was representative of native vegetation cover across the development footprint (not the entire site). This approach



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Drawing No:	0131035s_EA_G001_R3.mxd		
Date:	06/06/2013	Drawing Size: A4	
Drawn By:	DR	Reviewed By: ED	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 2.1 - Field Survey Effort

Paling Yards Wind Farm
Ecological Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

FIGURE 47 BUS Survey Effort

Source: ERM

has been used in previous indicative BioBanking assessments for wind farm projects and was considered appropriate for this project.

Limitations

The field surveys undertaken by ERM during May 2013 focused on vegetation mapping, flora, habitat, bird and bat survey. ERM note that while the surveys were undertaken in accordance with the *Threatened Species Survey and Assessment Guidelines*, the limited extent and timing of the surveys has resulted in divergence from the Guidelines in some instances (see *Fauna* section above). Where a divergence was necessary, ERM liaised with OEH to confirm the suitability of this approach.

12.3.2 Results

Areas of exotic pasture are widespread across the site, which is predominantly used for cattle and sheep grazing. The majority of the land within the development footprint of the proposed wind farm *"consists of improved pasture with scattered Eucalypt trees and small patches of derived native grassland around the periphery"*. These areas of pasture improvement are dominated by exotic pasture species. Field investigations identified 83 flora taxa within the site, 55 (66.3%) of which were indigenous and 28 (33.7%) are introduced.

The field investigations did not identify any threatened flora species nor any optimal or sub optimal habitat for any threatened flora species.

Four Biometric Vegetation Types (BVTs) were identified at the site. The BVT code, vegetation name/description, condition class and area of this BVT within the development footprint are summarised in the table below.

Table 22 Biometric Vegetation Types

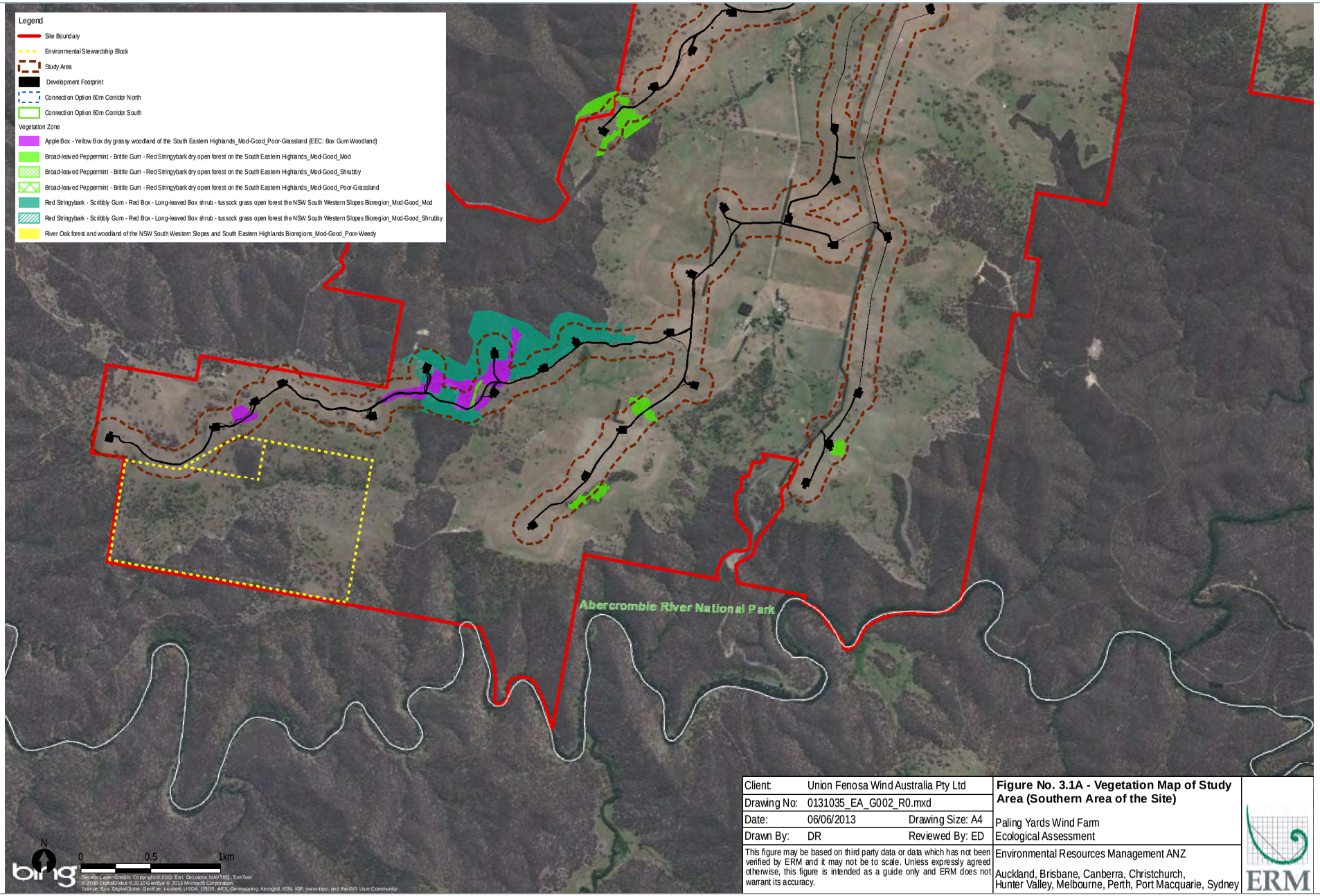
BVT code	Vegetation zone	Condition class	Area within development footprint *(ha)	Permanent impact area
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands (Box Gum Woodland occurring as Derived Native Grassland under TSC Act)	Mod-Good_Poor-Grassland	2.9	1.9
LA124	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	Mod-Good_Mod	6.9	6.9
		Mod-Good_Poor-Grassland	0.0	0.0
		Mod-Good_Shrubby	2.3	2.3
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	Mod-Good_Mod	1.4	1.0
		Mod-Good_Shrubby	0.2	0.2
LA186	River Oak forest and woodland of the NSW South Western	Mod-Good_Poor-Weedy	0.3	0.3

	Slopes and South Eastern Highlands Bioregions			
TOTAL			14 hectares	12.6 hectares
*This area includes the northern transmission line impact area				

Note: Development footprint includes areas of existing cleared farm track, covering approximately 0.4 ha
Source: Based on Table 4.3 in flora and fauna impact assessment report at Appendix 8b

The four BVTs and their areas within the proposed development footprint of the wind farm are shown on **Figure 48 – BVT Vegetation Map (Southern Area)** and **Figure 49 – BVT Vegetation Map (Northern Area)**. Each BVT is summarised below:

- *LA103: Apple Box - Yellow Box Dry Grassy Woodland of the South Eastern Highlands:*
    - Exists in small patches at the site and consists of native grasses occurring in pasture; scattered Apple Box (Eucalyptus bridgesiana), Yellow Box (E. melliodora) and Manna Gum (E. viminalis) trees occur throughout the pasture, but not in the patches of native grass.
    - The native grass patches in the west of the site are dominated by Red Grass (Bothriochloa macra) and the patch in the centre part of the site is dominated by Weeping Grass (Microlaena stipoides) (these patches are subject to ongoing stock grazing).
    - The Vegetation Zone does not constitute the EPBC-Act listed condition of Box Gum Woodland as the patches have no mature trees (including no regeneration) and very low herb species richness.
- *LA124: Broad-Leaved Peppermint - Brittle Gum - Red Stringybark Dry Open Forest On The South Eastern Highlands:*
    - A woodland dominated by Broad-leaved Peppermint (Eucalyptus dives) and Red Stringybark (E. macrorhyncha) with occasional Bundy (E. goniocalyx) and Black Sally (E. stellulata).
    - Grass species characteristic of this BVT are Small-flowered Wallaby-grass (Rytidosperma setaceum) and Snowgrass (Poa sieberiana).
    - Occurs mostly around the fringes of the site however some patches occur within the site.
    - The BVT is widespread in the development footprint area in two modified forms: cleared recently and allowed to regenerate with a thinned tree canopy layer and more densely distributed Cassinia shrubs and grasses; and cleared except for some scattered trees that have been retained amongst the native grasses used as pasture.
- *LA182: Red Stringybark - Scribbly Gum - Red Box - Long-Leaved Box Shrub - Tussock Grass Open Forest The NSW South Western Slopes Bioregion*:
    - Woodland dominated by Inland Scribbly Gum (Eucalyptus rossii) and Red Stringybark.
    - Occurs on crests and slopes in the south west of the site.



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Drawing No:	0131035_EA_G002_R0.mxd	
Date:	06/06/2013	Drawing Size: A4
Drawn By:	DR	Reviewed By: ED

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Figure No. 3.1A - Vegetation Map of Study Area (Southern Area of the Site)

Paling Yards Wind Farm
Ecological Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

FIGURE 48 BVT Vegetation Map (Southern Area)

Source: ERM

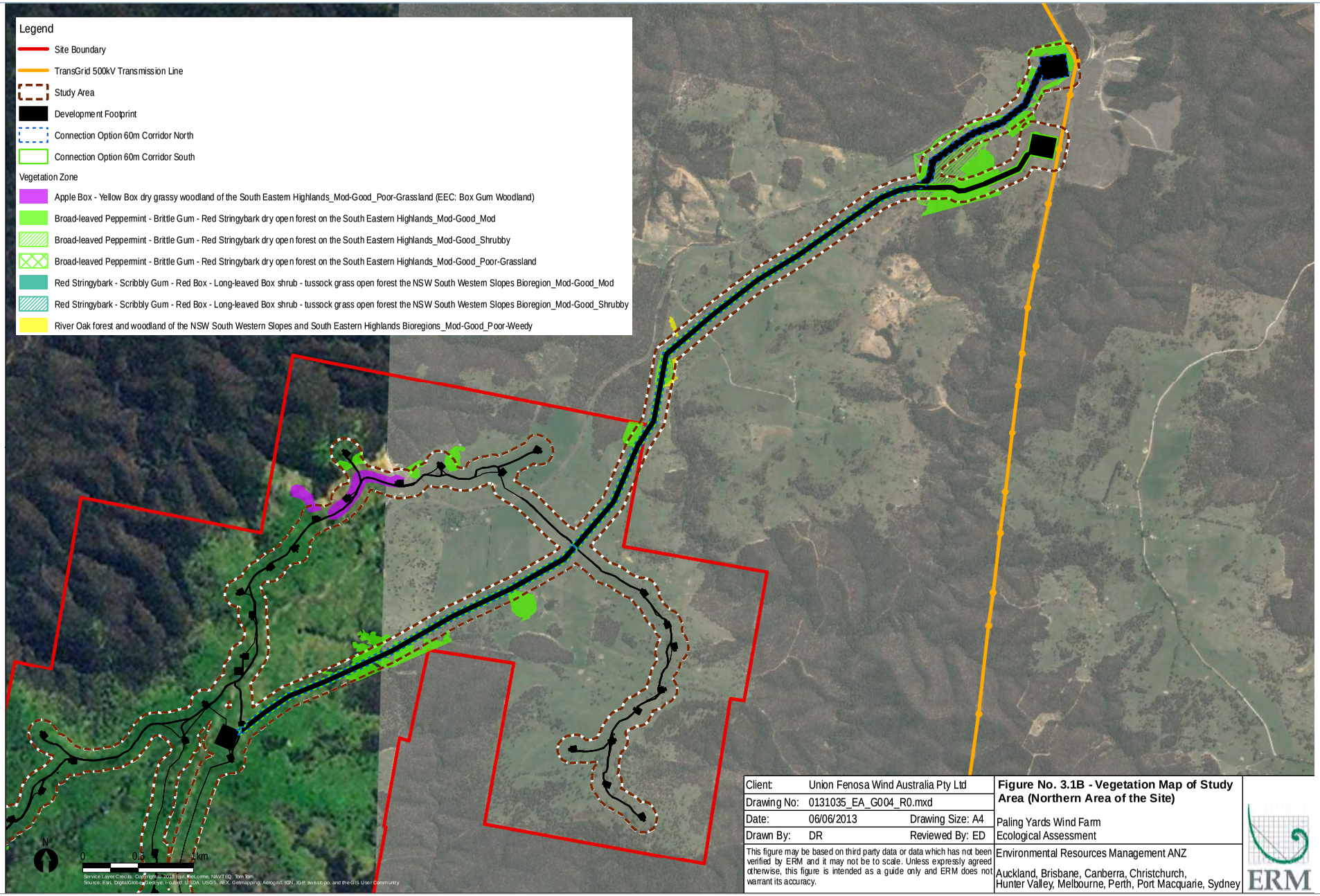


FIGURE 49 BVT Vegetation Map (Northern Area)

Source: ERM

- The BVT is widespread in the development footprint area. Occurs with a thinned tree canopy layer and more densely distributed shrubs such as Hoary Guinea Flower, Heath Wattle (Acacia brownii), Ploughshare Wattle (A. gunnii), Daphne Heath (Brachyloma daphnoides) and Purple Wiregrass (Aristida ramosa).

- *LA186: River Oak Forest and Woodland of The NSW South Western Slopes And South Eastern Highlands Bioregions*:
    - Woodland along some ephemeral drainage lines dominated by Blakely's Red Gum (Eucalyptus blakelyi) and Manna Gum (E. viminalis).
    - Willow trees (Salix spp.) present along these drainage lines.
    - Very few native species in the mid and ground layer with a major abundance of Blackberry (Rubus fruticosus agg. spp.) shrubs.
    - No River Oaks were observed.

During the field surveys over a five-day period, a total of five native mammals and two exotic mammals were observed. Forty bird species were recorded incidentally during the field surveys; including two species listed as Vulnerable under the TSC Act, the Flame Robin and the Scarlet Robin. Refer to **Figure 50 – Threatened Fauna Species Record Locations** for the locations where threatened fauna was recorded within the projects site.

During the BUS undertaken over a two day period, a total of 125 birds were recorded from 18 surveys. There were 13 different species identified, with the Australian Raven, Australia Magpie (Cracticus tibicen) and the Wedge-tailed Eagle being the most predominant species. One threatened species was recorded: Scarlet Robin (this species is unlikely to fly at RSA height). No migratory species were recorded. Wedge-tailed Eagles were recorded flying at RSA height nine times during the BUS, which is 7% of the total number of birds recorded. No threatened species were observed flying at RSA height during the BUS.

A total of 2,981 bat calls were analysed. Twelve microbat species were identified with varying levels of confidence (five definite, one probable, three possible and three that could be one of two species). This included three threatened species, none of which were a definite identification.

12.3.3 Assessment of impacts

The project comprises a number of components that would impact on flora and fauna features, including permanent and temporary components. However, ERM concludes that:

"The project would not have a significant impact on any threatened ecological communities or species. The majority of the development footprint consists of improved pasture with scattered Eucalypt trees and small patches of derived native grassland around the periphery. Measures have been provided to manage impacts, including avoidance and mitigation measures. An offsets package is proposed to be developed that will compensate for the residual impacts to biodiversity".

In regards to matters of national significance, the Department of Environment and Heritage (now Department of Environment) decided in March 2005 that the proposed 'action' under the EPBC Act is not a 'controlled action' and therefore, approval under Part 9 of the EPBC Act is not required (EPBC Reference 2005/2018).

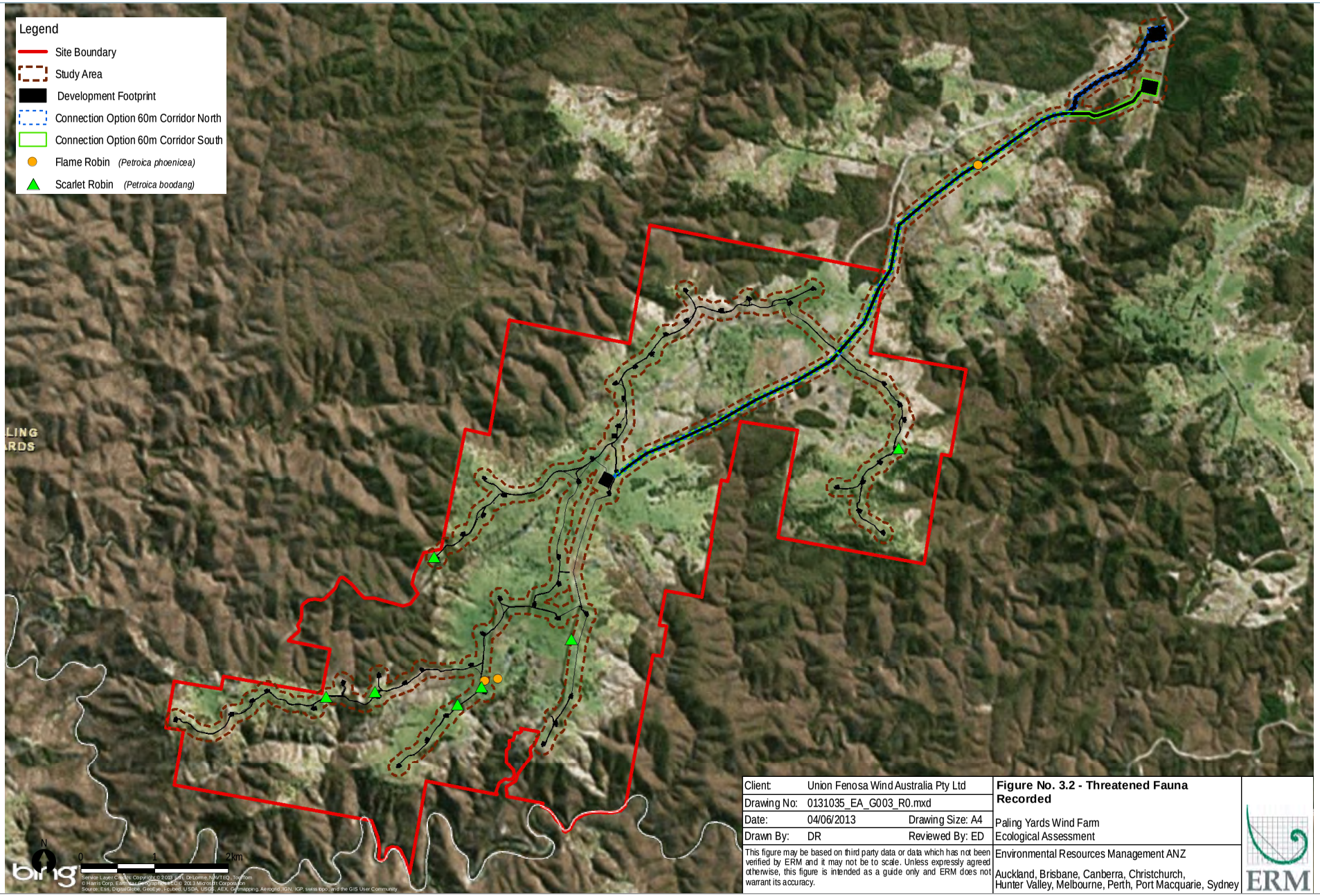


FIGURE 50 Threatened Fauna Species Record Locations

Source: ERM

ERM notes that since this decision, the potential impacts to 'Matters of National Environmental Significance' associated with the project have not changed, and therefore recommends that further assessment under the EPBC Act is not required.

The specific impacts that are considered in ERM's Flora and Fauna Impact Assessment (supplementary report) are:

- vegetation clearance;
- collision-related mortality;
- barotrauma; and
- avoidance of habitat (specific to birds and bats).

The potential impacts of the projects components on the flora and fauna within the site are outlined under the relevant headings below.

Vegetation clearance

ERM note that vegetation clearance is required to install the components of the wind farm, including temporarily cleared areas during the construction phase (rehabilitated upon completion of the construction works), and the permanently cleared areas. The potential impacts of vegetation clearance include:

- reduction in the extent of native vegetation
- loss of habitat
- introduction of weeds
- modification of surrounding areas of native vegetation

The project's development footprint covers a total area of 106.5 hectares, including:

- a permanent impact area of 33.1 hectares,
- a temporary impact area of 13.0 hectares, and
- an impact area of 60.4 hectares associated with the northern transmission line.

The clearing for the northern transmission line will be limited to the pole locations and the electrical safety clearance envelope for conductors.

Of the total development footprint, 92.5 hectares comprises exotic pasture, cropping, planted vegetation or bare ground, thereby reducing the extent of native vegetation clearance.

The remaining 14.0 hectares of the development footprint comprises areas of native vegetation (of which 12.6 hectares is permanent clearing). Therefore, 14.0 hectares of native vegetation is proposed to be removed for the project infrastructure (including the northern transmission line), with 1.4 hectares proposed to be rehabilitated.

ERM concludes that the proposed vegetation removal would not impact on the viability of ecological communities or native flora species within the site or the wider locality, as the majority of vegetation to be removed is not unique in the site or locality. The project is unlikely to impact seed dispersal, animal movements or remove habitat features that are essential to species survival.

Collision-related mortality

The Wedge-tail Eagle was the most frequently observed bird species flying at RSA height (9 sitings). The other species observed at RSA, the Australian Raven and Australian Magpie, were recorded infrequently. ERM found that significant collision-related mortality is not likely within the site due to the project, given the abundance and wide distribution of the species recorded flying at RSA height. No threatened bird species were recorded flying at RSA height.

A 99% avoidance rate was applied to the model and the results indicate that the Wedge-tailed Eagle has a collision risk which would result in 0.052 birds per month or 0.62 birds per annum colliding with rotors once the project is operational.

In relation to bats, the proportion of bats that would be at risk of rotor collision impacts at the site was assessed as relatively low, as the species recorded are likely to be dispersed over a wide area. However, ERM note that it was difficult to assess utilisation of the site without surveys throughout the summer and spring months and therefore the potential for collision impacts may be higher.

ERM recommends the monitoring of birds and bats during the operation of the wind farm, to determine the impact of the turbines. This monitoring should include bat and bird mortality, including that caused by collision and barotrauma for bats. This is valuable in order to determine which species are vulnerable to rotor impact and the abundance of animals affected.

Barotrauma

The bat species that may be at risk of mortality due to the effects of barotrauma are the Eastern False Pipistrelle, Eastern Bent-wing Bat and the Greater Broad-nosed Bat. In particular, the Eastern False Pipistrelle and the Eastern Bent-wing Bat forage near to RSA and have the potential fly into the low pressure areas created by moving turbine blades.

Avoidance of habitat (specific to birds and bats)

Careful turbine siting within the site to avoid areas of high habitat values assist in reducing the risk of alienation of habitat. The potential impact upon the Scarlet Robin and Flame Robin is unknown, as these species were recorded in areas of open pasture and may be displaced or remain largely unaffected by the presence of the turbines. ERM therefore adopted a precautionary approach in consideration of impacts to these species.

Wedge-tailed Eagles were observed frequently flying at RSA height and it is anticipated that they will avoid areas containing turbines (Smales 2005 cited in ERM report). It is noted that higher habitat for the species is widespread within the surrounding area. ERM found that there is unlikely to be a significant impact on this species.

12.3.4 Assessment of significance

The additional field surveys by ERM identified patches of Box-Gum Woodland derived native grassland within the proposed access track areas (refer to **Figure 48 – BVT Vegetation Map (Southern Area)**). Two threatened birds (Scarlet Robin and Flame Robin) and three threatened bats (Eastern False Pipistrelle, Greater Broad-nosed Bat and the Eastern Bent-wing Bat) were recorded during the May 2013 field surveys.

ERM assesses that the proposal is unlikely to have a significant impact on either the Scarlet or Flame Robin, the three threatened bats or the ecologically endangered community (Box Gum Woodland) and therefore, it is not considered necessary to undertake further assessment under the NSW TSC Act for the project.

12.3.5 Avoidance

Throughout the course of the project and planning process, the project design has undergone a series of amendments to take account of environmental, social and economic factors.

The amendments related to flora and fauna features considered the following factors outlined in the table below:

Table 23 Avoidance measures applied to site selection

Project feature	Original location	Adjusted location	Reason
Overhead transmission line	South from the PAA to the Crookwell 2 Wind Farm substation	North-east of the PAA to the Mt Piper to Bannaby 500kV transmission line	To avoid removal or modification of a large area of remnant native vegetation.
WTG: P2, P6 and P7 and their associated access tracks and crane pads	Within the Box Gum Woodland Environmental Stewardship Block	Removed	To avoid removal or modification of an area of Box Gum Woodland that is being managed under the Environmental Stewardship Program.
WTG P11 and its associated access tracks and crane pads	Within remnant native woodland	Removed	To reduce removal of areas of remnant native woodland.
WTG: P10, P13 and P14 and their associated access tracks and crane pads	Within remnant Red Stringybark Woodland and Broad-leaved Peppermint Woodland	Closer to the edge of the remnant	To reduce removal or modification of areas of remnant native woodland.

The above avoidance measures were taken in relation to the following flora and fauna considerations:

- areas of native vegetation, particularly those that are in good condition and / or meet the description of a TEC or EEC;
- habitat features for native fauna, including hollow bearing trees, exposed rock and native tussock grassland; and
- wildlife corridors.

The avoidance measures have been informed by ERM's analysis of the flora survey results and the extent to which native vegetation will be impacted by the project, as well as the results of the habitat and fauna surveys and potential fauna movements.

The project components have been sited predominantly within areas that do not support native vegetation or key habitat features. ERM considers that *"the level of avoidance is appropriate to the scale of the project and the ecological features of the area"*.

12.3.6 Additional mitigation measures

Additional flora and fauna impact mitigation measures are proposed for the project in the ERM report. These should be read in conjunction with the mitigation measures proposed by Anderson Environmental. The mitigation measures presented by ERM relate specifically to:

- native vegetation within the site; and
- bird and bat collision risk.

As part of the mitigation measures, ERM recommends a series of additions to the Construction Environmental Management Plan (CEMP), Operational Environmental Management Plan (OEMP), and Bird and Bat Monitoring Plan. They also recommend the preparation of an Ecological Restoration Plan.

Further ERM recommends that the proponent *"select the southern sub-option for the northern transmission line as this option would minimise clearing of native vegetation"* and *"develop an offset package in accordance with the Principles for the use of biodiversity offsets in NSW"* (OEH 2011).

These, as well as the native vegetation and bird and bat collision risk mitigation measures outlined below, have been added the Statement of Commitments at **Chapter 24**.

ERM recommends the following mitigation measures to minimise impacts on native vegetation and birds and bats within the site:

Vegetation Clearing

- all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna;
- the area to be cleared at the site will be clearly demarcated using flagging or fencing, and mapped on construction plans, to prevent breaches of the construction boundary;
- laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat;
- vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible;
- care will to be taken when working near wooded areas to prevent damage to adjacent tree roots and indirect impact to habitat areas;
- trenches will be excavated at least 15 m away from the base of trees where possible to prevent root damage;
- where practical, suitable fencing to be erected along trenches to prevent fauna falling in;
- habitat features such as logs, large rocks and fallen hollows within the proposed clearance footprint will be relocated to adjacent areas to supplement habitat where possible;
- any individual hollows removed will be replaced with artificial hollows within adjacent suitable habitat;
- Environmental Compliance Manager or field officer qualified in the handling of fauna to be present on-site during clearing to capture and re-release fauna (where appropriate);

- regular checking of trenches by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP;
- pre-clearance surveys (including diurnal and nocturnal) undertaken to determine if roosts, nests or dens are present in any trees proposed for clearing;
- implement a two stage approach to clearing works; o non-hollow bearing trees will be cleared before habitat trees to allow fauna an opportunity to move from the hollow bearing trees and allow time to concentrate rescue efforts on the trees that are most likely to be inhabited; and o hollow bearing trees will be felled after a minimum 24 hour delay after clearing of non-habitat trees.
- native vegetation that is removed will be chipped and mulched for on-site use where practical;
- where practical, native vegetation greater than 3 m in height to be retained during transmission line construction; and
- rehabilitation of internal access roads that are not required following construction to be undertaken.

Weed Management

- where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the site;
- piling of soil that may contain seeds of exotic species at least 50 m away from creeks, drainage lines and other areas of native vegetation, to prevent spread into adjacent areas during rainfall or wind events;
- topsoil recovery will be undertaken in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation;
- all construction staff and sub-contractors educated on noxious weeds present at the site and ways to prevent spread;
- where practical, topsoil that has very few weeds to be harvested to salvage the native soil seed bank and reintroduced into disturbed areas. Otherwise, revegetate with locally native endemic species characteristic of the cleared vegetation type;
- control of perennial weed grasses within the disturbance zone for 3 to 5 years after construction;
- where practical, and in consultation with host landowners, manage stock access during periods of revegetation; and
- imported soil and rubble to be certified as free of weeds and weed seeds.

Ecological Restoration Plan

ERM recommends that an Ecological Restoration Plan be developed that outlines the specific measures for rehabilitation, including:

- revegetation (including use of locally occurring species);
- instructions for how to reuse cleared vegetation in situ (including the spreading of mulched vegetation over cleared areas);
- areas of pasture should be re-seeded with pasture grass species removed; and
- areas where crane pads have been sighted in native vegetation should be mechanically loosened with machinery to alleviate compaction, enhancing seed germination potential in loose soil and micro-topography to enhance seed retention from surrounding woodland areas.

Birds and Bats

ERM recommend that a specific Bird and Bat Monitoring Plan be developed. The Bird and Bat Monitoring Plan should:

- outline the required monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required in order to achieve the objectives of the plan
- outline the roles and responsibilities for the proponent, operator and agencies in implementing, assessing and enforcing the plan.
- be developed in consultation with OEH
- determine the frequency of report strike data during the preparation of the monitoring programme.

ERM also recommends that the adaptive management measures that could be implemented should be negotiated with OEH when significant strike rates are detected. Bird and bat strike monitoring should be undertaken with consideration for the monitoring guidelines provided by the Australian Wind Energy Association.

12.3.7 Offset measures

The vegetation analysis and mapping indicated that vegetation offsets will be required for the project. ERM recommends that an offset strategy be developed in accordance with the principles for the use of biodiversity offsets in NSW (OEH 2011 cited in ERM report).

ERM proposes that offsets will be secured on-site within areas of Box Gum Woodland, Red Stringybark Woodland, Broad-leaved Peppermint Woodland and River Oak Forest. The *"areas of native grassland derived from these vegetation types will be offset into open forest / woodland areas comprising the original equivalent vegetation type"*, to achieve the 'improve or maintain' principle.

The area of offset required that was calculated by ERM using the BioBanking Assessment Methodology (BBAM) and the credit to hectare converter is shown in the table below.

Table 24 Credit requirements and their equivalent in hectares

BVT code	BVT name	Area in permanent footprint* (ha)	Required credits	Equivalent hectares required
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	1.9	36	3.9
LA124	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	9.2	181	19.5
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	1.2	66	7.1
LA186	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions	0.3	6	0.6
Total		**12.6**	**289**	**31.1**
***this area includes the northern transmission line impact area**				

As outlined above, 31.1 equivalent hectares are required to be provided as offsets for the project.

These offsets will be used to inform the preparation of an offset strategy in consultation with OEH and DoPI, which is to be consistent with the NSW Offsets Policy. The offset strategy will be prepared and its approval sought prior to commencement of works.

The location, management and securing mechanism will be included in the offset strategy to the satisfaction of OEH.

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CHAPTER 13

AERONAUTICAL IMPACTS

13 Aeronautical Impacts

13.1 Introduction

Aviation Projects Pty Ltd (Aviation Projects) was commissioned by UFWA to assess the aeronautical and obstacle lighting impacts arising from the project. The full aeronautical impact and night-lighting assessment report is found at **Appendix 9**.

Under the Civil Aviation Safety Regulations, the owner of a structure (or proponents of a structure) that will be 110 m or more above ground level must inform the Civil Aviation Safety Authority (CASA). This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.

13.2 Methodology

Evaluation of the potential aeronautical impact and obstacle marking and lighting has been undertaken in accordance with relevant safety regulations.

The methodology for the aeronautical impact assessment was as follows:

- the scope and deliverables were discussed with and agreed by the UFWA Project Manager;
- a site visit was conducted on 4 April 2011;
- a desktop review of the supplied materials was conducted;
- the relevant regulatory requirements and sources of information were reviewed;
- an assessment of the Procedures for Air Navigation Services – Aircraft Operations and Obstacle Limitation Surfaces (PANS-OPS and OLS) was prepared and forwarded to Airservices Australia, Bathurst Regional Council (Bathurst Airport), CASA, Goulburn Mulwaree Council (Goulburn Airport), Oberon Council (Oberon aerodrome), and Upper Lachlan Shire Council (Crookwell aerodrome) for consideration;
- other stakeholders, including the Aerial Agriculture Association of Australia, Commonwealth Department of Defence and NSW Rural Fire Service were consulted in writing and/or by telephone;
- interviews were carried out with stakeholders as required; and
- a report was prepared and finalised.

13.3 Results

13.3.1 Cumulative impacts

The project is relatively remote from other existing or approved wind farms, including the proposed Golspie Wind Farm, the closest wind farm to the site, approximately 25 km south-west. Accordingly, Aviation Projects concluded that there will be no significant cumulative impact arising from the Project and nearby existing or approved wind farms.

13.3.2 Obstacle lighting and marking

The need for obstacle marking and lighting of wind turbines, wind monitoring towers and transmission lines was assessed.

It was assessed by Aviation Projects that if the turbine model ultimately selected has a blade tip height of less than 150 metres there will be no requirement for the turbines to be lighted. However, Aviation Projects determined that if the turbine model ultimately selected has a blade tip height of in excess of 150 metres then the turbines are considered obstacles and selected turbines will therefore require obstacle lighting. An aeronautical study of the requirement for obstacle lighting should be prepared once the final model is selected and the final turbine layout and design has been determined.

If lighting is required, lights are recommended for turbines 1, 5, 6, 9, 11, 15, 17, 20, 21, 23, 24, 30, 31, 35, 36, 39, 42, 44, 47, 49, 51, 52, 55, 58 and 60. This lighting design is subject to confirmation of the final turbine layout. Refer to **Figure 51 – Indicative turbine lighting layout**.

If obstacle lighting is required, installed lights should be designed according to the criteria set out in the applicable regulatory material, which includes:

- two flashing red medium intensity obstacle lights should be provided;
- the light fixtures should be mounted sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction;
- both lights should flash simultaneously; and
- the characteristics of the obstacle lights should be in accordance with the applicable standards in MOS 139.

If obstacle lighting is required, medium intensity lighting will be used regardless of the final turbine height.

To minimise the visual impact on the environment, some shielding of the obstacle lights is recommended by Aviation Projects. Shielding may be provided to restrict the downward component of light to either, or both, of the following:

- such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and
- such that no light is emitted at or below 10 degrees below horizontal.

All obstacle lights on a wind farm should be synchronised so that they flash simultaneously.

Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be marked in accordance with CASA Manual of Standards (MOS) 139 Section 8.10 Obstacle Markings.

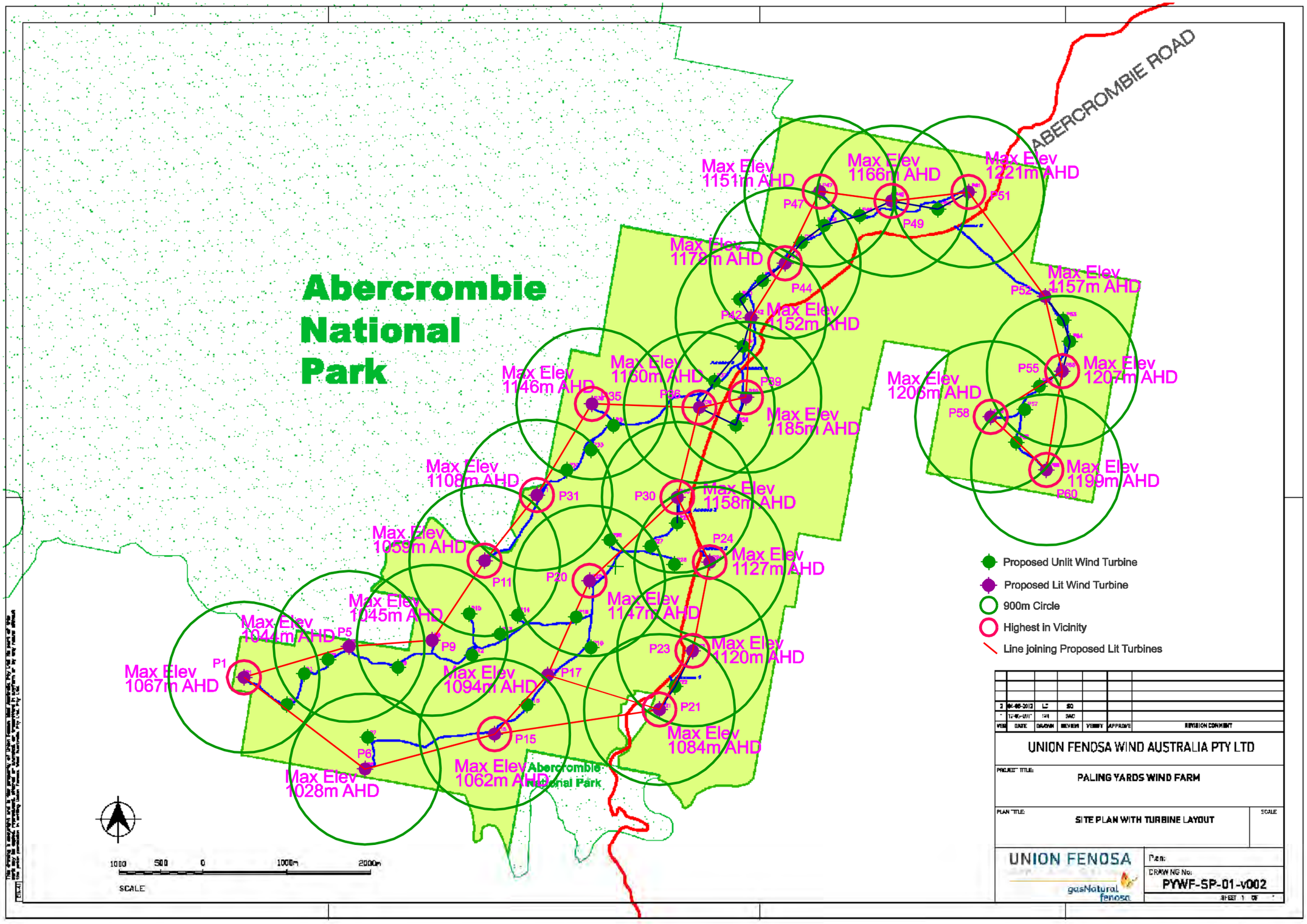


Figure 51 Indicative Turbine Lighting Layout

Source: UFWA

13.3.3 Aeronautical impacts

Aviation Projects assessed that "*the proposed development does not impose any significant risk to normal flying operations, provided aircraft are operated in compliance with applicable regulatory and operational control requirements and with the application of good airmanship".*

In relation to nearby aerodromes and aircraft landing areas, Bell ALA agricultural operation remains operational. The current aerial agriculture operator Mr. Fred Fahey has said that he would not be prepared to operate fixed wing aircraft on the property once turbines are installed. Rotary wing aircraft therefore remain a valid option for aerial agriculture operations. The aeronautical assessment acknowledged that the project will most likely prevent fixed wing aerial agricultural operations on the wind farm site; however, Aviation Projects conclude that safe aerial application operations would be possible on properties neighbouring the proposed wind farm, subject to final turbine locations, and subject to a case-by-case assessment.

In the event the immediate neighbouring landowner(s) would require aerial agriculture spraying of their land adjacent to the wind farm and there is an increase in cost associated with the proximity to turbines, the proponent will cover the reasonable cost increase for the aerial agriculture activity. The landowner seeking compensation for the cost increase must demonstrate and justify this increase with previous records.

There are a number of larger aerodromes at distances greater than 30km from the site, none of which will be impacted.

The project is not anticipated to have an adverse impact on obstacle limitation surfaces, PANS-OPS surfaces, radar interference, communication systems, defined air traffic routes, navigation aids, or electric or magnetic fields.

For operating aircraft, in order to avoid the wind farm, aircraft will have to fly at a higher altitude or divert around it.

In relation to fire-fighting methods, any fire-fighting activities in the vicinity of the proposed wind farm by either fixed or rotary wing aircraft would need to be conducted in consideration of the location of the wind turbines and monitoring masts. Therefore, the location of the wind turbines and monitoring masts should be made available to New South Wales Rural Fire Service (RFS) and aerial agriculture operators.

While aerial fire-fighting operations may potentially be restricted in the vicinity of the proposed wind farm, Aviation projects note that there is still a valid ground-based means of fighting bushfires.

Consultation with the Rural Fire Service (RFS) Development Assessment and Planning Officer, NSW (Mr. Doug Stevens) was undertaken. Mr. Stevens considered wind farms to be an advantage to RFS operations generally, because they required a cleared area, a water supply, and provided improved access to the property.

Further consultation with local fire authorities will occur prior to construction of the project.

13.4 Mitigation

The report recommends that the following actions be implemented to mitigate the aeronautical impacts of the project:

Notification of tall structures:

- Final (approved) turbine coordinates and elevations should be provided to RAAF Aeronautical Information Service (AIS) via the online vertical obstruction database.

Marking of turbines:

- The rotor blades, nacelle and the supporting mast of the wind turbines should be painted white, off-white or a light grey colour.

Lighting of turbines:

- If the wind turbines to be installed will have a blade tip height lower than 150 m AGL, no obstacle lighting is necessary.
- If the wind turbines to be installed will have a blade tip height of 150 m or more AGL, obstacle lighting may be required.
- An aeronautical study to determine the requirement for obstacle lighting, in the form of a detailed and thorough risk assessment using internationally recognised standards, should be prepared once the final approved turbine layout and design turbine height are known.
- UFWA may consider other factors in its decision as to whether obstacle lights should be installed.
- If lighting is required, lights are recommended for turbines 1, 5, 6, 9, 11, 15, 17, 20, 21, 23, 24, 30, 31, 35, 36, 39, 42, 44, 47, 49, 51, 52, 55, 58 and 60.
- Obstacle lighting should be designed in accordance with the characteristics specified in ICAO Annex 14 Vol 1 Chapter 6 and MOS 139 Chapter 9, while minimising visual impact.

Marking of wind monitoring towers

- Consideration should be given to marking the wind monitoring towers according to the requirements set out in MOS 139 Section 8.10.

Marking of electricity transmission lines:

- Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be marked in accordance with MOS 139 Section 8.10.
- Alternatively, consideration could be given to installing the AAAA endorsed power line marker reportedly developed in conjunction with Country Energy.

Other measures to mitigate the visual impacts of night lighting include vegetation screen planting, as detailed in **Chapter 9 – Landscape and Visual Impacts.**

The need for night lighting is under review given recent wind farm decisions. If CASA determine the wind farm does require night lighting it would comply with these specifications and recommendations contained in the aeronautical report.

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CHAPTER 14

TRANSPORT IMPACTS

14 Transport Impacts

14.1 Introduction

URS Australia Pty Ltd (URS) was commissioned by UFWA to assess the transport related impacts arising from the project. The full transport impact assessment (TIA) prepared by URS is found at **Appendix 10**.

The report identifies and considers the traffic impact of the project both during the construction and operational phases. It also identifies the likely measures required to improve conditions of the access routes to the site.

The report has been prepared in accordance with the scope agreed between URS and UFWA and focuses on the public roads defined as the preferred transportation routes between the site and the Port of Newcastle and Port Kembla.

14.2 Methodology

In order to establish the traffic conditions and likely traffic impacts arising out of the project, site investigations were undertaken by URS on 4 and 5 April 2011. Detailed observations were recorded during the inspection and photographs taken to supplement the observations.

The following key steps were undertaken for the assessment:

- A site inspection of the surrounding network and site access points was undertaken;
- The road network surrounding the site and the site access points was defined;
- The additional traffic generated during construction and operation phases of the project was defined.
- The impact of the additional construction and operational traffic was investigated using SIDRA analysis.

Based on an assessment of the existing road network conditions during the site visit and using the RTA's Travel Restrictions Vehicle Route maps, the most appropriate route options were detailed for use by construction and transport vehicles including Over Dimensional Vehicles, heavy vehicles and cars/personnel.

Management and mitigation measures were developed in order to minimise any traffic impacts from the project.

14.3 Results

Given the findings of the assessment, URS concludes that the "*traffic generated by this proposal is not considered to have a significant impact on the existing transport network, with current operation anticipated to remain at an acceptable Level of Service for key roads*".

14.3.1 Access to the site

The site is divided by the Goulburn-Oberon (Abercrombie) Road. There are six access points proposed to access the site from Abercrombie Road. The first access point is located approximately three kilometres north of the Abercrombie River and the remaining five access points are positioned within a distance of 7.5 kilometres from the first access.

The access points are shown on **Figure 12 – Indicative Access & Infrastructure Plan**. These access points have been selected due to the topographic features of the land and to avoid vegetation removal where possible.

Access to the site is provided via a number of roads and highways in the area.

Goulburn-Oberon (Abercrombie) Road is a classified two-lane, two-way road of approximately 150 km between the Hume Highway, Goulburn in the south and O'Connell Road, Oberon in the north. The condition of the road's surface varies considerably in the vicinity of the site. On the northern side the road's surface condition is excellent, and on the southern section the road has winding parts with diminishing surface condition.

In relation to existing traffic conditions, the Level of Service thresholds indicate that Goulburn-Oberon Road currently operates at a Level of Service B, which is the highest performance rating possible for Rolling Terrain.

The Great Western Highway, known as the National Route 32 in the vicinity of the site, provides access to the area from Sydney. Key access routes to Paling Yards and the site are also provided by Bells Line of Road (National Route 40), Jenolan Caves Road, Duckmaloi Road and O'Connell Road.

14.3.2 Over Dimensional Vehicles and Transport Routes

Over dimensional vehicles (OD vehicles) are required for the transportation of certain wind farm components. The full report by URS outlines haulage requirements for the construction of wind turbines, route options and OD vehicles swept paths.

For the purpose of this assessment, URS adopted a 'worst-case-scenario' whereby the greatest width, height and turning circle requirements are taken into account based on the transport requirements of each wind turbine manufacturer for the assessed wind turbine options.

The transport requirement for the identified 'worst-case scenario' for OD vehicle movements, taking into account the requirements of all assessed wind turbine manufacturers, is therefore defined as follows:

- Maximum OD vehicle length: 64.4 metres
- Minimum height clearance required: 6.6 metres
- Minimum road width required: 5.5 metres
- Maximum slope gradient permitted: 6%
- Maximum slide inclination permitted: 2%

A number of haulage route options have been identified for OD vehicles between Port Kembla and the site, and between the Port of Newcastle and the site.

Two feasible route options exist from Port Kembla to the site. These are shown on **Figure 15 – OD Vehicle Route Options Port Kembla**. The first route progresses north from Port Kembla to the Westlink M7, continues west from here and then travels south along Abercrombie Road to connect to the site. The length of this route is 328km and the estimated travel time in 5 hours. B-Double vehicles using this route must not be longer than 19 metres in length and must weigh less than 50 tonnes.

The second route is slightly longer in length than the first option, connecting to O'Connell Road in the north before progressing onto Abercrombie Road. The length of this route is 372km and the estimated travel time is 5.5 hours. B-Double vehicles using this route must be no longer than 26 metres in length.

Two feasible route options exist from the Port of Newcastle to the site. These are shown on **Figure 16 – OD Vehicle Route Options Port of Newcastle**. The routes follow the same path between the port and Bells Line of Road heading south-west.

Two route options are available when crossing the Blue Mountains to the site. The first option follows the same path as route option 1 from Port Kembla, and the second option follows the same path as route option 2 from Port Kembla.

B-Double vehicles using the first option must not be longer than 19 metres in length and must weigh less than 50 tonnes. The length of this route is 381km and the estimated travel time is 6 hours.

B-Double vehicles using the second option must be no longer than 26 metres in length. The length of this route is 425km and the estimated travel time is 6.5 hours.

The proponent will be required to apply to the NSW Roads & Maritime Services Department (RMS) for a special load carrying permit for the selected route that the Over Dimensional Vehicles take.

14.3.3 Impact of Traffic Generation

Construction Phase

The forecasted construction vehicle volumes generated by the project are based on the traffic generation estimates for Ryan Corner Wind Farm in Victoria, which is a similar project to Paling Yards, with 68 wind turbines. Therefore the following assumptions have been adopted for the project in this assessment:

- 18 month construction program,
- 11 hour (7am to 6pm) working weekday,
- 24 working days per month, and
- The eighth month being the peak construction month.

The total number of peak one-way vehicle movements generated by the project is estimated to be 120 vehicle movements per day, of which 3 are OD vehicles, 27 are heavy vehicles and 90 are light vehicles.

Two preferred site access routes have been chosen to analyse the performance of the existing road network and model traffic characteristics at the intersections during the peak construction phase of the project. The two chosen intersections are:

- East side of T-intersection on Abercrombie Road.
- West side of T-intersection on Abercrombie Road.

SIDRA modelling package was used in this analysis. Four scenario models were developed to determine the worst-case scenario impacts:

- Scenario 1: All construction vehicles enter and exit the site via one access point forming a T-intersection with Abercrombie Road on the eastern side of the site during AM peak;
- Scenario 2: All construction vehicles enter and exit the site via one access point forming a T-intersection with Abercrombie Road on the western side of the site during AM peak;
- Scenario 3: All construction vehicles enter and exit the site via one access point forming a T-intersection with Abercrombie Road on the eastern side of the site during PM peak;
- Scenario 4: All construction vehicles enter and exit the site via one access point forming a T-intersection with Abercrombie Road on the western side of the site during PM peak;

The results of this modelling indicated that:

- no major increases in Degree of Saturation or queue lengths will occur to the road network during the peak construction period of the project.
- minor impacts may occur during the PM peak hour; however these result in a negligible increase in queue lengths (i.e. one car length or less).
- roads operating at a Level of Service of C or better are generally considered to have acceptable flow conditions.
- the performance of each of the proposed access point intersections is well within acceptable performance criteria.

Operational and Decommissioning Phases

In relation to potential traffic impacts during the operating life of the wind farm, the TIA notes that the number of vehicles generated by the project during the operational phase will be *"insignificant relative to that experienced during the construction phase"*.

The impact predicted by the TIA of the project's construction traffic on the existing Degree of Saturation and Queue Lengths of all intersections modelled were found to be 'minimal, if non-existent'.

Therefore, it is anticipated that the traffic impact during the operational and decommissioning phases will also be insignificant.

14.4 Mitigation

URS advises that a detailed Transport Management Plan, in consultation with local councils and RMS, should be developed to outline the finalised transport details and include management and mitigation measures for the project. URS recommends that this document be prepared before the construction phase of the project, to form the foundations for all traffic related activities for the project.

This Transport Management Plan should include:

- Confirmation of the route selection;
- Define RTA approvals for OD vehicles;
- Further consultation with the RTA and local Council;
- Define operating hours and speed limits for construction vehicles;
- Develop traffic control signage plans where required at site access points and other intersections;
- Recommend and provide concept designs of vehicles swept paths at site access points for OD vehicles at key intersections along the defined OD vehicle route between Port and site;
- Outline a program for collecting a baseline assessment of the surrounding road network and a program of regular inspections;
- Detail any roadworks required and when these are required; and
- Details of measures to control soil erosion and dust generated by traffic volumes.

In order to ensure safety and reduce the impact of the development on the local road network, URS recommend the following commitments be included in the Statement of Commitments for the project:

Task	Notes
Prepare detailed management plan	To be completed prior to the construction phase of project
Finalise traffic generation numbers and proposed routes	To be included in Transport Management Plan
Confirm haulage contractor and prepare Haulage Transport Plan	To be completed prior to finalisation of Transport Management Plan
Liaise with appropriate road authorities	To be undertaken during Transport Management Plan tasks
Finalise design of access points	To be included in Transport Management Plan following finalisation of preferred site accesses
Finalise design of internal site tracks network	To be completed prior to construction phase of project
Undertake existing conditions assessment and roadside vegetation assessment	Any additional assessments required specific to the site to be included in Transport Management Plan
Intersection and road upgrades along OD route to safely accommodate the manoeuvrability of these vehicles	To be recommended in the Transport Management Plan and completed prior to the construction phase of the project

In addition, the following measures will also be undertaken for the project:

- Carry out a pre-construction road survey to determine existing conditions of local roads.
- Carry out any necessary upgrades and strengthening works along the access road network to provide safe construction access for the project.
- Prepare and implement a traffic management plan to ensure local roads are not adversely impacted by heavy vehicles.
- Notify the local community of changed traffic conditions and proposed road works via a newsletter or information line.

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CHAPTER 15

ELECTROMAGNETIC INTERFERENCE IMPACTS

15 Electromagnetic Interference Impacts

15.1 Introduction

Garrad Hassan Pacific Pty Ltd (Garrad Hassan) was engaged by UFWA to assess the electromagnetic interferences arising from the project. The full report undertaken by Garrad Hassan appears as **Appendix 11**.

Radiocommunications is used as a broad term in the report to encompass all services that rely on electromagnetic or radio waves to transfer information.

The report notes that "If not properly designed, wind farms have the potential to cause interference to analogue television broadcast signals and microwave signals". However, it is possible to design around these issues.

Two services that are most likely to be affected include analogue television broadcast signals and fixed point-to-point microwave signals. Analogue broadcast signals are still commonly used to transmit domestic television, while microwave links are used for line of sight connections for data, voice and video. The interference mechanisms are different for each of these, and hence, there are different ways to avoid interference.

For analogue television broadcast signals (point to point), large scale interference can generally be avoided by placing the wind turbines at an appropriate distance from the broadcast tower, at a recommended clearance of at least 1 km.

The assessment reviewed and considered the *Draft NSW Wind Farm Guidelines* (Draft Guidelines) in relation to electromagnetic interference.

15.2 Methodology

The methodology for assessing the potential radiocommunications interference in this assessment undertaken included identifying the telecommunications towers located within 75 km of the site boundary and investigating the telecommunication licenses attached to these towers.

The Draft Guidelines recommend a radial distance of 50-60km from the centre of the wind farm would normally capture all of the potentially affected services in the area.

Therefore, the approach used in this report meets (and exceeds) the requirements of the Draft Guidelines regarding electromagnetic interference.

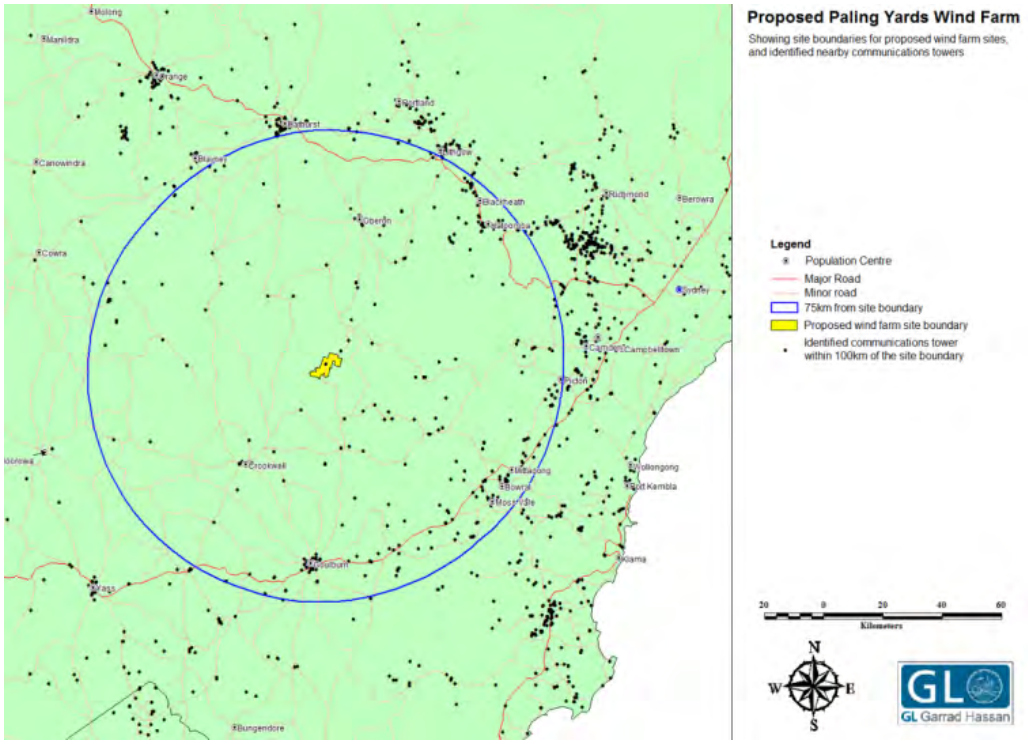
Other services with the potential to experience interference from the project were also identified, and the potential for interference to those services reported.

15.3 Results

Telecommunications Towers

An image of the ACMA database dated June 2012 was used for this assessment. From the database, there are 417 telecommunication towers within a nominal 75 km of the wind farm. The locations of these telecommunication towers are shown in **Figure 52**.

Figure 52 Location of identified proximate radio communication sites



The assessment identified several point-to-point microwave links with a path over, or near to the site boundary. Of these links, two links (involving six fixed licences in total) were identified as passing through wind turbine locations.

The interference zones around these point-to-point links have been identified and it has been found that five turbines from the project have the potential to cause interference to the links. Refer to **Figure 53**.

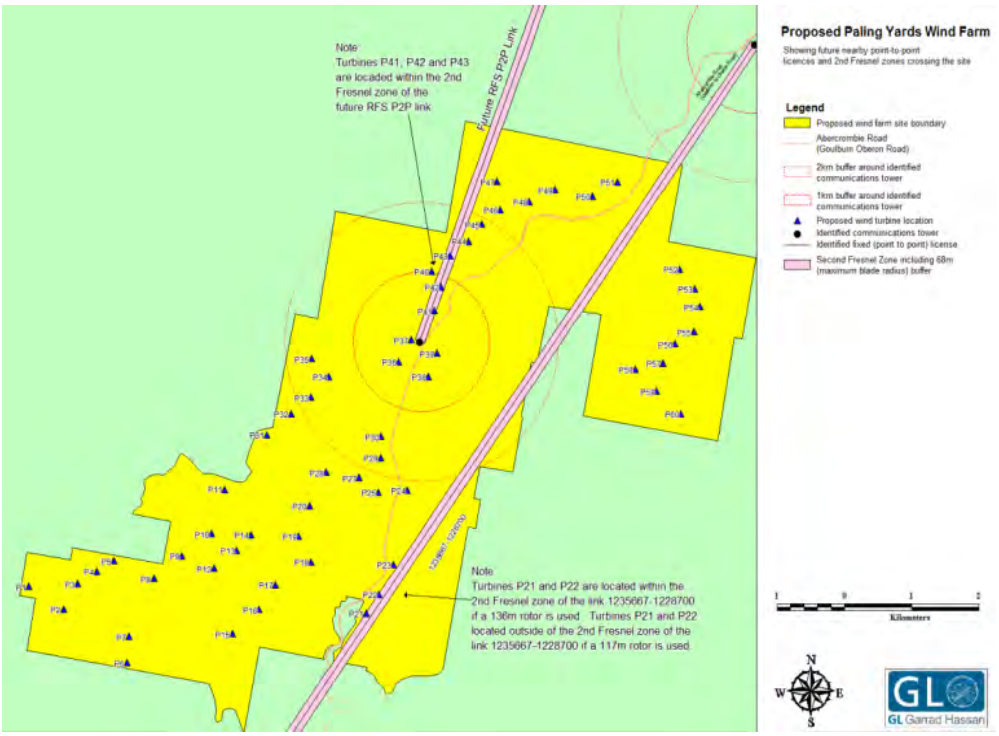
For the first link, operated by Telstra, two turbines may interfere with the link when a rotor diameter of 136 m is considered. However UFWA has indicated that they intend to reduce the rotor diameter of these turbines to 117 m, resulting in an unlikely interference with the link.

For the second link, a future NSW RFS P2P link, three turbines may interfere with the link, being turbines P41, P42 and P43.

A number of mitigation options may be available, including moving the three turbines in question outside of the exclusion zone or relocating the communications tower. When further clarity on potential interferences to this link due to the project is provided, the appropriate mitigation measures will be put forward and implemented. As discussed with NSW RFS, the preferred option would be to relocate the communications tower. NSW RFS understand that UFWA would be willing to contribute to costs associated with the relocation.

The proponent will resolve this issue through further consultation with NSW RFS.

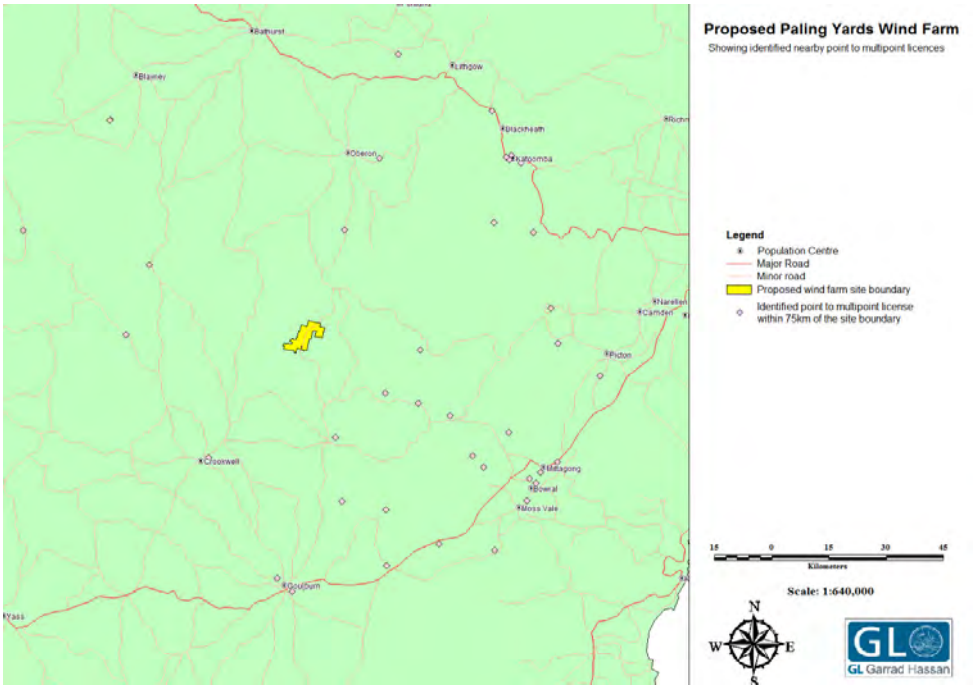
Figure 53 Proposed telecommunication vectors and 2nd Fresnel zones plus 58.5 m buffer



In relation to point-to-multi-point microwave links, there are no point-to-multipoint base stations listed in the ACMA database within 20km of the site boundary (refer to **Figure 54**). It is unlikely that stations at this distance will be servicing customers in the vicinity of the site.

Garrad Hassan has contacted operators of the majority these stations to assess any potential impact that the wind farm could have on their service, and has not been informed of any potential impacts by these parties. Garrad Hassan has endeavored to contact the remaining stations. The proponent will endeavour to contact the remaining stations; however due to the lack of responses from these parties, potential impacts to these remaining stations are not anticipated.

Figure 54 Location of point-to-multipoint stations within 75 km



A review of other licences within 75 km of the site was conducted. Many of the licences identified can broadly be described as base to mobile station style communication, and include radio broadcasting, commercial and private mobile telephony.

Garrad Hassan highlight that these license types are generally not affected by the presence of wind turbines any more than other effects such as terrain, vegetation and other forms of signal obstruction. Should reception difficulty be encountered, the user may move a short distance to receive a clearer signal.

Garrad Hassan found that the project is unlikely to unreasonably impact emergency services, meteorological radar, trigonometrical stations, Citizens Band Radio, wireless internet, satellite television, internet or AM radio.

A review of the mobile GSM and NextG network coverage found that the general area around the site has marginal network coverage and in some areas, turbines may potentially cause some interference to the signal. In such cases, the installation of an external antenna or moving a short distance until the signal strength improves will help to improve the signal quality.

An examination of the potential impact of the wind farm on radio broadcasting found that FM signals may be susceptible to interference from wind turbines, resulting in hissing and distortion of the signal. This can be mitigated by the installation of a high quality antenna.

An assessment of the potential impact of the project on broadcast towers found that interference to analogue television could potentially occur at:

- 11 houses, when tuned to the Canberra transmitter at Black Mountain,
- 16 houses if tuned to the Central Tablelands transmitter at Mount Canobolas,
- 10 houses if tuned to the Gore Hill transmitter in Sydney, and
- 6 houses if tuned to the Knights Hill transmitter at Illawarra.

However, Garrad Hassan note that analogue television is being phased out across Australia. The transmissions from most of the analogue transmitters whose signals can be received in the vicinity of the site may have been ceased by the time the wind farm is constructed.

If digital reception is marginal, residents in the vicinity of the site may be eligible to receive access to the Government-funded satellite television service to view free-to-air television.

15.4 Mitigation

The electromagnetic interference mitigation measures proposed throughout the report include:

- For any interference with fixed point-to-point links, either the relevant turbines or the communications tower may be slightly relocated, where possible.
- Realigning or relocating the householder's TV antenna.
- The installation of an external antenna or more directional and/or higher gain antenna at the affected household;
- The installation of cable/satellite TV at the affected household; and
- Installation of a TV relay station.
- A person with portable device moving a short distance to a new or higher location until the signal strength improves.

Garrad Hassan note that as television interference from wind turbines is readily identifiable, appropriate mitigation measures can be readily taken if required.

In the event that TV interference is an issue during wind farm construction or after wind farm commissioning, the following options are recommended, in approximate order of increasing cost:

1. Realigning the householder's TV antenna more directly towards their existing transmitter;
2. Tuning the householder's antenna into alternative sources of the same or suitable TV signal;
3. The installation of more directional and/or higher gain antenna at the affected house;
4. Relocating the antenna to a less affected position;
5. The installation of a digital set top box (and UHF antenna if required);
6. The installation of cable/satellite TV at the affected house; and
7. Installation of a TV relay station.

In the event that digital TV does not provide an acceptable amelioration option, satellite television represents another potential option.

In relation to the NSW RFS proposed P2P link, further discussion will be undertaken with RFS to confirm actual interference and whether the P2P tower or interfering turbines should be relocated.

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CHAPTER 16

FIRE IMPACTS

16 Fire Impacts

16.1 Introduction

A wind farm in a rural area, as with many large scale developments, can increase the risk of bushfire to nearby people and property. This includes fire caused by the turbines (and associated components) themselves, impacts on the turbines caused by fire sparked elsewhere, and impacts on the ability to fight fires in and around a wind farm site.

This chapter draws on current literature to describe and detail the risk and outlines a range of mitigation measures designed to reduce the risk. The potential risk to people and property depends on a number of factors, including the inherent flammability of the turbine generators, the landscape in which the turbines sit, and the capability and methods used by local fire services to fight fires in the area.

The Draft NSW Wind Farm Guidelines specify that assessment must detail bushfire hazards and risk, including recommending consultation with the NSW Rural Fire Service.

As a result of increased wind farm development in Victoria and NSW, the Victorian Country Fire Authority (CFA) and the RFS have extensively studied the implications of wind farms on fire, and the possible mitigation measures to reduce the risk.

16.2 General Risk

Local communities have expressed concern that wind turbines may increase the risk of bushfires due to the introduction of electrical devices and mechanical components on site (NSW Legislative Council 2009). In addition, residents are concerned that bushfires may be started through lighting strikes on the turbines, leading to combustion and the commencement of a wider fire (NSW Legislative Council 2009).

Wind turbines manufactured today incorporate the highest quality and safety standards (CFA 2012). Despite this, *"the risk of fire always exists when electronics and flammable oils and hydraulic fluids exist in the same enclosure"* (CFA 2012). The risk of fire at a wind farm can be associated with nacelle fires, electrical faults during construction or from connection lines, fire fighting limitations within and adjoining the wind farm footprint, access to water sources and air fields, operation of winches and machinery during maintenance tasks, and impacts from downwind air turbulence on fire behaviour (CFA 2012).

The CFA considers that "the risk of wildfire resulting from the wind farm operations is not unduly greater than that resulting from other agricultural and industrial practices which operate within the country area" (DPCD 2009, McArthur 2006 Panel Report). Furthermore, the risk of fire is considered to be in fact minimised by wind farm developments and their associated permit conditions because they introduce more intensive fire planning (DPCD 2009, Mt Mercer 2006 Panel Report).

The NSW Legislative Council (No.5, 2009) concluded in their report that wind farms do not significantly increase the risk of bushfires in rural areas. Wind farm developers are aware of the potential risks and implement appropriate management measures to prevent bushfires from occurring (NSW Legislative Council 2009). It is also important to note that no bushfires have been started through wind farm activity in NSW (NSW Legislative Council 2009).

The potential impacts of wind farm activities on fire is considered lower in comparison to normal power generation sites, as power transmission is located within the turbine towers and underground to the transformers (CFA 2012). Due to modern day manufacturing, the risk of fire at wind farms is 'very low' (AusWind 2007), in terms of

both fire damage to wind turbines and fire caused by the turbines. This is because modern turbines are equipped with safety devices to reduce the risk of fire. It is also because:

- *the flammable components are located high above the ground;*
- *there is normally no vegetation around the base of the turbine towers;*
- *medium-voltage connections are underground;*
- *access tracks act as fuelbreaks and provide fire fighting access;*
- *comprehensive lightning protection devices are installed on every wind turbine, including internal lightning conductor rods running all the way to the blade tips; and*
- *dedicated monitoring and control systems shut down the wind turbines when the threshold temperatures of critical components are reached (AusWind 2007).*

Additionally, wind turbines must comply with the Building Code of Australia and Australian Standards, and vegetation around transformers are generally kept below 100 mm (NSW Legislative Council 2009). While it is possible for an electrical failure to cause fire within a wind turbine, the system is designed to contain fire rather than spread it to the surrounding area (Fenwick 2009). The wind farm can also be shut down in the event of a fire situation.

Applications for approval under Part 3A are assessed against *Planning for Bush Fire Protection* 2006, to ensure that the required measures have been incorporated into the project. The ability for the project to comply with *Planning for Bush Fire Protection* is the key objective of this assessment (NSW Rural Fire Service 2007).

An additional fire risk is the possible lack of experience of the local RFS staff and volunteers, who may have little experience in fighting fires in wind farms. This may include unfamiliarity with the wind farm layout, location of water sources, and internal operational mechanisms of the turbines. This risk can be reduced though training and education.

In relation to fire-fighting methods, any fire-fighting activities in the vicinity of the project by either fixed or rotary wing aircraft would need to be conducted in consideration of the location of the wind turbines and monitoring masts. Therefore, the location of the wind turbines and monitoring masts should be made available to RFS and aerial agriculture operators.

While aerial fire-fighting operations may potentially be restricted in the vicinity of the project, there is still a valid ground-based means of fighting bushfires. Further discussion on the implications of wind farm on aerial fire fighting in the vicinity of the site is found in **Chapter 13 – Aeronautical Impacts**.

16.3 Local Risk

Oberon Council considers that the whole of the Rural 1(a) zone in Oberon is susceptible and or liable to bush fires, including the subject site. The presence of dense areas of native vegetation to the west (Abercrombie National Park) and to the east on private land, combined with the steep topography to the south of the site, increase the risk of bushfire in this region.

However, several site factors assist in reducing the potential for fire or enhance the ability to control existing fires. These include a ready supply of water through the Abercrombie River, local dams, and smaller waterways, and the fact that the majority of the turbine locations are cleared of treed native vegetation. The taller native

vegetation has been replaced by lower pasture grasses which present much lower flammability.

A further factor reducing the risk of fire is the accessibility of the majority of the site from the sealed Abercrombie Road and the internal network of farm tracks. Properly constructed, these allow the free passage and direct access to the turbines and all parts of the site. All these factors are likely to reduce the severity and duration of any fire.

An 'Abercrombie River National Park Fire Management Strategy' has been prepared for the adjacent land by the NSW Parks and Wildlife Service (2005). It provides direction for fire management activities within the park to fulfil the Service's obligations under various legislation and Government policy. It aims to protect from bushfires, persons and property on, or immediately adjacent to the park through strategies such as fuel management and trail maintenance.

Whilst the site is susceptible to bushfire, the risk of either the wind farm igniting a fire, or that the wind farm significantly affecting the ability to control a fire started elsewhere, is considered low.

16.4 Mitigation

The mitigation measures that will be implemented as part of this project will be detailed in a Fire Management Plan, prepared in consultation with State and local RFS, and the State Planning Department, in accordance with *Planning for Bushfire Protection 2006*. This would address safety, communication, site access and emergency response protocols.

Other mitigation measures proposed by this Environmental Assessment which are to be implemented as part of the project include:

- Consultation and training with the NSW Rural Fire Service in regard to the adequacy of bushfire prevention measures to be implemented on site during construction, operation and decommissioning.
- Consultation with the NSW PWS on the management of bushfires in the adjacent National Park
- Consult with the RFS during periods of high fire danger
- Inform RFS and any aerial agriculture operators on the location of the wind turbines, transmission lines and monitoring masts.
- Development of workplace health and safety protocols to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.
- On-site vegetation management during construction and operation to minimise potential sources of fuel.
- Re-organisation of construction activities during periods of high fire danger, including ceasing use of explosives, and management of hot work activities such as welding or cutting.
- Use of materials and equipment during operation that minimise the likelihood of fire.
- Maintenance of vehicles to minimise sparking from exhaust systems.
- Automatic shutdown of any overheating turbine mechanism.
- Shut down of turbines during a bush fire in the area.

- Lightning protection on each turbine.
- Under-grounding of electrical and communication cables where practicable.
- Access to adequate water supply, with water access points be located in safe, easily identifiable areas and accessible in all weather conditions by equipment up to 15 tonnes
- A turning circle with a minimum radius of 10 metres will be provided for fire appliances at all water access points.
- The location and number of tanks or other water supply points will be determined in consultation with the NSW RFS.
- Careful storage and handling of flammable materials and ignition sources brought onto the site, as per manufacturer's instructions.
- Storage of appropriate fire fighting equipment onsite during the construction phase, ensuring that a minimum of one person on site is trained in its use.
- Periodical inspection of overhead transmission easements to monitor any regrowth of encroaching vegetation.
- Vehicle turn-around facilities to be provided at every turbine tower site.
- At least 5-metres wide internal access tracks to be provided that are driveable and permanently clear of vegetation for heavy fire-fighting equipment up to 15 tonnes
- Provision of wind turbine access tracks that continue onto adjacent paddocks and are not dead-ended.
- Implementing a wide fuel break in accordance with RFS, Council and State Government recommendations to slow the spread of fire.
- Any vegetation plantings to have low fire resistance.

Micro-siting of the turbines following approval will consider bushfire risk.

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CHAPTER 17

SHADOW FLICKER IMPACTS

17 Shadow Flicker Impacts

17.1 Introduction

Garrad Hassan Pacific Pty Ltd (Garrad Hassan) was engaged by UFWA to assess the potential impact of shadow flicker arising from the proposed wind turbines, which are part of the project on surrounding view locations. The results of the shadow flicker assessment are summarised in Chapter 11 of the Landscape Visual Impact Assessment (LVIA) report by Green Bean Design, and a copy of the detailed shadow flicker assessment is found in the LVIA at **Appendix 6**.

The assessment describes the shadow flicker effect as follows:

"Due to their height, wind turbines can cast shadows on surrounding areas at a significant distance from the base of the wind turbine tower. Coupled with this, the moving blades create moving shadows. When viewed from a stationary position, the moving shadows appear as a flicker giving rise to the phenomenon of 'shadow flicker'. When the sun is low in the sky the length of the shadows increases, increasing the shadow flicker affected area around the wind turbine".

17.2 Methodology

Garrad Hassan utilised the following methodology in assessing the impact of the project:

"The number of hours of shadow flicker experienced annually at a given location can be calculated using a geometrical model which incorporates the sun path, topographic variation over the wind farm site and wind turbine details such as rotor diameter and hub height".

The report further suggests that this modelling makes the following assumptions:

- *that there are clear skies every day of the year;*
- *that the turbines are always rotating;*
- *that the sun can be represented as a single point;*
- *that the blades of the turbines are always perpendicular to the direction of the line of sight from the specified location to the sun; and*
- *that the sun is modelled as a point source.*

The above assumptions have not been applied to the shadow flicker duration results, meaning that the results should be regarded as conservative.

The shadow flicker assessment adopted the Victorian Planning Guidelines, *Policy and planning guidelines for development of wind energy facilities in Victoria*, (Sustainable Energy Authority Victoria, 2009), which recommend a shadow flicker limit of 30 hours per year in the immediate area of a dwelling. This recommendation is also reflected in the *Draft NSW Planning Guidelines Wind Farms Guidelines* (Draft Guidelines), which also recommend a shadow flicker limit of 30 hours per year to be experienced at any dwelling as a result of the operation of a wind farm. The Draft Guidelines also recommend assessment of the impact of shadow flicker on all houses within 2km of a proposed wind turbine.

The likelihood and duration of the shadow flicker effect depends upon a number of variable factors as follows:

- *Direction of the property relative to the turbine.*
- *Distance from turbine (the further the observer is from the turbine, the less pronounced the effect would be).*
- *Wind direction (the shape of the shadow would be determined by the position of the sun relative to the blades, which would be oriented to face the wind).*
- *Turbine height and rotor diameter.*
- *Time of year and day (the height of the sun in the sky).*
- *Weather conditions (cloud cover reduces the occurrence of shadow flicker).*

17.3 Results

17.3.1 Shadow Flicker

Garrad Hassan has assessed the impacts of shadow flicker arising from the project on surrounding view locations. Refer to **Figure 55 – Theoretical annual shadow flicker duration at 2 metres (Option 1)** and **Figure 56 – Theoretical annual shadow flicker duration at 2 metres (Option 2)**.

The shadow flicker assessment takes into account the impact of shadow flicker on all houses within 2km of the turbines as recommended by the Draft Guidelines.

The results of the of the shadow flicker assessment for the project determined that the following seven residential view locations may be subject to levels of shadow flicker above the recommended limit of 30 shadow flicker hours per year:

- House ID 7,
- House ID 7A,
- House ID 8,
- House ID 8A
- House ID 9,
- House ID 9A, and
- House ID 9B.

The residences listed above are project-involved landowners, and UFWA will negotiate an agreement with the owners of these dwellings.

The predicted flicker impacts from the worst-case scenario turbine option are summarised in the table below.

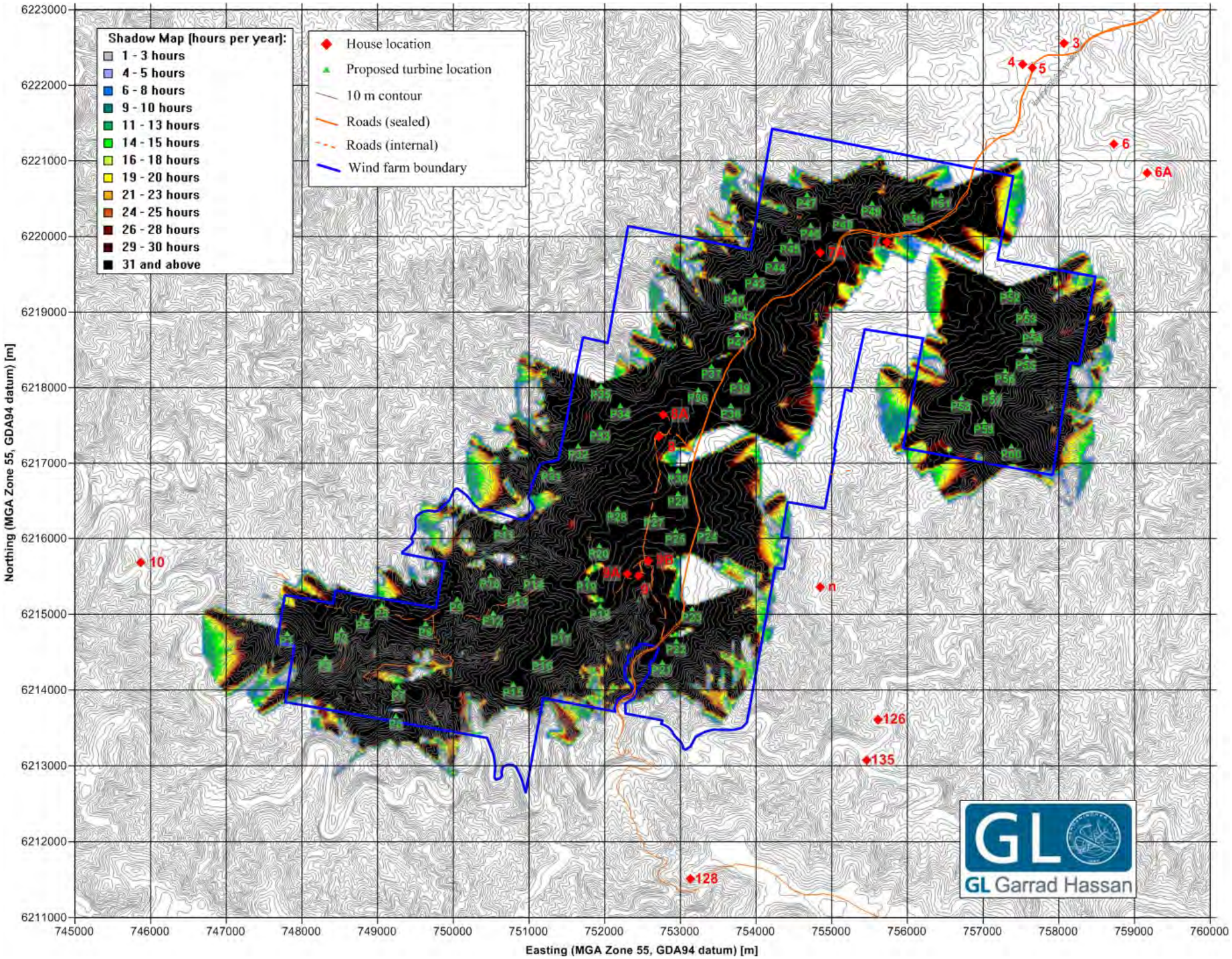


Figure 4. Map of proposed Paling Yards Wind Farm showing turbines, house locations and theoretical shadow flicker duration at 2 m for Turbine Option 1.
(13 turbines with an 100 m rotor diameter and an 80 m hub height, and 46 turbines with an 117 m rotor diameter and a hub height of 91 m)

Figure 55 Theoretical Annual Shadow Flicker Duration At 2 Metres (Option 1)

Source: *GL Garrad Hassan*

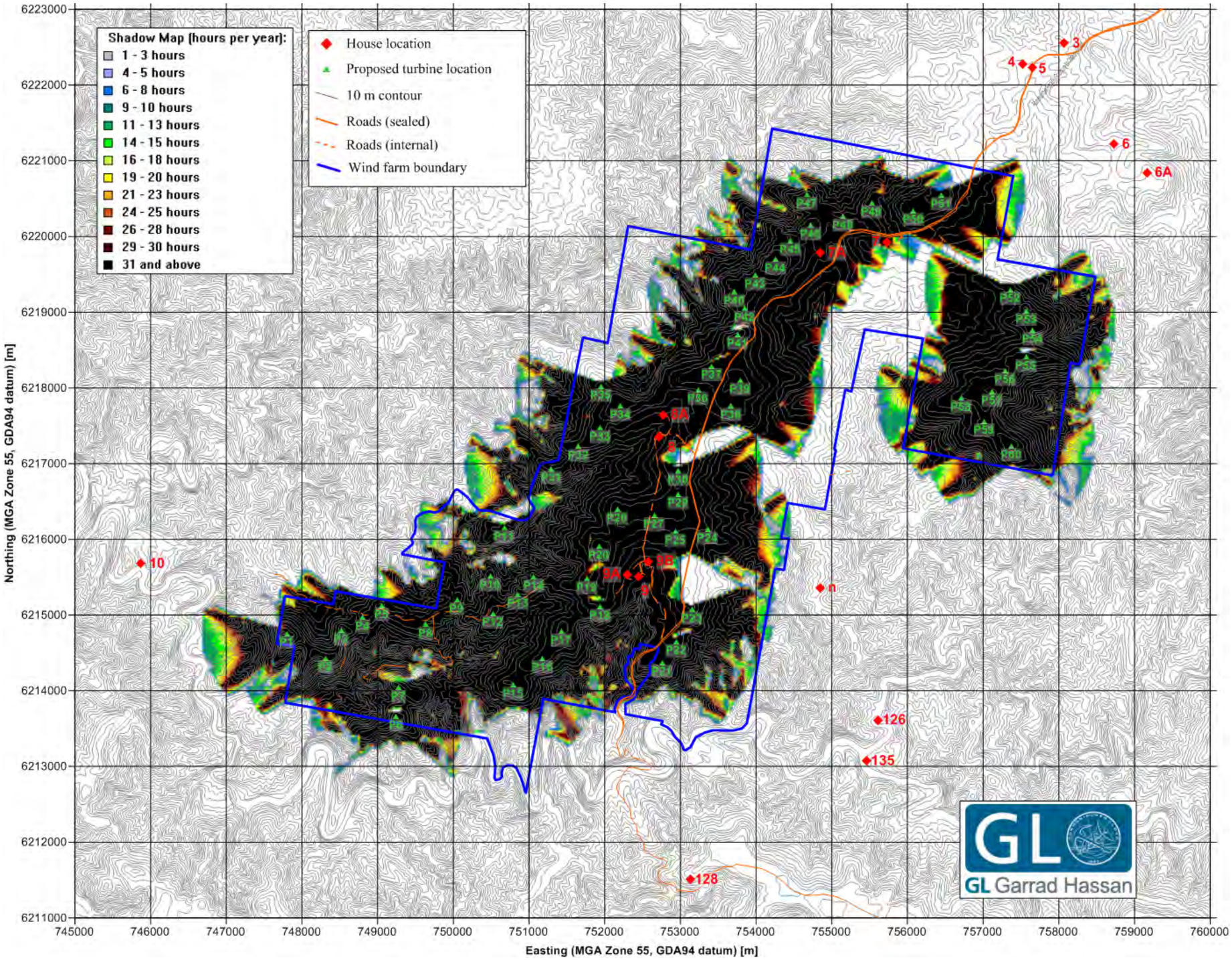


Figure 6. Map of proposed Paling Yards Wind Farm showing turbines, house locations and theoretical shadow flicker duration at 2 m for Turbine Option 2.
(15 turbines with an 100 m rotor diameter and an 80 m hub height, and 44 turbines with an 136 m rotor diameter and a hub height of 107 m)

Figure 56 Theoretical Annual Shadow Flicker Duration at 2 Metres (Option 2)

Source: *GL Garrad Hassan*

Table 25 Flicker assessment for worst-case scenario turbine option

House ID	Theoretical				Predicted Actual			
	At Dwelling [hr/yr]		Max Within 50m of Dwelling [hr/yr]		At Dwelling [hr/yr]		Max Within 50m of Dwelling [hr/yr]	
	At 2m	At 6m	At 2m	At 6m	At 2m	At 6 m	At 2m	At 6m
7	36	34	90	83	13	12	25	23
7A	151	153	180	180	55	55	63	63
8	51	50	71	70	18	17	25	25
8A	186	187	197	197	56	57	58	58
9	68	66	81	81	23	23	28	28
9A	84	82	141	141	24	24	43	43
9B	120	117	156	156	31	31	41	41

Note: the number of hours in this table represents the worst-case scenario at each dwelling for turbine design Options 1 and 2 investigated in the shadow flicker assessment.

To assist UFWA to reach an agreement with these dwellings, detailed time-of-day theoretical shadow flicker durations have been prepared.

It is important to note that the shadow flicker assessment may overestimate the actual number of annual hours of shadow flicker at a particular location due to a number of reasons including:

- *The probability that the wind turbines would not face into or away from the sun all of the time.*
- *The occurrence of cloud cover.*
- *The amount of particulate matter in the atmosphere (moisture, dust, smoke etc) which may diffuse sunlight.*
- *The presence of vegetation.*
- *Periods where the wind turbine may not be in operation due to low winds, or high winds or for operational or maintenance reasons.*

17.3.2 Photosensitive Epilepsy

Garrad Hassan also acknowledges the potential issue of 'photosensitive epilepsy', which is defined by the Canadian Epilepsy Alliance as *"a sensitivity to flashing or flickering lights, usually of high intensity, which are pulsating in a regular pattern – and people with photosensitive epilepsy can be triggered into seizures by them"*. The assessment notes that both the Canadian Epilepsy Alliance and Epilepsy Action Australia estimate that less than 5% of people with epilepsy are photosensitive.

An assessment of these sources found that;

"Given the low flicker frequency associated with the Paling Yards wind turbines, which falls below the range suggested by Epilepsy Action Australia as a potential trigger for

photosensitive epileptic seizures, it is unlikely that the Paling Yards wind turbines would present a risk to people with photosensitive epilepsy".

17.3.3 Motorists

There is the potential for motorists to experience shadow flicker sensations whilst driving as a result of shadows cast on the road from roadside or overhead objects such as trees, poles, or buildings, including turbines.

It is possible that the sensation of shadow flicker may cause annoyance and may impact on a driver's ability to operate a motor vehicle safely. The report considered the potential of shadow flicker associated with wind turbines to road uses, and concluded that;

"As the potential flicker frequency for the Paling Yards wind turbines is likely to be around 1Hz, it is unlikely that the flicker effect would cause annoyance or impact on a driver's ability to operate a motor vehicle safely whilst travelling along local roads surrounding the wind farm".

The figure below presents a typical situation where shadow flicker may be experienced whilst driving along a road where trees cast shadows.

Figure 57 Potential shadow flicker created by trees filtering sunlight across road



Source: Shadow Flicker Impact Assessment, Garrad Hassan Pacific Pty Ltd, Appendix 6

17.3.4 Blade Glint

The assessment also addresses 'blade glint', which is described as a *"phenomenon that results from the direct reflection of sunlight (also known as specular reflection) from a reflective surface that would be visible when the sun reflects off the surface of the wind turbine at the same angle that a person is viewing the wind turbine surface"*.

Glint usually results in a 'low impact' due to the infrequency of occurrence and environmental factors including cloud cover.

The assessment notes that the potential for blade glint from a wind farm is reduced by the turbines' surfaces, including the towers and blades, as they are *"largely convex, which will tend to result in the divergence of light reflected from the surfaces, rather than convergence toward a particular point which will also reduce the potential for blade glint"*.

Blade glint can also be further mitigated through the use of matt coatings.

As no non-project involved, identified dwellings are located within 2km of the site, the assessment of blade glint, coupled with the proposed mitigation measures is considered acceptable in accordance with the Draft Guidelines.

17.4 Mitigation

The report concluded that several options are available for mitigation of shadow flicker and blade glint on the view locations such as the noted dwellings, based on the owner's approval. These options are as follows:

- Use of non-reflective paint on turbine blades;
- Installation of screening structures or planting of trees to block shadows cast by the turbines; and
- Use of turbine control strategies which shut down turbines when shadow flicker is likely to occur.

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CHAPTER 18

HERITAGE IMPACTS

18 Heritage Impacts

18.1 Introduction

Anderson Environmental Consultants Pty Ltd (Anderson Environmental) was commissioned by UFWA to undertake an indigenous and non-indigenous cultural heritage impact assessment of the project. The full report prepared by Anderson Environmental is found at **Appendix 12a**. Following the preparation of Anderson Environmental's report, Environmental Management Resources Australia Pty Ltd (ERM) was engaged by UFWA to undertake an assessment of the significance of heritage sites referred to in the Anderson Environmental report and prepare a supplementary heritage impact assessment report in November 2013 to address the adequacy review comments from DoPI dated 24 June 2013. The heritage impact assessment report by ERM can be found at **Appendix 12b**. These reports should be read in combination, and where the same issues are addressed, the ERM report should be considered as the most up to date information which has informed the mitigation measures.

The purpose of the ERM report was to identify the archaeological/scientific and cultural/social values of sites identified during Anderson Environmental's field survey and assess their significance. ERM notes that 'Archaeological (or scientific) significance' refers to *"the potential of a site to contribute to current research questions"*, and that 'Cultural/social significance' concerns *"the value of a place, feature or site to a particular community group, in this case the local Aboriginal communities*".

The Anderson Environmental report outlines the results of a heritage investigation of the project in relation to the potential impact of the proposed activity on indigenous, non-indigenous and cultural heritage values, including the results of the 2005 surveys by Heritage Concepts. The assessment also outlines recommendations to mitigate the potential heritage impacts of the project.

18.2 Methodology

Anderson Environmental's assessment was conducted in two parts being:

- a desktop assessment; and
- field assessment and surveys.

The desktop assessment reviewed historical databases and heritage lists to ascertain the level of potential for archaeological and historical value within the site and to establish a statutory process for further work under the legislative framework. The previous survey undertaken in 2005 was also reviewed as background for the current survey.

Areas were identified in which indigenous and non-indigenous cultural heritage objects or artefacts were predicted to be located, based on the lands topographical, vegetation, sheltering and historical hunting resources. Once the areas in which object or artefacts were predicted to be located were determined, indigenous and non-indigenous cultural heritage field surveys were undertaken by foot. The areas surveyed included all of the sites for potential turbine locations as well as all the transmission line route options. Other areas where there was a high potential to find objects or artefacts were also assessed. The specific surveys for non-indigenous heritage involved surveying the site for European artefacts and signs of early European settlement and farming/land management practices

The site had previously been well surveyed by Heritage Concepts during 2005, during which the drought was at its height and as such the soil exposure was high compared to the current surveys which followed good rain and so had reduced visibility.

Surveys for non-indigenous heritage involved surveying the site for European artefacts and signs of early European settlement and farming/land management practices.

ERM's review of the fieldwork and assessment components of the project undertaken by Anderson Environmental confirms that the requirements of the *Aboriginal cultural heritage consultation requirements for proponents 2010* (OEH 2010) were incorporated in the methodology, and that the project has been conducted in accordance with the OEH 2010 *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*.

In undertaking the supplementary heritage impact assessment, ERM has not undertaken any additional field work or had any direct consultation with Aboriginal parties.

Seven key criteria have been used by ERM to examine the scientific significance of a site. These are based on the legislative guidelines (OEH 2010 and NPWS 1999). These are:

1. *rarity: whether any or all aspects of a site (type, location, integrity, content and archaeological potential) can be considered common or rare within a local, regional or national context;*
2. *representativeness: the comparative rarity of the site when considered and contrasted against other similar sites conserved at the local and/or regional level;*
3. *archaeological landscapes: the study of the cultural sites relating to Aboriginal peoples within the context of their interactions in the wider social and natural environment they inhabited. Landscapes can be large or small depending upon specific contexts (i.e. local or regional conditions); they may also may be influenced by Aboriginal social and demographic factors (which may no longer be apparent);*
4. *connectedness: whether a site can be connected to other sites at the local or regional level through aspects such as type, chronology, content (i.e. materials present, manufacturing processes), spatial patterning or ethno-historical information;*
5. *integrity & condition: integrity refers to the level of modification a site has been subject to (the cultural and natural formation process) and whether the site could yield intact archaeological deposits, which could be spatially meaningful. Condition takes into account the state of the material, which is especially relevant for organic materials;*
6. *complexity: the demonstrated or potential ability of a site to yield a complex assemblage (stone, bone and/or shell) and/or features (hearths, fire pits, activity areas); and*
7. *archaeological sensitivity: the potential to yield information (from sub-surface materials which retain integrity, stratigraphical or not) that will contribute to an understanding of contemporary archaeological interest, or which could be saved for future research potential.*

Each site is designated a significance rating by ERM as either 'High', 'Moderate', 'Low/Moderate' or 'Low' based on the above criteria.

ERM's assessment of the cultural/social significance involved an analysis of the consultation process that was undertaken with local Aboriginal stakeholders. ERM confirms that in accordance with the consultation guidelines, Aboriginal representatives, stakeholder groups or individuals who hold information concerning the significance of Aboriginal cultural heritage and wished to be consulted were identified and consulted with. Refer to **Chapter 22** of this report for further details on the consultation process.

18.3 Results

18.3.1 2005 Heritage Concepts assessment

An indigenous and non-indigenous cultural heritage survey and draft impact assessment was previously undertaken by Heritage Concepts in June 2005. This report is not available for publication due to its draft format and potential copyright restrictions; however the proponent has been granted permission to use and reference the results of the surveys. The 2005 assessment found 14 Aboriginal Archaeological sites and 5 historic cultural sites across the landscape. For the detailed results of the 2005 survey refer to 'Appendix C Aboriginal Archaeological Sites (June 2005)' and 'Appendix D Historic Cultural Sites (June 2005)' in the Anderson Environmental Heritage Impact Assessment at **Appendix 12a**. Prior to the 2005 assessment, no other indigenous cultural heritage surveys had been undertaken and therefore no Aboriginal Archaeological sites had previously been identified.

The following three sites which were found in the 2005 surveys occur near proposed turbines and/or infrastructure and therefore have the potential to be impacted (refer to **Figure 58 – Aboriginal Archaeological and Historic Cultural Heritage Sites**):

- Site PYWF A11 located near Turbine P47.
- Site PYWF A10 located near access track between turbines P45 and P46.
- Site PYWF A7 located near access track between turbines P54 and P55.

It may be possible to avoid these sites through the micro-siting of turbines and access tracks; however, a range of options will be explored in the future Cultural Heritage Management Plan prior to the construction phase. If impact cannot be avoided due to terrain restrictions, then the heritage sites would be salvaged and relocated nearby as instructed by the relevant agency.

In the supplementary heritage impact assessment, ERM notes that *"of the 14 sites recorded in the Heritage Concepts 2005 Report, A7, A10 and A11 contain a moderate archaeological sensitivity and scientific significance, whilst also having a high Aboriginal cultural significance"*. ERM recommends that direct impact upon these three sites be avoided through micro-siting and through effective construction management as part of a CHMP.

18.3.2 Indigenous cultural heritage

The indigenous cultural heritage survey by Anderson Environmental detected eight additional Aboriginal Archaeological sites distributed on both the eastern and western sides of the site. The additional areas surveyed were designed to include the new proposed development footprint that was outside the 2005 survey scope. Refer to **Figure 58 – Aboriginal Archaeological and Historic Cultural Heritage Sites** for the locations of the sites.

Anderson Environmental found that none of the sites detected would likely be impacted by the project.

The targeted surveys revealed that indigenous artefacts were not at high levels within the site. The artefacts that do exist within the landscape are distributed generally near the ridge lines and small rises in the country (refer to **Figure 58**).

Sites 1, 2, 3 and 4 are considered to be of low significance and will not be impacted by the project.

Site 5 is considered to be of moderate significance. Based on the current indicative layout, this site will not be impacted by the project. However, the impact on this site will be revised once the final layout is determined.

Site 6 is considered to be of moderate to high significance based on its location within the landscape. Based on the current layout, this site will not be impacted by the project. However, the impact on this site will be revised once the final layout is determined.

Site 7 is considered to be of moderate significance. Based on the current indicative layout, this site will not be impacted by the project. However, the impact on this site will be revised once the final layout is determined.

Site 8 is a moderately significant site due to a high number of artefacts found in this location. The site is near the proposed turbine location 31. However, any impacts on this site may be able to be avoided as the proposed turbines and access road do not currently fall within the Site 8 area. Therefore, based on the current indicative layout, this site will not be impacted by the project. However, the impact on this site will be revised once the final layout is determined.

A summary of the eight identified sites and artefacts detected is provided in the table below.

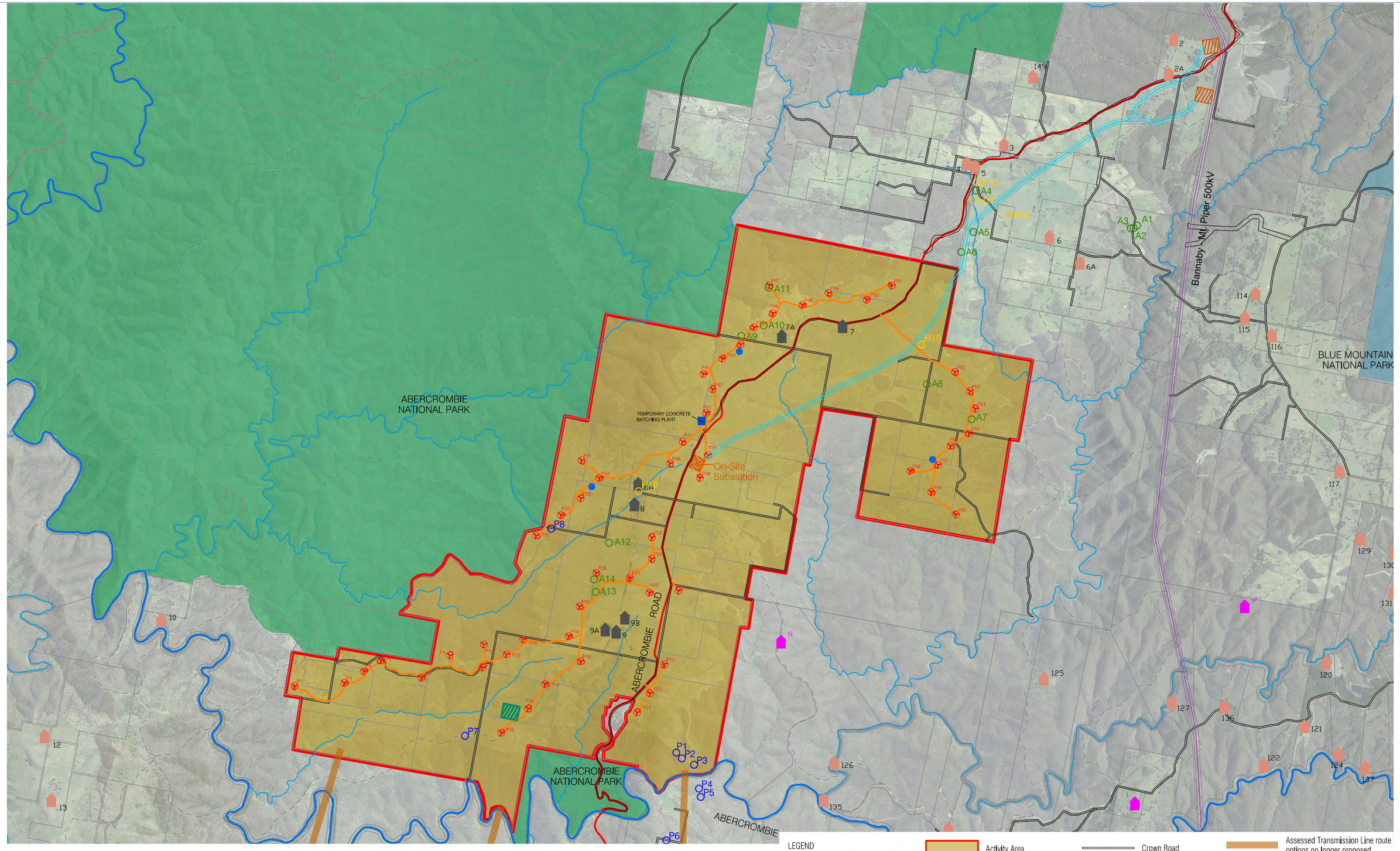


Figure 58 Aboriginal Archaeological & Historic Cultural Heritage Sites

Source: *Tract Consultants*

Table 26 Survey results of indigenous artefacts found on site

Site No. and contents	Heritage Type	Location	Impact Significance
Site 1 8 stone fragments	Indigenous	Towards the south-east boundary of the site, adjacent to a fenceline.	Low significance. Pejar LALC agrees with this assessment of significance.
Site 2 4 artefacts	Indigenous	Downhill from site 1 along the cleared fenceline area.	Low significance. Pejar LALC agrees with this assessment of significance.
Site 3 6 artefacts	Indigenous	This site is present further downslope along the fenceline from Site 2.	Low significance. Pejar LALC agrees with this assessment of significance.
Site 4 5 artefacts	Indigenous	Top of a rise on the southern side of the Abercrombie River, outside the site boundary.	Low significance. Pejar LALC agrees with this assessment of significance.
Site 5 1 core and five flakes and two larger artefacts	Indigenous	On the southern side of the Abercrombie River on the lower eastern knoll near to "the racecourse", outside the site boundary.	Moderate significance. Pejar LALC agrees with this assessment of significance.
Site 6 35 various flakes and cores	Indigenous	Top of a hill approximately 800 metres south-west from Site 5.	Moderate to high significance. Pejar LALC agrees with this assessment of significance.
Site 7 1 core and backblade artefact	Indigenous	Towards the south-western side of the site boundary.	Moderate significance. Pejar LALC agrees with this assessment of significance.
Site 8 55 artefacts	Indigenous	Approximately 3km north of Site 7, in the west side of the site.	Moderate significance. Pejar LALC agrees with this assessment of significance.

The project remains subject to detailed design, particularly in relation to the location of the access tracks, underground cabling and overhead electrical connections. As such, it may be possible to avoid these sites through the micrositing of turbines and access tracks. A range of options will be explored in the future Cultural Heritage Management Plan prior to the construction phase.

Additional surveys will be required once the project is approved and the final locations of access tracks, cabling, and powerlines are determined and pegged. This would allow for minor changes to the final design if required.

Further assessment is not deemed to be required in most paddock areas as there is a long history of soil disturbance and pasture improvement.

Significant consultation has taken place with relevant parties in particular with the Pejar Local Aboriginal Land Council (Pejar LALC) regarding the identified heritage sites. However, prior to construction further consultation relating to the preparation of the Cultural Heritage Management Plan should be undertaken in collaboration with Pejar LALC and other stakeholders (collectively referred to as 'Registered Aboriginal Parties') that have registered their interest for participation in the consultation process for this development project.

18.3.3 Non-indigenous cultural heritage

In relation to non-indigenous heritage, Anderson Environmental found that a number of non-indigenous cultural heritage items are located within the site, including Mingary Park Airstrip, Quobleigh basalt chimney and plantings, Steam Boiler, Stockyards and Stillwell burial ground. However, none of the non-indigenous cultural heritage items located within the site would be disturbed as part of the project.

Furthermore, none of the non-indigenous sites are considered to be significant and none are listed under any heritage register or recorded in the Local Environmental Plan (LEP) for Oberon and Upper Lachlan Shires, or the recent Cultural Heritage Study of the Upper Lachlan Shire.

18.4 Assessment of significance

18.4.1 Archaeological significance

ERM Pty Ltd evaluated the significance of the archaeological sites and landscapes identified in the surveys and assessment undertaken by Anderson Environmental. ERM acknowledges that a total of 22 Aboriginal sites are recorded within the project site (14 recorded in 2005 by Heritage Concepts and eight recorded by Anderson Environmental in 2012).

ERM assessed the eight sites recorded in the recent survey and designated each site with a scientific significance ranking in terms of rarity, representativeness, archaeological landscape, connectedness, integrity and condition, complexity, and archaeological sensitivity, in accordance with the legislative guidelines (OEH 2010 and NPWS 1999). Refer to the methodology at **Chapter 18.2** for the determination of the ranking.

The table below summarises the archaeological sensitivity and scientific and aboriginal cultural significance of the landscapes and the eight identified archaeological sites (P1-P8) within the project site.

Table 27 Summary of Heritage Significance Assessment

Landscape units and sites	Archaeological sensitivity	Scientific significance	Aboriginal cultural significance	Overall ranking
Head of gullies	Moderate	Moderate	Moderate	Moderate
Low rises (near water)	Moderate	Moderate	Moderate	Moderate
Slight slope areas (near water)	Moderate	Moderate	Moderate	Moderate
Site P1	Moderate	Low	High	Low
Site P2	Moderate	Low	High	Low
Site P3	Low	Low	High	Low
Site P4	Low	Low	High	Low
Site P5	Low/ Moderate	Moderate	High	Moderate
Site P6	Low/ Moderate	Moderate	High	Moderate
Site P7	Low/ Moderate	Moderate	High	Moderate
Site P8	Moderate	Moderate	High	Moderate

Following an assessment of the significance of the sites, ERM concludes that:

- All sites identified within the project site are common site types at a local and regional level
- Stone artefact scatters are the only site type represented in the region
- Four of the artefact scatters within the project site (Sites P1, P2, P3 and P4) have been assessed as having 'Low' archaeological significance, as these sites have not demonstrated a significantly greater diversity or complexity in comparison to other known sites within the region
- The remaining four sites (Sites P5, P6, P7 and P8) have been allocated a 'Moderate' archaeological significance rating based on the larger number of artefacts present and the sites' potential to reveal in situ sub-surface deposits

In terms of actual impacts caused by the project, ERM found that any real risks associated with turbine placements and construction is associated with site P8. Therefore, ERM recommends that *"sub-surface investigation may be warranted associated with any turbines proposed within 100m of site P8, which could occur post development consent"*. ERM also recommends that a minimum distance or separation buffer of 100 metres should be maintained from any turbine and site P8.

18.4.2 Cultural significance

ERM acknowledges that *"landscapes or locations within a landscape may hold special significance to Aboriginal communities as places where traditional lifestyles have occurred and where sacred or symbolic significance places exist"*. Accordingly, ERM notes that Aboriginal cultural significance is determined by the Aboriginal community.

In response to the consultation process undertaken (including the newspaper advertisements in 2010 and expression of interest (EOI) in community participation and consultation letters in 2010 and 2013, which are outlined in more detail in **Chapter 22**,

registrations of interest were received from three Aboriginal Parties. These parties were:

- Luke Burges (Pejar Local Aboriginal Land Council)
- Lance Syme (Warrabinga Native Title Claimants Aboriginal Corporation)
- Bill Allen (Muri Clan Group of the Wiradyri People)

The registered stakeholders were provided with written information regarding the scope of the proposed project and the methodology for the proposed cultural heritage assessment process. Mr Luke Burges of the Pejar Local Aboriginal Land Council replied to the request to participate in the project and provide feedback on the proposed methodology.

During the fieldwork component of this study and in accordance with the relevant Aboriginal consultation guidelines, Mr Burges was asked about the cultural significance (to individuals and the community more broadly) of the project site and the identified heritage sites. Mr Burges responded that:

- *"the project site holds a high level of cultural significance to Aboriginal people as it is situated within areas that were used for hunting, gathering and camping by past Aboriginal groups and therefore represents Aboriginal occupation of the region, a past way of life and a direct link to their ancestors*
- *the wider landscape, particularly the flora, fauna and water courses associated with the study area are significant to them and other past and present Aboriginal people as they formed part of an economic resource environment"*.

In response to the identification of the project site as holding a high level of Aboriginal cultural significance, the layout of the project components has been carefully designed to minimise impact on the identified archaeological sites, and mitigation measures have been developed to further minimise impacts on archaeological and cultural heritage (refer to **Chapter 18.5** below). This includes the preparation of a Cultural Heritage Management Plan for the project and consultation and collaboration with the Registered Aboriginal Parties.

In accordance with the DGRs for this project, the heritage assessments have been developed in consultation with Aboriginal stakeholders who hold cultural knowledge or responsibility for the land within the project site.

18.5 Mitigation

The report recommends the following actions in order to preserve areas of cultural heritage significance and amelioration of potential impacts;

- Avoid, as far as practicable, impacts on the known archaeological sites.
- A comprehensive Cultural Heritage Management Plan should be prepared in consultation and collaboration with the Registered Aboriginal Parties to reduce and mitigate the impacts of the project on any artefacts which may be detected within disturbance zones. If it is not practicable to locate infrastructure so as avoid objects / artefacts then cooperation with Registered Aboriginal Parties should be undertaken to determine the management option for these objects / artefacts (i.e. collection for education purposes or moving the objects / artefacts slightly to outside the zone of disturbance).

- The movement of identified objects is considered to be a suitable mitigation measure in most cases as the distances involved would not be significant, and many of the objects may have been moved in the past via water movement, erosion or vehicle/tractor movements such as road grading and cultivation of the ground.
- The Cultural Heritage Management Plan should also outline management strategies for the management of any potential unrecorded sites which are identified within the site during construction of the project. In accordance with the Draft NSW Wind Farm Planning Guidelines, the construction program control measures should include provision to temporarily halt the excavation of a specific site in the event that a previously unidentified Aboriginal object(s) and historic relic is uncovered. All works likely to affect the object/relic should cease and the OEH officers and the Registered Aboriginal Parties notified. Works should not recommence at the specific site until an appropriate strategy for managing the object/relic has been determined in consultation with OEH and the Aboriginal stakeholders and a permit or written authorisation has been obtained from OEH.
- If impacts to any further sites which are identified cannot be avoided then further investigation would be required in consultation with Registered Aboriginal Parties and OEH. This would include sub-surface digs and analysis.
- As the detailed design of the proposed access tracks and electrical connections were not available at the time the field surveys were conducted, potential deviations to the surveyed routes may be made during detailed design to reduce impact(s) on the land.
- Once the proposed access track locations and other disturbance areas are pegged on the ground, additional targeted surveys of these areas should be undertaken. Where these additional targeted surveys identify any further sites, test pits should be undertaken in order to determine the extent of significance of any sites which would be potentially impacted.
- The final micrositing of the proposed infrastructure should be undertaken in consideration of utilising and upgrading as much as possible the existing farm access tracks where possible to achieve an overall site plan which minimises unnecessary new soil disturbance.
- A minimum distance or separation buffer of 100 meters to be maintained from any turbine and site P8. If the separation distance is not practical, then a sub-surface investigation should be undertaken for any turbine proposed within 100m of site P8.

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CHAPTER 19

GEOTECHNICAL IMPACTS

19 Geotechnical Impacts

19.1 Introduction

URS Australia Pty Ltd (URS) was commissioned by UFWA in order to assess the potential geotechnical impacts in relation to the project. The full report undertaken by URS accompanies this application as **Appendix 13**.

The assessment has been prepared in order to;

- provide a preliminary understanding of the geological setting and its potential impact on footing type and size for turbines, monitoring towers, substations and transmission towers;
- consider groundwater and slope stability issues and their implications for footing types, trenching and access tracks;
- make a preliminary assessment of geotechnical constraints that could affect the construction of access roads, hardstand and lay down areas including the use of locally sourced materials;
- provide preliminary indication regarding electrical resistivity and thermal conductivity of site soils; and
- consider the potential for soil erosion and/or soil/groundwater contamination.

The report presents findings on a number of geotechnical aspects relevant to the project. These include the following:

- Details of the investigation
- Subsurface conditions and geotechnical considerations for the proposed wind turbine sites.
- Groundwater issues
- Potential slope stability considerations
- Construction considerations
- Recommendations for future investigations

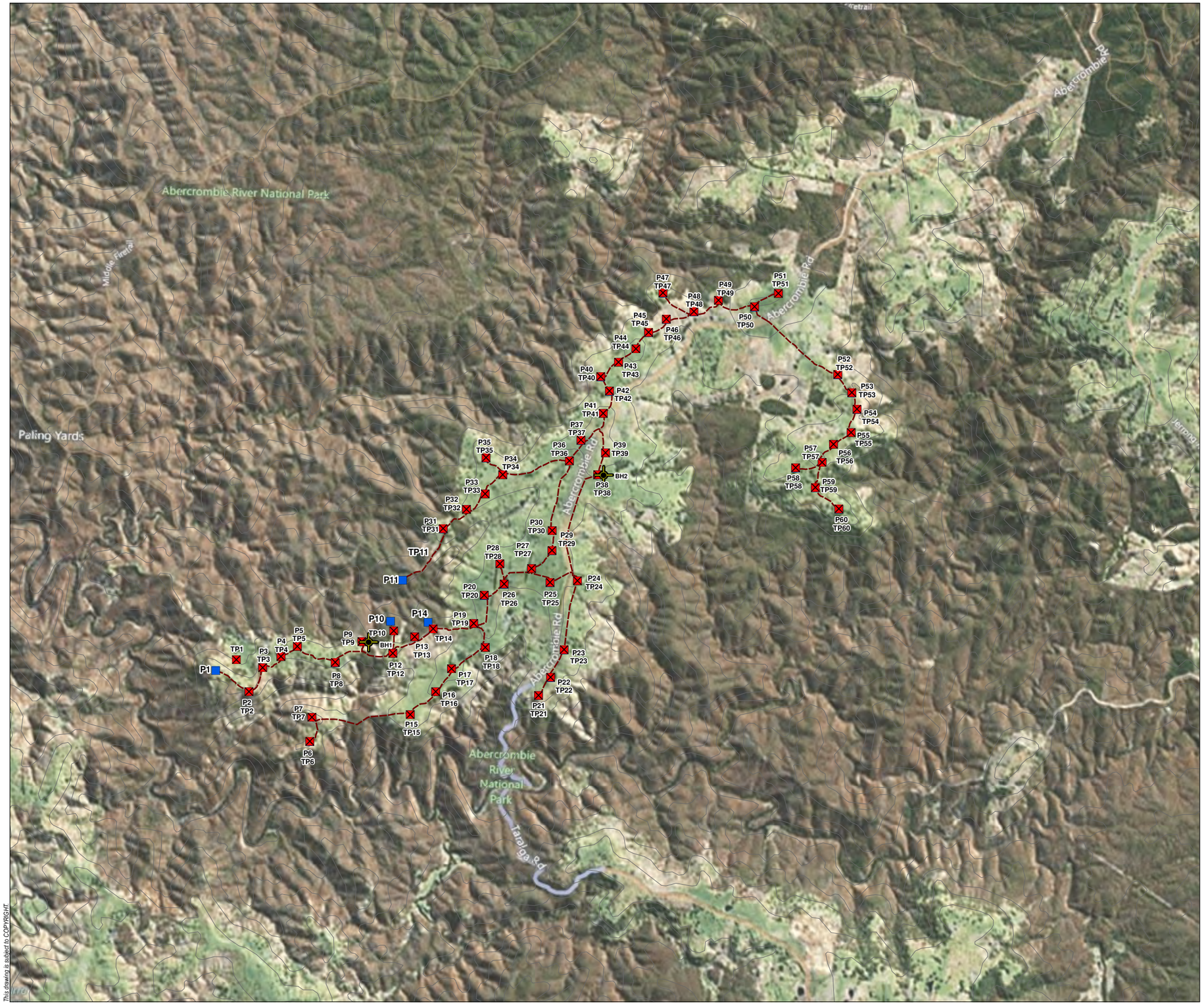
19.2 Assessment Methodology

Preliminary geotechnical investigations were carried out between 11 April 2011 and 21 July 2011 to identify and characterise the main geologic units at the site. All the geotechnical investigation work was carried out by an experienced URS geotechnical engineer.

The following works were carried out to characterise the soil and rock properties of the main geologic units across the site:

- A walk over inspection of the site and surroundings.
- Drilling of two geotechnical boreholes up to a depth of 20m.
- Excavation of sixty test pits.
- A total of sixty Dynamic Cone Penetrometer (DCP) tests were carried out, ensuring a DCP test adjacent to each test pit.
- Collection of representative soils samples for laboratory testing.
- The Test Pit and DCP locations are shown on Figure 1, Appendix A of the geotechnical report.

The test pit locations for the geotechnical assessment are shown on **Figure 59**.



This drawing is subject to COPYRIGHT

LEGEND

- TP1 — TEST PIT
- P1 — TURBINES
- BOREHOLES
- 33kV UNDERGROUND CABLE

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Km

Datum: GDA94

Source: Aerial Image from Bing Maps Copyright © 2010 Microsoft Corporation and/or its suppliers

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**TEST PIT LOCATION
SITE PLAN**

URS | Figure: 1 | Rev. A | A3

Figure 59 Geotechnical Investigations Test Pit Locations

Source: *UFWA*

19.3 General Site Geology and Topography

The majority of the site comprises farmland with farm houses and stock sheds present. The site is accessible from Abercrombie Road and via a network of unsealed roads.

The site topography comprises 'plateau' and 'hillcrest' areas at an elevation of between 900 metres and 1065 metres surrounded by steeply sloping gullies and creek lines that flow to the Abercrombie River. The gently sloping plateau areas are generally cleared and used for grazing, while the more steeply sloping areas are generally uncleared and heavily vegetated.

The plateau areas are "*underlain by Tertiary aged Volcanics which typically comprises residual clay, frequently with cobbles and boulders, overlying variably weathered basalt at relatively shallow depths". Tertiary aged alluvial deposits "underlie the Tertiary Volcanics at depth, overlying Ordovician aged meta-siltstone basement".*

19.4 Results

Importantly, the report highlights that "*It has revealed that from the investigations carried out, there are no major geological issues that would potential prevent the construction of the proposed development, provided the recommendations of this study are followed and further investigation is undertaken at a later stage where warranted"*.

19.4.1 Geological conditions

The geological conditions of the site were found to comprise Tertiary Volcanics and Ordovician materials with associated residual soils. The surface soils were determined as predominantly silty sand that is fine grained and dense, as well as some gravel, cobble, and boulder basalt.

The residual soils were found to be a mix of clayey sand, gravel sand, sandy clay and clay, with some fine grained and some course grained gravel basalt, as well as some cobble basalt. The bedrock in the Tertiary Volcanics area is basalt of medium to high strength, and distinctly to extremely weathered, while the Ordovician bedrock is siltstone, ranging from low to medium strength, and also distinctly to extremely weathered.

URS note that "*no major faults of shear zones cross the site and the boundaries between the rock units are erosional"* and "*the Basalt and Siltstone are fractured on a regional scale, the Basalt due to cooling and the Siltstone due to folding and low grade metamorphism".*

19.4.2 Groundwater

In relation to groundwater conditions, URS did not observe any groundwater in the test pits or boreholes during drilling. However, URS emphasise that *"these observations were made at the time of the field investigation and actual groundwater levels may fluctuate significantly in response to seasonal effects, regional rainfall, and other factors that are not related to this investigation"*.

URS note that "*it is anticipated that the fractured Basalt and the underlying Tertiary sediments are typically water bearing and can form perched water tables on weathered Ordovician basement".*

19.4.3 Footing Systems

The conventional turbine foundations are reinforced concrete gravity footings founded 1.5 to 3 metres below the existing ground surface. URS found that the footings are sized such that the maximum allowable bearing pressure is not exceeded on one side of the footing while the other side of the footing experiences uplift loads.

URS identifies the potential foundation system suitable for the proposed wind turbines currently under consideration. The two main footing systems available to be utilised for the wind turbine generators in this project are:

- gravity footings; and
- anchored footings.

The use of these different types of footings would largely rely on the final turbine type selection and the localised conditions at the base of each individual turbine.

The report concludes that further geotechnical investigations at the turbine sites are recommended to guide footing designs.

19.4.4 Excavation conditions

Based on the subsurface conditions assessed from the test pits, excavations for access roads, construction platform and foundations for the proposed wind turbines would likely encounter a 'variable thickness' of *"sandy clay/clayey sand with some basalt cobble and boulder, weathered basalt and siltstone bedrock"*.

URS note that some basalt boulders may be encountered when excavating within first few meters, which may require large plant or over excavation to remove.

Bulk excavation in the 'extremely to distinctly weathered' basalt or siltstone may be generally carried out using a heavy bulldozer or a heavy hydraulic excavator.

19.4.5 Cut Batter Slope and Fill Batter Stability

All batter slopes will need to be assessed and confirmed on site as construction work proceeds. URS note that *"the stability of batter slopes within the basalt and siltstone rock will depend on the orientation and spacing of joints and defects, which should be assessed during construction phase"*. Temporary surface protection may be provided for temporary cuts subject to the frequency of rainfall during the construction period.

Fill batters up to 10m high may be supported by battering at '2Horizontal:1Vertical'. On sloping ground fill batters shall be keyed into the slope using terraces not less than 1.0 metre high and 1.0 metre wide.

19.4.6 Re-use of In-Situ Materials

URS make the following comments on the potential re-use of excavated materials for engineered fill:

- *The performance of the residual sandy clay and clayey sand soils is likely to be sensitive to changes in moisture content.*
- *Careful moisture conditioning and compaction will be required to compact these materials effectively.*
- *The extremely to distinctly weathered basalt and siltstone rock may be re-used as engineered fill if, during excavation, handling and re-compaction, the rock breaks down to fragments in the order of 100mm or less.*

19.4.7 Pavement sub-grade

The results of limited soaked California Bearing Ratio (CBR) tests conducted on selected sub-grade samples of residual sandy clay, sandy or gravelly sand, indicated CBR values of between 1.5% and 10%.

URS recommends that a CBR value of 2% to be adopted for sub-grade materials with a high clay content (such as where the Basalt outcrops), and a CBR value of 10% adopted for predominantly weathered siltstone bedrock in the design of flexible sealed or unsealed granular pavement.

19.4.8 Slope Stability Assessment and Erosion

URS found slope instability issues along Abercrombie (Goulburn-Oberon) Road, adjacent to the southern central boundary of the site. The subject area and its hilly surrounds support 'mature, healthy native forest vegetation'. URS found that *"small slope failure has occurred during the investigation period"* but *"no evidence of major slope instability was observed"*.

The report notes that slope instability issues are likely to be confined to steeply sloping land at the head of a gully. URS recommends that:

- *Access roads should be designed to stay on the ridge crests and remain clear of potential land slips.*
- *if crossing a potential land slip is required then the road formation should be designed to remove any potentially unstable material and found on stable bedrock.*
- *site works, including excavation and filling, be planned accordingly to reduce the risk of high concentrated surface water runoff.*

19.5 Mitigation

Based on the preliminary investigations on site, the report outlined the following recommendations and measures to mitigate any adverse geotechnical impacts:

- *further detailed subsurface geotechnical investigation and analysis be conducted to provide information for the detailed design of footings, access road, slope stability, and other associated infrastructure.*
- *access roads should be designed to stay on the ridge crests and remain clear of potential land slips.*
- *if crossing a potential land slip is required then the road formation should be designed to remove any potentially unstable material and found on stable bedrock.*
- *site works, including excavation and filling, be planned accordingly to reduce the risk of high concentrated surface water runoff.*
- *a Soil Erosion Management Plan be prepared as part of the Construction Environmental Management Plan.*

In relation to sub-grade preparation and fill replacement, URS recommend that the following site preparation be carried out for pavement sub-grade and fill placement beneath structures and footings using predominantly residual sandy clay and clayey sand soils and broken up basalt and siltstone rock:

- *Remove any soft, wet, and highly compressible material or topsoil material and organics.*

- *Assess moisture contents of the bulk excavated soils and weathered rock. For compaction of any materials other than free draining sands, the moisture content should be in range OMC +/-2% (wet/dry), where OMC is the optimum moisture content at Standard Compaction.*
- *Test roll the complete surface of the sub-grade in order to detect the presence of any soft or loose zones, which should be excavated out and replaced with approved filling. Test rolling should be carried out with a smooth drum roller with a minimum static weight of 8 tonne.*
- *For pavements, compact the natural foundation soil to a minimum dry density ratio of 98% Standard for clay soils or a minimum density index of 75% for sand soils.*
- *For pavements, approved filling excavated from site, should be placed in layers not exceeding 250mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% Standard or a minimum density index of 75% for filling greater than 0.5m below top of finished subgrade level. It is recommended that the final upper 0.5m of filling sub-grade be compacted to a minimum dry density ratio of 100% Standard or 80% density index. Where filling has a clay content, moisture content within the filling should be maintained within OMC -2% (dry) to OMC +2% (wet) during and after compaction.*
- *All filling beneath structures and footings should be compacted to a dry density ratio of at least 100% Standard or relative density index of at least 80%. This compaction should apply to all filling extending from a nominal horizontal distance of 2m at the edge of each structure with a nominal zone of influence of 1H:1V down and away from the proposed sub-grade level.*
- *Any compaction of silty or sandy clay foundation soils at or close to footing formation level should be sealed or covered as soon as practicable, to reduce the opportunity for occurrence of desiccation and cracking.*
- *Level 1 testing and supervision of filling, in accordance with AS3798, is recommended where the filling is to be used for support of structural loads, within the 2m horizontal distance and spread from structures as outlined above.*
- *All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, should be processed so that individual particles are in the order of 100mm or less.*
- *All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, should be processed so that individual particles are in the order of 100mm or less.*
- *Approved rock filling excavated from site should be placed in layers not exceeding 300mm loose thickness with care taken to minimise the occurrence of voids. Fine sands and dispersive clays should not be included in the fill due to the susceptibility to erosion.*
- *Where pavements are proposed over bulk rock filling, it is recommended that the rock fill be covered with a non-woven, needle punched, continuous filament polyester geofabric of sufficient strength to avoid punching failure.*
- *Place a minimum 0.5m thick cover of granular bridging on the geofabric in two layers of 250mm loose thickness, to provide sub-grade support for the pavement. The bridging layers should be compacted to a minimum dry density ratio of 100% Standard or 80% density index.*
- *Granular bridging or sub-grade filling should comprise engineered fill material.*

In relation to potential water contamination, the CEMP will include measures to ensure that any contaminated soil encountered during any excavation works construction is appropriately managed and disposed of offsite.

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CHAPTER 20

HYDROLOGICAL IMPACTS

20 Hydrological Impacts

20.1 Introduction

Environmental Resources Management Australia (ERM) Pty Ltd was commissioned by UFWA to assess the potential hydrological impacts in relation to the project. The full report undertaken by ERM Pty Ltd accompanies this report at **Appendix 14**.

A wind farm in a rural area can potentially impact on the hydrology of the area, notably on streams, drainage lines, dams and water catchments.

This hydrological assessment identifies potential water-related risks and appropriate management and mitigation measures to ensure that construction and operation of the project would not result in any unacceptable hydrological impacts.

20.2 Methodology

ERM undertook a site visit to assess the existing conditions on site and in the surrounding area and to identify potential water-related risks.

The assessment was prepared to:

- Address the DGRs relating to "Water Supply and Waterways".
- Describe the existing soil and water conditions across the Project area;
- Identify the key potential soil and water impacts and assess associated risks;
- Identify likely impacts to waterway crossings and measures to minimise impacts;
- Provide details of waterway crossings;
- Identify appropriate management and mitigation measures. A Conceptual Soil and Water Management Plan is provided;
- Analyse water demands and supply options to determine whether an adequate and secure water supply is available for the life of the project;
- Identify the statutory (licensing) context of the water supply sources and assess potential impacts;
- Determine the balance of water supply based on expected construction and operation water requirements; and
- Where the project lies within the Sydney drinking water catchment area, assess potential impacts for water pollution consistent with the heads of consideration provided in Drinking Water *Catchments Regional Environmental Plan No.1*.

20.3 Existing Environment

The site is characterised by a prominent elevated plateaux landscape dissected by deep valleys. More than 50 ephemeral first order watercourses are present within the site, including the Abercrombie River. The watercourses flow generally towards the south and west, to the Abercrombie River. Refer to Section 2.3 'Surface Waters and Watercourse Crossings' of **Appendix 14** for further information.

These first order watercourses exist within open depressions mostly without incised channels or defined bed or banks; they are for the most part stable and well vegetated with pasture grasses. There are very few instances of active erosion along watercourses.

The higher order watercourses also tend to be stable and well vegetated, with only minor areas of active erosion.

The Abercrombie River is present directly south of the site, flowing along the site's south-eastern boundary. It is 130 km in length and commences from Mount Werong in the east to the Wyangala Dam near Cowra to the west. The river is a tributary of the Lachlan, a significant river in central New South Wales, which it joins at Wyangala lake.

The Goulburn-Oberon (Abercrombie) Road crosses the Abercrombie River in the Abercrombie Gorge.

The site is located within the jurisdiction of two water sharing plans:

- Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012; and
- Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011.

The provisions of these two water sharing plans apply where water supply for the project is to be accessed via surface water and/or groundwater. Further discussion of these plans and how they relate to the project is provided in Section 3 'Water Licensing and Statutory Matters' of **Appendix 14**.

20.4 Water Requirements and Supply Options

The main water requirements during construction are expected to be for the following activities:

- Concrete production;
- Construction of roads and hardstands; and
- Dust suppression.

ERM estimates that the total water demand over the 12 month construction period will be approximately 30ML. Refer to Section 4.1 'Construction Water Demands' of **Appendix 14**. The total amount of water required for the project will depend on the time of year for construction, moisture present in the ground, final foundation design, and final road design. Water use during the operation of the project is negligible.

A number of water supply options have been identified for the water required during construction, the key options being:

- surface water collection from existing (or new) dams;
- groundwater pumping from existing (or new) bores;
- water abstraction from a nearby permanent water source (i.e. Abercrombie River); and
- tankering water to site.

ERM considers that the existing dams at Paling Yards and Mingary Park have the capacity to provide a good proportion of the project needs in a good rainfall year, but may be restricted in a dry year. Therefore ERM note that *"Construction of a new dam, particularly in a spring fed location, would greatly improve security of surface water supply and would meet the project needs under most rainfall scenarios"*.

ERM also note that *"groundwater supply from a new bore would be capable of supplying a large proportion of the project needs, and this could be considered in combination with use of surface water from existing dams"*.

While the Abercrombie River offers a highly secure source of water for road construction and dust suppression, the option of obtaining a Water Access License (WAL) from the Abercrombie River, while feasible, has logistical issues that require

further investigation. ERM consider that *"water extraction from the river would not be expected to diminish flows to the extent that environmental values or existing water users are adversely affected"*.

UFWA will consult with the NSW Office of Water in determining the preferred water supply option for the project and to ensure that all regulatory requirements are addressed and all required water access licences are obtained. Water access licensing would need to be addressed depending on the preferred option, and should be discussed with licensing officers at the NSW Office of Water. Refer to Section 3.1.6 'Water Access Licences' of **Appendix 14** for further information.

20.5 Impact Assessment

There is the potential that soil and water may be adversely affected during the construction, operation and decommissioning stages of a wind farm project.

As previously mentioned, ERM estimates that the total water demand over the 12 month construction period is 30ML. ERM assessed that the overall impact on water resources is expected to be negligible.

There are no instances where proposed access tracks are required to cross significant watercourses that would require construction of bridges or culverts. Further, there are no crossings over third order or higher watercourses.

The transmission line route options 1, 2 and 3 on **Figure 17 – Former Transmission Line Options Plan** cross a number of watercourses in approximately 17 locations. However, the Northern Transmission Line Route (option 4) does not cross any third order or higher watercourses. UFWA has selected option 4 as the preferred option due to its shorter length and reduced potential impacts. The potential hydrological impacts associated with the transmission line are therefore minimal..

Accordingly, ERM note that the potential soil and water impacts of the project relate mainly to:

- *"construction activities such as road and turbine construction;*
- *trenching for service installation;*
- *production and delivery of concrete (and managing concrete wastes);*
- *storage and handling, or incidental spills, of fuels, oils, concrete wastes and other hazardous substances; and*
- *inadequate management of the site compound facility's waste water and sewage runoff".*

As identified in Section 5 'Potential Impacts to Soil and Water' of **Appendix 14**, potential water-related impacts are primarily associated with the construction stage of the project. Once operational, the water usage requirements and potential impacts on water due to the project will be minimal.

Through appropriate management of construction activities, such as erosion and sediment control, hazardous material storage and handling, and spill emergency response and clean-up procedures, ERM note that potential water-related impacts could be contained on site and prevented from impacting watercourses.

These measures will be outlined in a detailed Soil and Water Management Plan (SWMP) to be prepared prior to construction.

The installation of wind turbine infrastructure is focused on high elevation areas, avoiding drainage lines. All disturbance areas associated with turbine construction

would be located greater than 20 metres from all watercourses and would be significantly further away from third order and higher order watercourses.

It is proposed that water recycling would be implemented during the construction phase. A stormwater recycling system will be provided with capacity sufficient to store runoff and to reuse collected wastewater. This would include the capture of water at the wash-down areas in the entrance gates and reuse for dust containment on unsealed access tracks and the watering of rehabilitated areas. Refer to Section 6 'Conceptual Soil and Water Management Plan' and Section 8 'Mitigation Measures' of **Appendix 14** for further details.

ERM's qualitative risk assessment found that "*the overall potential risks to water and soils are relatively minor".*

ERM recommends that the identified risks can be adequately managed through the implementation of appropriate preventative and management measures as part of the construction environmental management plan (CEMP) and SWMP. ERM provides a conceptual SWMP in Section 6 'Conceptual Soil and Water Management Plan' of (**Appendix 14**).

Based on the nature of the project and management techniques to be implemented, it is not expected that any of the local water bodies would be unreasonably impacted by the project.

20.6 Transmission Line Impacts

ERM identifies in Section 7.1 'Sydney Catchment Area and REP1' of **Appendix 14** that approximately 9 km of the southernmost section of the transmission line route comprising the common part of Options 1, 2 and 3, occurs within the hydrological catchment for Sydney's drinking water supply (*Drinking Water Catchments Regional Environmental Plan No 1* (REP1)).

It is important to note that, following further assessment, these connections options for the transmission line route are no longer proposed as the northern transmission line option (Refer to **Figure 13** and option 4 on **Figure 17**) has been identified as the preferred option.

ERM nonetheless assesses the impacts of transmission line route Options 1, 2 and 3 on **Figure 17** under REP1 and notes that, were these options to be implemented, potential water-related impacts could be contained on site and prevented from reaching watercourses through appropriate management of construction activities, to be outlined in a detailed SWMP prepared prior to the construction phase.

ERM accordingly concludes that the project complies with Clause 28(3)(b) of the REP1 and would maintain a 'neutral' or 'beneficial' effect on water quality.

20.7 Mitigation

ERM recommends the following management and mitigation measures to address potential soil and water impacts:

- prepare a detailed Soil and Water Management Plan (SWMP) prior to construction commencing. The SWMP should be prepared by a suitably qualified person, such as a soil conservationist;
- prepare Progressive Erosion and Sediment Control Plans as the project progresses to address management requirements at individual work sites;
- design and construct the wind farm and transmission line to minimise land disturbance and therefore reduce the erosion hazard;

- stage construction activities to minimise the duration and extent of land disturbance;
- manage topsoil resources to minimise the risk of erosion and sedimentation, and maximize reuse of topsoil during rehabilitation;
- divert upslope (clean) stormwater around the disturbed site capture sediment-laden runoff from within the disturbed site for diversion to sediment control devices;
- rehabilitate the site promptly and progressively as works progress;
- inspect and maintain erosion and sediment control devices for the duration of the project;
- avoid construction of new vehicle watercourse crossings;
- if need, any water crossings would be designed to minimise impacts on existing banks, water flow, animal passage and on the movement of flows.
- avoid land disturbance within 20 m of minor streams (first and second order watercourses) and 40 m of third order or higher watercourses;
- ensure appropriate procedures are in place for the transport, storage and handling of fuels, oils and other hazardous substances, including availability of spill cleanup kits;
- minimise disturbance during transmission line construction by using existing access tracks and roads, and avoiding construction of a permanent access track along the transmission line easement;
- avoid over-extraction of surface water or groundwater to prevent adverse impacts on environmental flows and water availability for existing licensed users;
- obtain any necessary water access licenses; and
- ensure appropriate stormwater, collection, treatment and recycling at the concrete batch plant, in accordance with relevant best practice guidelines and any requirements of the NSW Office of Environment and Heritage.

The above list of mitigation measures is included in Section 8 'Mitigation Measures' of **Appendix 14**.

Water would be reused where possible to reduce water consumption. No water would be sourced from creeks or rivers without relevant permits being sought.

Dust suppression would be carried out as required through either watering or chemical means (via environmentally friendly polymer based additives to the water).

A Spill Control Plan would be developed, as a sub-plan of the Construction Environmental Management Plan.

With the mitigation measures outlined in this report, and given the site characteristics, the overall impact on water resources is expected to be negligible.

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CHAPTER 21

CUMULATIVE EFFECTS

21 Cumulative Effects

21.1 Introduction

The New South Wales Central Tablelands and NSW/ACT Border Region has been identified as being highly suitable for wind turbines and the generation of renewable energy. As a result:

- other wind farms are proposed, approved or already operating in the wider region;
- companies are active in the wider region identifying suitable future wind farm sites; and
- the NSW Government has included Paling Yards within a designated renewable energy precinct.

When a number of wind farms are proposed or constructed in an area, there is potential for the impacts of one project to combine with the impacts of another to generate greater collective impacts than the individual projects themselves.

Cumulative effects are the total or combined impacts arising from a number of connected or separate projects, affecting the same environmental issue.

Cumulative impacts are defined as "*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions* (CEQ, 2010).

This chapter assesses the potential cumulative impacts of the project with surrounding proposed, approved and operating wind farms in the locality.

21.2 General impacts

Assessment agencies and the wind industry itself acknowledge the difficulties associated with undertaking cumulative impact assessments, due to the lack of information about the final form and expected impacts of proposed or approved wind farms, and whether surrounding wind farm proposals would actually proceed.

It is not uncommon for a permitted wind farm to sit idle for many years before construction commences, if at all. A decision to refuse a particular wind farm based on the unacceptable cumulative impacts of it together with another nearby wind farm relies on the certainty that the adjoining project would proceed.

Established planning practice does not allow for the development of a wind farm project to be conditional on the abandonment of another.

The potential for cumulative impacts arising out of a proposal is dependent on the type of impact and the proximity of the projects. For example, shadow flicker has a very localised impact, and therefore requires two very closely placed wind farms in order for cumulative impacts to arise.

Flora and fauna impacts, however, are more regional in that a large number of wind farms in a given region may give rise to impacts to threatened species that depend on the wider region for habitat. Similarly, visual impacts of a wind farm can extend tens of kilometers and, when viewed in conjunction with another wind farm, can result in unacceptable cumulative impact.

A number of wind farms in the region either exist or are in various stages of the approvals process.

The greatest potential for cumulative impacts arising from the project is with the wind farms closest to the site, being the proposed Golspie Wind Farm and the approved Taralga Wind Farm, approximately 25km and 28km south of the site respectively. All other wind farms (proposed, approved or operating) are greater than 30km from the site.

Golspie Wind Farm is located approximately 25km south-west of the site. It is currently proposed, and includes upward of 100 turbines and a total capacity of 250 MW.

Taralga Wind Farm is located approximately 28km south-east of the site. It is an approved wind farm, and includes 62 turbines and a total capacity of 186 MW.

The project is located within a generally isolated location, and given that all wind farms (proposed, approved or operating) are a distance of approximately 25km or greater from the site. As a result, it is not anticipated that any significant cumulative impacts will occur due to the project.

21.3 Wind farm developments in the Central Tablelands

The NSW Department of Environment, Climate Change and Water (DECCW) has established six Renewable Energy Precincts. Precinct 4: NSW/ACT Border Region (within which the site lies) is home to several wind farms, with a number of others either approved or in planning stages (refer to **Figure 7** in **Chapter 3 – Site Context**).

Each of the six Renewable Energy Precincts precincts have been established as locations for the State's future wind power investment due to the area's suitability for the technology.

There are currently 14 proposed wind farms, ten approved wind farms and five wind farms in operation in NSW**.** Of these 29 wind farms, none are located within a 20 km radius of the site, and only one is located within a 25km radius, being the proposed Golspie Wind Farm.

The table below summaries wind farms within the region and includes information on the number of turbines, the status (proposed, approved or in operation) and the proponent for each of the wind farms.

Please refer to **Figure 60 – Cumulative Impacts Plan** for the project locations.

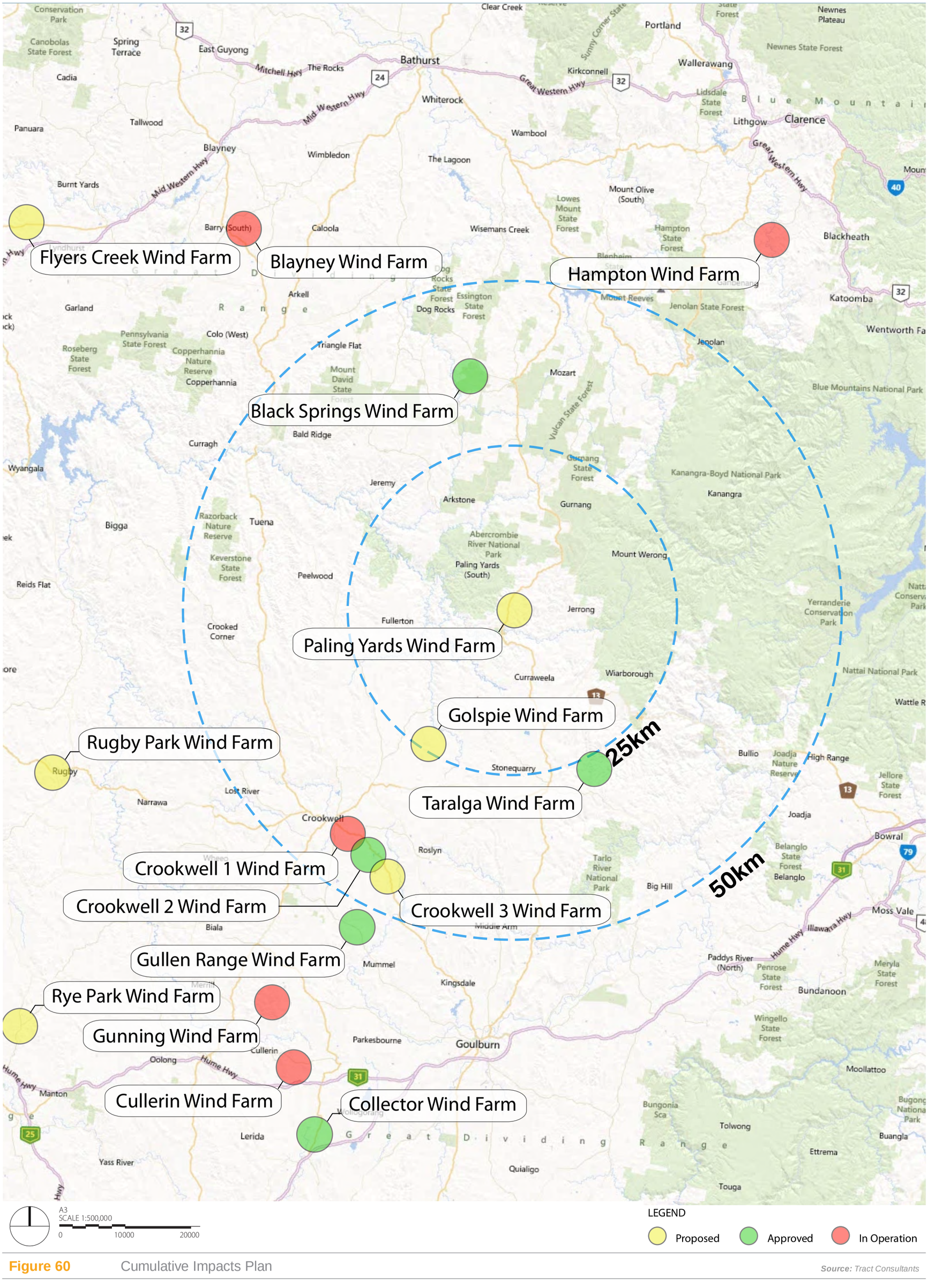


Figure 60 Cumulative Impacts Plan

Source: Tract Consultants

Table 28 Surrounding wind farms

Wind Farm	Proponent	No. of Turbines	Site Area	Total Capacity	Status
Adjungbilly Wind Farm	Wind-CBD Adjungbilly Pty Ltd	26	*	39 MW	DGRs lapsed
Birremer Wind Farm	Epuron Pty Ltd	60-80	*	90-272 MW	Proposed
Black Springs Wind Farm	Wind Corporation Australia Ltd	9	635ha	18.9 MW	Approved
Blayney Wind Farm	Eraring Energy	15	*	9.9 MW	In Operation
Boco Rock Wind Farm	Boco Rock Wind Farm Pty Ltd	67	11,750 ha	113 MW	Approved
Bodangora Wind Farm	Infigen Energy	33	*	99 MW	Approved
Capital Wind Farm	Renewable Power Ventures Pty Ltd	67	1,200ha	140 MW	In Operation
Collector Wind Farm	Transfield Services (Australia)	55	3,300ha	182 MW	Approved
Conroy's Gap Wind Farm	Origin Energy	15	*	30 MW	Approved
Crookwell 1 Wind Farm	Eraring Energy Pty Ltd	8	*	4.8 MW	In Operation
Crookwell 2 Wind Farm	Union Fenosa Wind Australia Pty Ltd	46	2,088ha	92 MW	Approved
Crookwell 3	Crookwell Development Pty Ltd	30	1,500ha	54-102 MW	Proposed
Cullerin Wind Farm	Origin Energy Pty Ltd	15	*	30 MW	In Operation
Flyers Creek Wind Farm	Flyers Creek Wind Farm Pty Ltd	44	*	80-132 MW	Proposed
Glen Innes Wind Farm	Glen Innes Wind Power Pty Ltd	27	*	54-81 MW	Approved
Golspie Wind Farm	Wind Prospect CWP Pty Ltd	100	*	250 MW	DGRs lapsed
Gullen Range Wind Farm	Epuron Pty Ltd	73	*	165.5 MW	Approved
Gunning Wind Farm	Acciona Energy	31	*	46.5 MW	In Operation
Hampton Wind Farm	Hampton Wind Park Company	2	*	1.2 MW	In Operation
Rugby Wind Farm	Suzlon Energy Australia Pty Ltd	50	*	160 MW	Proposed
Rye Park Wind Farm	Epuron Pty Ltd	80-110	*	120-374 MW	Proposed

Wind Farm	Proponent	No. of Turbines	Site Area	Total Capacity	Status
Sapphire Wind Farm	Wind Prospect CWP Pty Ltd	159	*	397 MW	Approved
Silverton Wind Farm	Silverton Wind Farm Developments Pty Ltd	598	*	1000 MW	Approved
Taralga Wind Farm	RES Australia Pty Ltd	51	*	107 MW	Approved
White Rock Wind Farm	**Epuron Pty Ltd**	**119**	*****	**357 MW**	**Approved**
Woodlawn Wind Farm	Woodland Wind Pty Ltd	23	*	46 MW	In Operation
Yass Wind Farm	Epuron Pty Ltd	152	*	266-500 MW	Proposed

** Information not available*

21.4 Visual Impacts

It is acknowledged that a cumulative landscape and visual impact may result from a wind farm being constructed in conjunction with other nearby wind farm developments.

However, due to the distance of the closest wind farm being approximately 25km from the site, it is not anticipated that any significant cumulative visual impacts will occur as a result of the project.

The LVIA prepared by Green Bean Design determined that the project is unlikely to result in any significant 'direct', 'indirect' or 'sequential' cumulative visual impact and is unlikely to significantly increase the level of visual impact. The LVIA notes that;

- *'Direct' cumulative visual impacts may occur where two or more winds farms have been constructed within the same locality, and may be viewed from the same view location simultaneously.*
- *'Indirect' cumulative visual impacts may occur where two or more wind farms have been constructed within the same locality, and may be viewed from the same view location but not within the same field of view (i.e. the viewer has to turn their head in order to view both wind farms).*
- *'Sequential' cumulative visual impacts may 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.*

The report found that there are opportunities for intervisibility between the project turbines and other proposed, approved or operating turbines from discrete elevated and cleared ridgeline areas to the east and south of the project. The assessment considered the Crookwell 1, 2 and 3 Wind Farms, Gullen Range Wind Farm, Golspie Wind Farm and Taralga Wind Farm in particular.

The assessment found that the opportunity for 'direct' or 'indirect' views to other approved wind farms is limited for most of the residential dwellings within the Paling Yards Wind Farm 10km viewshed due to residential dwelling position and orientation and the distribution of dense and scattered tree cover and undulating topography.

The LVIA concluded that:

- *The project is unlikely to result in any significant 'direct', 'indirect' or 'sequential' cumulative visual impact and is unlikely to significantly increase the level of visual impact that has been determined for the nominated view locations in relation to the project development.*
- *The potential for the occurrence of 'direct' and 'indirect' cumulative visual impact is mitigated to a degree by the screening or partial filtering of views toward approved and existing wind farms.*
- *Sequential views from local roads would be mitigated to some extent by undulating landform and tree cover alongside road corridors.*

As tall structures, some of the wind turbines may (depending on the legislation at the time of construction) require obstacle lighting. The LVIA noted that only a relatively small number of residential dwellings within 5km of the lit turbines would experience some degree of potential visual impact. The impact can be significantly reduced by curtains or blinds being drawn at night time.

Furthermore, the intensity of the visual impact of night time lighting would tend to *"diminish over 3 to 4km from the lit turbines, and would be more likely to be screened by topography and vegetation surrounding individual residential dwellings"*.

The LVIA found that night time lighting associated with the project is unlikely to have a significant visual impact on the majority of view locations.

21.5 Flora and Fauna Impacts

Significant environmental impact has occurred in the vicinity of the site due to the clearing of native vegetation for grazing and subsequent settlement. The vegetation across the site is represented for the most part by cleared grazing paddock, most of which is highly disturbed.

The wind turbines are proposed to be located primarily on cleared grazing lands, as are the access roads and other associated infrastructure. Some vegetation clearance is required for turbines and tracks, but not in areas deemed to be significant.

As the closest wind farm is more than 25km away, the cumulative ecological impacts arising from the project in conjunction with other nearby wind farms is considered low.

21.6 Noise Impacts

Due to the distance of the closest wind farm being approximately 25km from the site, it is not anticipated that any significant cumulative noise impacts will occur as a result of the project.

21.7 Aeronautical Impacts

It is acknowledged that an increase in the number of wind farms in a given area would increase the number of hazards that pilots must avoid during flights. Therefore additional wind farms in the region can create a cumulative aeronautical impact.

The risk is mitigated through notification to the relevant authorities in order to include the wind farm layout on local aeronautical mapping systems.

The aeronautical assessment prepared by Aviation Projects Pty Ltd found that the project is relatively remote from other existing or approved wind farms. According to DoPI NSW Wind Farm map dated 18 April 2011 and accessed 21 October 2011, the nearest approved wind farm is located at Taralga, some 25 km distant.

For this reason it has been assessed "*that there is no significant cumulative impact arising from nearby existing or approved wind farms".*

21.8 Traffic Impacts

It is acknowledged that there is potential for cumulative traffic impacts arising out of the construction phase of a wind farm project.

It is considered that the highways and roads between the ports (Port Kembla and the Port of Newcastle) and the site have sufficient capacity to cater for the project, as well as a number of other wind farms in the region to be built without compromising the road network.

An analysis of the site access routes was conducted in the transport impact assessment (TIA) prepared by URS, which found that;

"Traffic generated by this proposal is not considered to have a significant impact on the existing transport network, with current operation anticipated to remain at an acceptable Level of Service for key roads".

Therefore, it is not anticipated that significant cumulative impacts will occur as a result of the project.

21.9 Economic and Social Impacts

The cumulative social and economic impacts arising out of several wind farms within a region can be both positive and negative.

The cumulative economic impacts are outlined below:

- if a number of wind farms are constructed sequentially then this allows for an industry to be developed in the region – generating ongoing work and continuing skill improvement for local people;
- greater wind farm development in the region increases the opportunity for local business to capture more of the investment locally;
- tourism generated by wind farms, and visits to viewing platform such as Crookwell I, are likely to increase with greater wind farm development; and
- greater diversification of the local economic base away from agriculture.

The cumulative social impacts are outlined below:

- the building of several successful wind farms in the region can decrease fear associated with an unknown infrastructure development;
- multiple wind farms can add to the annoyance of those opposing any single wind farm;
- there is potential for multiple wind farms to alter the character of the region – whilst some residents and visitors may consider wind farms positively add to the character of the region others may consider that several wind farms in the region are a negative addition to the character; and
- multiple wind farms can assist in the positioning of the region as a leader in renewable energy and the generation of new opportunities for local residents.

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CHAPTER 22

CONSULTATION

22 Consultation

22.1 Introduction

The proponent understands the need to effectively communicate with residents and all relevant stakeholders through a program of community consultation. Further, the proponent is also required to consult with communities prior to development of the project under the:

- Draft National Wind Farm Guidelines (July 2010);
- Draft NSW Wind Farm Guidelines (December 2011);
- Director General's Requirements (6 May 2010);
- Supplementary Director General's Requirements (16 August 2011);
- Oberon Shire Council DCP requirements

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by the proponent to undertake public consultation and make recommendations for future actions.

The following scope of work was undertaken by ERM:

- attendance at an onsite inception meeting organised by the proponent to obtain an overview of the project, an appreciation of the site, its setting and location, timetables for planned activities and preliminary identification of anticipated issues and impacts;
- reporting on the Community Engagement Strategy and activities undertaken by the proponent, ERM and other members of the environmental assessment team;
- reporting of surveyed community attitudes;
- a baseline review of publicly available information to gain an understanding of existing socio-economic conditions in the local area and the potential challenges for developing the project; and
- analysis of the baseline data to determine the potential project impacts and to systematically assess their significance, and reporting of the findings of this research and assessment;

The full socio-economic impact assessment report, which considers community consultation, is found at **Appendix 5.**

The proponent has undertaken a comprehensive program of stakeholder engagement and community consultation throughout the application process in accordance with the DGRs and supplementary DGRs. The consultation program has been guided by the Community Engagement Strategy which sets out how to engage with all identified stakeholders during the project.

Consultation undertaken to date for the project has taken the form of direct face-to-face engagement, phone and email dialogue, website information, and the distribution of a project newsletter.

A key step in the stakeholder identification process and community consultation was undertaken through the door-knock consultation and surveys carried out by representatives of the proponent and an ERM representative.

22.2 Objectives

The key objectives of the Community Engagement Strategy are to:

- identify stakeholders that should be engaged in the consultation process;
- identify the appropriate methods and extent of engaging with identified stakeholders;
- ensure that key stakeholders are aware of the approval process;
- ensure that the community and stakeholders are informed about the project through the provision of factual project information;
- identify the potential issues or concerns that stakeholders and the community raise in relation to this project; and
- provide feedback to the community and stakeholder enquiries and explain that how their input will influence the final project design.

22.3 Community Engagement Activities

As part of project, the consultation program involves:

- consultation with State Government agencies and other government bodies;
- consultation with Oberon Shire Council and Upper Lachlan Shire Council;
- identification of stakeholder groups (which are listed in **Table 29** below);
- consultation with landholders immediately surrounding the boundaries of the site;
- newsletters widely distributed in the region (to all registered addresses in the Bathurst, Oberon, Crookwell, Goulburn and Taralga post offices districts, to relevant government agencies and to anyone else who registered interest in the project);
- advertisements in local newspapers;
- a door-knock consultation and survey;
- consultation with the local community;
- a second independent round of consultation with the community/stakeholders.
- responding to queries via the information line and email;
- compilation of the community engagement material and outcomes;
- a media release informing the community about the establishment of a Community Consultative Committee;
- hosting of a widely advertised Information Day for residents and other stakeholders during the public exhibition period; and
- providing responses to the submissions received during public exhibition of the application.

Refer to Annex A of the socio-economic report at **Appendix 5** of this report for the full *Union Fenosa Wind Australia Stakeholder Consultation & Engagement Strategy for Paling Yards Wind Farm* as well as **Table 29** below.

The consultation activities commenced many years ago at the beginning of the project in 2004 and are proposed to continue throughout the various phases of the project, including during the operation of the project. The consultation timeline will be dynamic

and will be updated as required to suit the planning process and feedback from key stakeholders.

Further details of the engagement and consultation program for this project are outlined below.

22.3.1 Stakeholder engagement

The stakeholders identified and consulted in this project include project involved landowners, local residents within a 5km radius of the site, the wider communities of Oberon Shire Council, Upper Lachlan Shire Council, relevant government departments and agencies, organisations, and community groups. The socio-economic report details all of the stakeholders engaged, and is summarised in **Table 29** of this report.

Planning for the proposed project commenced in 2002 and included initial consultation with the key stakeholders, primarily with the owners of land on which the proposed wind farm is situated. The scope of consultation was then broadened to include the local councils, government agencies, neighbouring landowners and the wider local community.

In accordance with the Aboriginal Cultural Heritage Consultation requirements for proponents 2010 (OEH 2010) and its predecessor guidelines, the relevant aboriginal stakeholders (organisations and individuals) were identified and contacted via direct mail.

The consultation with stakeholders (refer to **Table 29 – Stakeholders**) that has taken place prior to the submission of this EA included:

- telephone discussions (including with one local resident prior to the door-knock and two local residents after the door-knock on the 1800 information line, and with the majority of government departments, agencies and organisations listed in the table below);
- emails (including two emails to the project email address from local residents advising of different addresses to which correspondence should be sent, and to the majority of government departments, agencies and organisations listed in the table below);
- letters (other than community newsletters) (including residents within 5km of the site who were absent during the door-knock and some government departments and organisations);
- publication and distribution of a newsletter in the region in May 2011;
- advertisements in local newspapers regarding the upcoming door-knock (17, 19, 24 and 26 May, 2011 in the Crookwell Gazette; and 19 and 26 May, 2011 in the Oberon Review).
- a door-knock consultation survey, whereby the proponent visited households within a 5 km radius of the proposed wind farm and along the transmission line route options on 30 and 31 May and 1 June 2011;
- a second round of door-knock consultations on 5 and 6 July 2011;
- responses to further information requests from some residents in relation to aspects of the proposal;
- formal briefings and meetings with heads of relevant State and local government departments, councillors, council officers, and relevant government agencies and organisations (refer to the list of stakeholders in the table below); and

- a media release advertised in local newspapers regarding nominations for the Community Consultative Committee (9 and 23 October, 2012 and 6 and 20 November, 2012 in the Crookwell Gazette; 17 and 31 October, 2012 and 14 November, 2012 in the Goulburn Post; and 11 and 25 October, 2012 and 8 and 22 November, 2012 in the Oberon Review).

Additional stakeholder engagement and consultation activities that are proposed to take place following the lodgement of this EA include:

- Warrabinga Native Title Claimants Aboriginal Corporation - included in the list for consultation as a registered aboriginal stakeholder for this project and will be included in the consultation process for additional field surveys post approval and preparation of the Cultural Heritage Management Plan (CHMP).
- Mr Bill Allen (as an individual also representing the Muri Clan Group of the Wiradyri People) - included in the list for consultation as a registered aboriginal stakeholder for this project and will be included in the consultation process for additional field surveys post approval and preparation of the CHMP.
- publication and distribution of another newsletter in the region providing an update on the proposal and the process;
- responses to website, phone and written requests for further information in relation to aspects of the proposal;
- meetings with government agencies (refer to the table below);
- hosting of a Community Information Day, whereby interested members of the community have the opportunity to talk directly with the proponent and the consultant team; and
- requesting and responding to submissions in the public exhibition period.

The individual issues raised in the engagement and consultation process have been valuable in guiding the development of the proposed wind farm. Refer to **Chapter 22.4** for the details on the key issues identified and the responses to these issues.

Since 2010, a number of revisions to the site plan and turbine layout have been specifically influenced by stakeholder input, as well as by the specialists studies completed, including:

- Selection of the northern transmission line as the least impact option;
- Removal of the southern substation;
- Removal of turbine P26 in response to the findings of the noise assessment to reduce potential noise impact for the project involved landowners;
- Removal of turbines P2, P6, and P7 in response to the findings of the flora and fauna assessment and the Conservation Agreement in place for the Box Gum Grassy Woodland project as part of the Commonwealth Government's Environmental Stewardship program;
- Removal of turbine P11;
    - removal of associated crane pad from the remnant area; and
    - removal of associated 1,184m of access track of which 353m were in the remnant area.
- Relocation of turbine P10 to 184m south of original location;
    - removing 184m of access track from the remnant area.

- Relocation of turbine P13 to 70m south-east of original location;
    - removing 77m of access track from the remnant area; and
    - turbine and crane pad will be located in a more cleared area, hence reducing the vegetation clearing by approximately 50% for this location.
- Relocation of turbine P14 to 86m south-east of original location;
    - removing 101m of access track from the remnant area; and
    - turbine and crane pad will be located closer to the edge of the remnant area, hence reducing the vegetation clearing by approximately 20% for this location.
- Micrositing of the turbines to minimise local impacts;
- Changes to the location of:
    - several access tracks to further utilise the existing farm tracks and reduce the infrastructure footprint;
    - underground cabling to provide more efficient transfer of electricity and reduce the infrastructure footprint;
    - an access road to separate the wind farm construction vehicle traffic from the access used by the project involved landowners;
    - selecting a smaller wind turbine envelope size for specific locations to reduce potential noise and shadow flicker impact for the project involved landowners;
    - substations to reduce length of overhead powerlines; and
    - powerline poles for the northern transmission line route to minimise and avoid where possible the removal of native vegetation.

Refer to **Figure 10 – History Plan** for further details.

The project team intends to continue the consultation process through the planning, construction and operation of the project. It is proposed that the consultation process would be reviewed to assess its effectiveness over these stages.

The following modes of consultation will continue to be used throughout the planning process:

- face-to-face meetings; and
- regular project liaison including emails and telephone calls.

DoPI is the main government agency in the approvals process. Regular liaison with the DoPI will continue to occur throughout the assessment process.

Table 29 outlines the parties that have been consulted to date.

Table 29 Stakeholders

Sector	Relevant Persons
Local Community	▪ Landowners who would host turbines on their land ▪ Landowners within a 5km radius of the wind farm ▪ Landowners along transmission line route options ▪ Other interested community members ▪ Aboriginal stakeholder individuals, including Mr. Bill Allen (as an individual also representing the Muri Clan Group of the Wiradyri People)
Government Agencies	▪ Civil Aviation Safety Authority (CASA) ▪ Commonwealth Department of Defence ▪ Lachlan Catchment Management Authority ▪ Land and Property Information (LPI) ▪ Livestock Health and Pest Authorities State Management Council ▪ NSW Crown Lands Division ▪ NSW Department of Planning and Infrastructure (DoPI) ▪ NSW Department of Trade and Investment (formerly the Department of Industry & Investment) ▪ NSW National Parks ▪ NSW Office of Environment & Heritage (OEH) (formerly the Department of Environment, Climate Change & Water) ▪ NSW Office of Water (formerly the Department of Water & Energy) ▪ NSW Police Force Telecommunications ▪ NSW Rural Fire Service (RFS) ▪ Oberon Shire Council ▪ Office of the Registrar, Aboriginal Land Rights Act 1983 (NSW) [Registrar of Aboriginal Owners] ▪ Roads and Maritime Services (formerly the Road and Traffic Authority) ▪ Sustainability Environment Water Population and Communities (SEWPAC) (formerly the Department of the Environment, Water, Heritage and the Arts) ▪ Sydney Catchment Authority ▪ Upper Lachlan Shire Council
Non-Government Agencies and Organisations	▪ Aboriginal stakeholder organisations ▪ Airservices Australia (AA) ▪ Aerial Agricultural Association of Australia (AAAA) ▪ Ambulance Service of NSW ▪ Bureau of Meteorology (BOM) ▪ Dhuuluu-Yala Aboriginal Corporation ▪ Endeavour Energy ▪ Essential Energy

Sector	Relevant Persons
	▪ Gundungurra Aboriginal Heritage Association Inc ▪ Gundungurra Tribal Council Aboriginal Corporation ▪ Local Aboriginal Land Councils (LALCs) ▪ Local Environmental Group(s) ▪ Local Community Group(s) ▪ Industry Groups (ICNNSW) ▪ Local tourism Organisation(s) ▪ Mineral exploration and mining title holders ▪ Mingaan Aboriginal Corporation ▪ Mooka Traditional Owners Council ▪ Murray River Regional Telecommunications Company Ltd ▪ Native Title Services Corporation ▪ North-Eastern Wiradjuri ▪ State Emergency Services ▪ St John Ambulance Australia ▪ Telstra ▪ TransGrid ▪ Warrabinga Native Title Claimants Aboriginal Corporation ▪ Wiradjuri Council of Elders ▪ Wiradjuri Interim Working Party ▪ Wiradjuri Traditional Owners Central West Aboriginal Corporation ▪ Other Organisation(s)
Media	▪ Oberon Review ▪ Crookwell Gazette ▪ Goulburn Post

22.3.2 Project Inception

The proponent approached landowners in the local area during the project inception in 2002 with a proposal to host a monitoring station to assess the suitability of the area and determine whether there was an adequate and consistent wind resource to support a commercial wind farm.

After determining that the wind conditions in the area where suitable for a wind farm, the proponent commenced consultation with property owners between 2004 and 2006 to establish their interest in being involved in the project.

The discussions with landowners over leasing arrangements were confidential, which is a standard procedure for wind farm and other large commercial projects.

Once the project gained some certainty, broader consultation was also undertaken with identified stakeholders in the local area and the greater region, as outlined below. Up until that point, the project may not have proceeded.

22.3.3 Consultation with the local community

The proponent has conducted considerable consultation with the landowners hosting turbines (project involved residences), landowners within a 5km radius of the site, landowners hosting/adjacent to transmission line route options, and other interested residents of the wider community (refer to **Table 29**), including through:

- Door-knock consultation meetings in May, June and July 2011,
- A community newsletter in May 2011,
- Advertisements in local newspapers regarding the upcoming door-knock (17, 19, 24 and 26 May, 2011 in the Crookwell Gazette; and 19 and 26 May, 2011 in the Oberon Review),
- Advertisements in local newspapers regarding the establishment and nominations for the Community Consultative Committee (9 and 23 October, 2012 and 6 and 20 November, 2012 in the Crookwell Gazette; 17 and 31 October, 2012 and 14 November, 2012 in the Goulburn Post; and 11 and 25 October, 2012 and 8 and 22 November, 2012 in the Oberon Review),
- Direct mail on 16 May 2013 to listed Aboriginal stakeholder individuals with a request for confirmation of their interest to register as an Aboriginal stakeholder for the project, and
- Website information.

In addition, landowners agreeing to host turbines (project involved residences) have received regular correspondence in regards to various issues such as preliminary assessments, impact findings and issues related to the project in general.

The local community will continue to be informed and involved in the project through community newsletters and a community information day session.

22.3.4 Consultation with government and non-government agencies and organisations

The proponent has conducted considerable consultation with the relevant government agencies, non-government agencies and organisations, including all those listed in the DGRs, in relation to the project (refer to **Table 29**), by way of:

- phone calls;
- emails;
- letters;
- face-to-face meetings;
- advertisement in local newspapers;
- media release; and/or
- website information.

The consultation with government and non-government agencies and organisations served primarily to:

- inform the agency about the project;
- encourage the agency to review the project details and contact the proponent with any concerns or feedback; and
- encourage the agency to register for participation in the consultation process.

All issues raised or feedback on the project was documented, and is addressed in the relevant section of this EA. A summary of the discussions with each stakeholder and the proponent's response is provided in Table 2.1 of the socio-economic report at **Appendix 5**.

DoPI and Oberon Shire Council will continue to be directly involved throughout the consultation process through regular project liaison, community newsletter distributions, and informed of a community information day session. The remaining government agencies (refer to **Table 29**) will continue to be provided with all of the relevant project information in order to be able to provide feedback and will be informed of a community information day session.

The non-government agencies and organisations listed in **Table 29** will continue to be consulted and involved in the project through receipt of all relevant project information in order to be able to provide feedback and informed of a community information day session.

22.3.5 Newsletter

A newsletter was prepared in May 2011 providing details and a map of the proposal. The newsletter introduced the project, the proponent and the project team and also included the scope of issues to be explored by the project team during the environmental assessment of the project.

The newsletter contained information on:

- details of the proposed wind farm;
- the approvals process; the matters to be addressed as part of the environmental assessment; and
- the upcoming door-knock and invited people to request a face-to-face meeting.

Additionally, company contact details were provided for telephone, post, email and internet.

In May 2011, 812 copies of the newsletter were distributed to all registered addresses in the Bathurst, Oberon, Crookwell and Taralga post office districts, and to anyone who had already expressed interest in the project.

The newsletter was subsequently posted on the proponent's website. A copy of the newsletter is found at **Appendix 15**.

After the newsletter was distributed the proponent received one phone call requesting a face-to-face meeting during the door-knock.

The next newsletter is proposed to be distributed before the exhibition phase and will advise residents of the opportunity to prepare and lodge a submission. The newsletters will provide general information about the project, the planning and approvals process, details of the planned community information day session, and project updates.

The distribution of the next newsletter is proposed to be expanded to include any additional interested parties identified in the interim period. The newsletter will also be made available to the wider community at the Oberon Shire Council offices and the information centres.

22.3.6 Advertisements and media release

The proponent placed advertisements in the following local newspapers:

- Crookwell Gazette;
- Goulburn Post; and
- Oberon Review,

These ran for two consecutive weeks between 17 and 26 May 2011 advising the community of the upcoming door-knock and inviting individuals to make appointments to register and participate in the consultation process. As a result of the advertisements one appointment was made.

Copies of the advertisements are provided at **Appendix 16**.

In October 2012, the proponent issued a media release informing the community that the proponent is seeking nominations from local community members and/or affected stakeholders to represent the community for the proposed Paling Yards Wind Farm's Community Consultative Committee (CCC). This advertisement included the proponent's free-call number for interested members of the community to contact the company. Copies of the media release are found at **Appendix 16**. To date, no response has been received from the local community.

22.3.7 Door-knock consultations and surveys

A significant component of the stakeholder identification process and community consultation was the undertaking of the door-knock surveys.

On 30 and 31 May and 1 June 2011, the proponent's representatives and an ERM representative conducted a door-knock consultation of households within a 5 km radius of the site and along the transmission line route options.

The purpose of face-to-face door-knock meetings was:

- to provide stakeholders with detailed information about the project and the approvals process;
- to provide the opportunity for individuals to have their say in relation to the project; and
- to enable the proponent to gather information about peoples' opinions and any concerns they may have.

A total of 142 dwellings were identified for the door-knock exercise. The proponent representatives and the ERM representative could not gain access to all properties due to gates being locked or driveways being unsuitable or unsafe to access.

During the door-knock, 20 surveys were completed in the vicinity of the wind farm and 25 surveys in the vicinity of the transmission line. Where access was not available or no one was home, the proponent's representative left a letter in the letterbox informing the owner of the visit and inviting the owner to contact the proponent to discuss the project.

Following the door-knock, the proponent received two phone calls to the 1800 information line number to discuss the project. Feedback from these calls was recorded in the survey form used in the door-knock survey.

A supplementary two-day door-knock was undertaken on 5 and 6 July 2011 to consult with those residents who were not available during the last door-knock timeframe or who had responded to the letter informing the owner of the visit.

Community concerns raised during the door-knock surveys have been recorded, as has the response provided to the issues of concern (refer to **Appendix 17 – Door-knock Consultation Meeting Record template**). Specialist assessments commissioned by the proponent have been undertaken and reports prepared to address these concerns. These assessments and reports have been included in this report.

Survey forms were completed by:

- 20 households in the vicinity of the wind farm; and
- 25 households in the vicinity of the transmission lines options,
- during the door-knock.

Both survey forms asked respondents to grade their level of support for wind farms. The majority (52 %) of the householders surveyed in the vicinity of the wind farm indicated that they are supportive or highly supportive of wind farms.

Refer to **Chapter 22.4** below for the key issues identified and the response to each issue.

22.3.8 Community Information Day

A Community Information Day is proposed to be held at a venue in the local area during the public exhibition period (which will be nominated by DoPI) of the wind farm application. This will take form of an information session where interested members of the community will have the opportunity to talk directly with the proponent's representatives and the environmental assessment team about the project. A range of experts in their fields will attend the information day to answer any questions and provide further details relating to the project.

The information day will include display of posters explaining the project and the approvals process. The session will be advertised in local papers two weeks prior to the session occurring. The timing of the information day is intended to coincide with the start of the exhibition period, allowing interested parties an opportunity to learn more about the project to inform their submission. The information day will also advertise the exhibition period and invite for submissions.

Feedback forms will be made available to all attendees, to provide an opportunity for the community to further comment on the project, in addition to the formal exhibition and submission process. Comments received through this feedback will be documented as part of the community consultation process.

22.3.9 Website and information line

The proponent has established a dedicated e-mail address, website and a freecall 1800 number that is to be included on all project material to allow stakeholders to make contact and make enquiries or comments.

Any comments or complaints received via the e-mail address, website and a freecall 1800 number will be recorded on a '*Record of Contact Form'* and actioned as necessary.

The proponent provides information to the public on approved and proposed wind farm developments via the website: <www.unionfenosa.com.au>. The website provides information on wind energy, renewable energy targets and information about the company history and structure. The May 2011 newsletter that was distributed in region was posted on the website, as well as the advertisement in October 2012 seeking nominations for the Community Consultative Committee.

The proponent endeavours in all correspondence to answer the community's questions in a timely manner.

22.3.10 Documentation of stakeholder input into the approvals process

In order to adequately respond to local community members and stakeholders' enquiries, records of all correspondence to date have been compiled and distributed to the relevant consultant for their review and consideration as part of this consultation program.

22.3.11 Response to submissions

All records of the correspondence with stakeholders after the lodgement of this report will be compiled and reviewed.

The proponent will review and respond to the issues raised during the Community Information Day, by formal submissions and during the ongoing consultation program. Where necessary, the proponent may make changes to the project to address the issues raised. In this way, further feedback received will be incorporated into the project design.

22.4 Key Issues Identified

The key issues identified during the consultations and UWFA's responses to these issues are shown in **Table 30** below. These issues are further discussed in the full socio-economic report found at **Appendix 5** as well as in the relevant technical reports annexed to this report.

The proponent's response and approach to all the issues raised in the table below also includes a commitment to implement the impact mitigation measures recommended in the technical reports and outlined under each chapter of this EA.

Table 30 Summary of issues raised

Issue Category	Specific Issues	The Proponent's Response and Approach
High Voltage Transmission Lines	Visual impacts and the loss of privacy due to the introduction of infrastructure to remote areas.	Visual impacts have been addressed in the Landscape and Visual Impact Assessment (LVIA) prepared by Green Bean Design at **Appendix 6**. The proposed northern transmission line route option (option 4) has been selected in part due to reduced landscape and visual impacts.
Visual Impact	Concerns about the appearance of wind turbines in the landscape, especially the height; and concerns about proliferation of wind farms in the local area.	Visual impacts have been addressed in the LVIA prepared by Green Bean Design at **Appendix 6**. The LVIA determined that the landscape surrounding the project has an overall 'medium to high sensitivity' to accommodate change and that the wind farm would not be an unacceptable development within the region. The proponent has selected the northern transmission line route as the

		preferred and proposed option due to its shorter length, and as a result of concerns raised through the consultation process regarding the potential impacts of the extensive infrastructure for the southern transmission line route options. The visual impact mitigation measures proposed include: ▪ Vegetation planting for screening. ▪ Careful selection of final transmission line route. ▪ Use of low-reflective materials and colour that reduces visual contrast with the background. ▪ Revegetation post-construction. ▪ Designing and locating ancillary infrastructure sympathetically. Refer to **Chapter 9.8** for further details.
Impacts to land value	Concerns about impacts to land values as a result of the wind farm.	An economic assessment on the potential impact to land and property values is provided at Section 3.6 of the socio-economic impact assessment at **Appendix 5** and in **Chapter 8.3.3** of this EA. There is no strong evidence to suggest that wind farms negatively impact property prices. Potential impacts on property prices are generally confined to the short term due to buyer uncertainty about future developments in the region. The potential impact on property prices can also be positive for landowners who accommodate wind turbines on their land.
Noise	Concerns about noise impacts from the wind farm and high voltage transmission line.	Potential noise impacts from the project are addressed in the Noise Impact Assessment report prepared by SLR Pty Ltd at **Appendix 7**. The noise assessment found that all non-project involved receptors were found to be below the relevant noise criteria, and therefore comply with the relevant noise standards. Further noise monitoring will be conducted and mitigation measures will be put in place. Agreements with affected project involved landowners will also be put in place.

		If undue turbine noise impacts are identified during operations, then adaptive management' measures may be implemented to mitigate or remove the impact, including: ▪ 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 undue impacts. ▪ Operating turbines in a reduced 'noise optimised' mode during identified times and conditions. ▪ Providing acoustic upgrades (glazing, façade, masking noise etc) to affected dwellings. ▪ Turning off turbines that are identified as causing the undue impact during identified times and conditions. Upon finalising the layout and turbine models a revised noise assessment will be completed and noise impact mitigation techniques investigated in order to ensure a fully noise compliant turbine layout.
Fire Hazard	Concerns about wind turbines causing fire.	Mitigation measure to minimise the risk of fire is found at **Chapter 16**. Wind turbines incorporate high quality standards to avoid ignition and are fitted with remote monitoring systems to enable shut down in the event that a threshold temperature is reached or an electrical fault is discovered. Lightning conductors will also be installed in turbines to ground lightning strikes to minimise the risk of fire ignition and damage to the turbines. Overhead transmission lines will be located over predominantly cleared grazing land, thus reducing the risk of fire. Vegetation along the transmission lines will be routinely maintained.
Impacts to flora and fauna	Potential impacts to threatened species (flora and fauna) and potential habitat loss.	Potential flora and fauna impacts of the project have been assessed in the Flora and Fauna Impact Assessment reports prepared by Anderson Environmental Consultants Pty Ltd and ERM Pty Ltd at **Appendix 8a** and **Appendix 8b** respectively.

		The results of the assessment concluded that the project is not likely to result in a significant impact on any endangered ecological community or flora species and fauna species listed under the EPBC Act or TSC Act. A total area of approximately 14 hectares of remnant vegetation removal would be required for the project, of which approximately 1.4 hectares is proposed to be rehabilitated post-construction. Native vegetation disturbed during construction would be rehabilitated as part of a Vegetation Management Plan. The proponent has selected the northern transmission line route as the preferred and proposed option due to its shorter length, and as a result of concerns raised through the consultation process regarding the potential impacts of the extensive infrastructure for the southern transmission line route options.
Impacts to Aerial Agriculture	Impacts to aerial agricultural applications (increased cost, difficulty).	Potential impacts arising from the project on aerial agriculture are addressed in the Aeronautical Impact Assessment prepared by Aviation Projects Pty Ltd at **Appendix 9**. The project will most likely prevent fixed wing aerial agricultural operations on the wind farm site; however, safe aerial application operations would be possible on properties neighbouring the project, subject to final turbine locations, and subject to a case-by-case assessment. In the event the immediate neighbouring landowner(s) would require aerial agriculture spraying of their land adjacent to the wind farm and there is an increase in cost associated with the proximity to turbines, the proponent will cover the reasonable cost increase for the aerial agriculture activity. The landowner seeking compensation for the cost increase must demonstrate and justify this increase with previous records.

Electro Magnetic Interference (EMI)	Interference to radio and TV reception; and concerns about adverse impacts to health.	Concerns about impacts arising from EMI around the turbines are addressed in the Electromagnetic Interference Impact Assessment prepared by Garrad Hassan at **Appendix 11**. The assessment found that in relation to radio and TV reception: ▪ FM signals may be susceptible to interference from wind turbines, which can be mitigated by the installation of a high quality antenna. ▪ Interference to analogue television could potentially occur at particular houses (listed in the report), however, analogue television is being phased out across Australia, and if digital reception is marginal, residents in the vicinity of the site may be eligible to receive access to the Government-funded satellite television service to view free-to-air television. Other mitigation measures proposed to address EMI include: ▪ For any interference with fixed point-to-point links, either the relevant turbines or the communications tower may be slightly relocated, where possible. ▪ Realigning or relocating the householder's TV antenna. ▪ The installation of an external antenna or more directional and/or higher gain antenna at the affected household; ▪ The installation of cable/satellite TV at the affected household; and ▪ Installation of a TV relay station. ▪ A person with portable device moving a short distance to a new or higher location until the signal strength improves.

Shadow Flicker	Concerns about shadow flicker from wind turbines.	Concerns about shadow flicker impacts are addressed in the assessment prepared by Garrad Hassan Pacific Pty Ltd and included as part of the LVIA at **Appendix 6**. The assessment found that all except seven of the residential view locations will be subject to levels of shadow flicker below the recommended limit of 30 shadow flicker hours per year. The seven residences are project-involved landowners, and the proponent will negotiate an agreement with the owners of these dwellings.
Heritage Impact	The Pejar LALC recommends: ▪ Avoid impacts on known sites. ▪ Prepare a CHMP in collaboration with the Aboriginal Stakeholders registered for the project ▪ Cooperate with the Aboriginal Stakeholders registered for the project to determine the management options for artefacts ▪ If impacts to additional sites identified cannot be avoided then further investigation is required in consultation with the Aboriginal Stakeholders registered for the project ▪ Undertake additional targeted surveys once the disturbance areas (particularly the access tracks) have been pegged post-approval	As recommended in the heritage impact assessment there will be additional field surveys post-approval once all access tracks have been pegged prior to construction, and the preparation of the CHMP will be undertaken in collaboration with Pejar LALC along with other registered Aboriginal Stakeholders.

22.5 Draft NSW Wind Farm Guidelines

22.5.1 Community Consultative Committee

The proponent is in the process of establishing a Community Consultative Committee (CCC), in accordance with Guideline 1.3(d) of the Draft Guidelines.

The purpose of the CCC is to provide a forum for open discussion between the proponent, the community, Council and other stakeholders about issues relating to the wind farm development. If the wind farm is approved, the CCC will function as a forum for ongoing communication with the community during the construction, operation and decommissioning phases.

The CCC will comprise, in accordance with the Draft Guidelines:

- an independent chairperson;
- five to seven representatives of the local community and other stakeholders;
- one representative of the local council; and
- two representatives of the proponent.

The proponent issued a media release in October 2012 seeking nominations from local community members and/or affected stakeholders to represent the community for the proposed Paling Yards Wind Farm CCC. A copy of the media release and advertisements are found at **Appendix 16**.

On 9 October 2012 Oberon Council sent a letter to the proponent nominating the Council representatives for the CCC.

The closing date for nominations was 30 November 2012. No community nominations have been received to date to be a member of the CCC.

Once the CCC is established, meetings will be held in accordance with the Draft Guidelines. If the project is refused, the committee will be abandoned.

Committee members will be encouraged to discuss issues and circulate information about the project with the wider community. The proponent will keep minutes of all CCC meetings, which will be presented to Council, CCC members, and published on the website.

Once the CCC is established, the proponent will provide the committee with updates on the assessment studies being prepared and the issues being investigated, the design layout options being considered during the assessment process.

If the project is approved, the proponent will comply with its responsibilities contained in Appendix C of the Draft Guidelines.

22.5.2 Neighbours Agreement

No neighbours agreements are required for the project. The site is in a generally isolated location and there are no non-project involved, identified dwellings within 2km of any of the proposed turbines.

It is noted that one non-project involved building is located within 2km of the proposed wind farm, however this building has not been identified as an official dwelling and the owner cannot be contacted. The proponent has made several attempts over a two year period to contact the owner of the land on which the building is erected with no success.

The proponent was provided with a name and contact number of the landowner and attempted contacting this landowner for the first time over the phone on 26 May 2011 and left a message on the voicemail. The proponent has tried several times since this date to contact the landowner. During the door-knock the proponent tried to access/find the property but with no success. Attempts were also made in 2012 to contact the landowner, but the phone number has been disconnected.

22.6 Recommendations

The proponent appreciates that the Community Engagement Strategy is a critical element in understanding and managing community and stakeholder expectations of the project, especially as the project moves through the approval and construction process.

The proponent will:

- progress a number of recommendations in consultation with government and non-government agencies, local groups and organisations, local council, and the local community;
- continue to provide up-to-date information about the proposed wind farm to the community, stakeholders and government agencies through newsletters, website

information, responding to calls on the 1800 free-call line, responding to emails and letters, and a community information done;

- continue to implement the Community Engagement Strategy; and
- formalise, maintain and promote a consultation register, grievance mechanism and issue resolution tracking mechanism which is integrated into the proponent day-to-day operations as well as supplier agreements.

UNION FENOSA
WIND AUSTRALIA

gasNatural fenosa

PALING YARDS WIND FARM

CHAPTER 23

RISK ANALYSIS

23 Risk Analysis

This chapter provides an environmental risk assessment of the project. It has been prepared in accordance Australian Standard 203:2006 *Environmental Risk Management – Principles and Process* and the associated Companion. This is the commonly adopted and accepted method for a high level qualitative assessment of a wind farm project.

It identifies the key environmental risks, the severity (or consequence), likelihood, mitigation commitments, and the consequential level of risk. This risk analysis has been based on the variety of specialist investigations that form part of this EA, and the statement of commitments outlined in **Chapter 24**.

The following explains the methods used in the analysis in this chapter. **Table 31** outlines the criteria used to determine the correct classification of consequence for the particular environmental risk. **Table 32** provides the criteria to determine the degree of likelihood of the risk occurring.

Table 31 Classification of severity/consequence (Companion to AS 203:2006)

Category	Rank	Health and Safety	Environment	Community
Catastrophic	1	Multiple fatalities or significant irreversible effects.	Long term and possible eradication of populations or habitats, serious negative impacts on ecosystem, permanent damage to a significant area.	Major public or media outcry, major long-term detrimental effects, community outrage on broader community and substantial formal opposition.
Major	2	Single fatality and/or severe irreversible injury or disability.	Major changes in population or habitat, negative impact on ecosystem, lasting damage to a significant area.	Significant adverse effects on the local community resulting in high level of community opposition.
Moderate	3	Injury or illness (hospitalisation).	Moderate impacts on populations and habitat but no negative impacts on ecosystem function, damage to a limited area.	Moderate inconvenience leading to general community concern.
Minor	4	Reversible injury (off-site medical care).	Minor impacts on populations and habitat but no negative impacts on ecosystem function, limited damage to a limited area.	Minor inconvenience on local community, restricted to localised community concerns.
Insignificant	5	Negligible injury (first aid sufficient).	Impacts on populations and habitat that could be reversed, insignificant damage to a limited area.	None to insignificant local community concern.

Table 32 Classification of likelihood (Companion to AS 203:2006)

Category	Rank	Description	Frequency
Almost certain	A	Expected to occur frequently	At least annually or more frequently
Likely	B	The event has occurred in the past	Once every three years
Possible	C	The event may occur, unusual but possible	Once every 10 years
Unlikely	D	Not expected to occur	Once every 30 years
Rare	E	Conceivable only in exceptional circumstance	Once every 100 years

Having established the severity/consequence, and the likelihood of the risk, the table below provides a matrix to establish the overall risk rating for each issue.

Table 33 Qualitative risk analysis matrix (Companion to AS 203:2006)

		Severity/Consequence				
		Catastrophe	Major	Moderate	Minor	Insignificant
Likelihood		1	2	3	4	5
Almost Certain	A	Extreme	Extreme	Extreme	High	High
Likely	B	Extreme	Extreme	High	High	Moderate
Possible	C	Extreme	Extreme	High	Moderate	Low
Unlikely	D	Extreme	High	Moderate	Low	Low
Rare	E	High	High	Moderate	Low	Low

The following risk analysis considers the mitigated risk of the project. This means that it considers the construction, operation and decommissioning of the project as described in this EA after any mitigation measures outlined in **Chapter 24**. The mitigation measures are an integral part of the project and will be required as conditions of approval. This scenario is therefore the most accurate assessment of the environmental risks associated with the project.

The following table has focussed on the negative impacts of the project, and the mitigation measures are designed to avoid or reduce the impacts. This EA also details a range of positive impacts of the project.

Table 34 Risk analysis

Sector	Issue	Project Stage	Mitigated Consequence	Mitigated Likelihood	Mitigated Risk Rating
Economic and Social	Community Division	C/O/D	3	D	Medium
	Loss of agricultural land	C/O/D	4	E	Low
	Reduction in property values	C/O	3	E	Medium
	Lack of project awareness and	C/O/D	4	D	Low

Sector	Issue	Project Stage	Mitigated Consequence	Mitigated Likelihood	Mitigated Risk Rating
	community involvement				
Visual	Significant visual impact of turbines on nearby dwellings	C/O	3	D	Medium
	Significant visual impact of transmission line on nearby dwellings	C/O	4	D	Low
	Significant change to landscape character	C/O	4	C	Medium
Noise	Operational noise exceedances of turbines on non-involved dwellings	O	3	D	Medium
	Construction noise impacts including blasting	C	4	D	Low
	Substation and transmission line noise impacts	O	5	D	Low
	Negative impacts arising from special audible characteristics	O	3	E	Medium
Health	Negative impacts on human health	C/O	3	E	Medium
Flora and Fauna	Impacts on native vegetation	C	4	C	Medium
	Impact on threatened species (exc Birds)	C/O	4	D	Low
	Bird and Bat Strike	O	4	D	Low
Aviation	Creation of significant aviation hazard	O	3	E	Medium
	Limitations on aerial agriculture by neighbours	O	4	C	Medium
	Visual impacts of obstacle aviation lighting	O	4	C	Medium
Transport	Impacts on road condition	C/O/D	4	D	Low
	Negative impacts on traffic flow and capacity	C/O/D	4	D	Low
EMI and Telecommunications	Television and radio signal impacts	O	4	E	Low
	Interferences to Point to Point link	O	4	D	Low
Fire	Turbine fire ignition	C/O/D	3	E	Medium
	Fire ignition from other infrastructure	C/O/D	3	E	Medium

Sector	Issue	Project Stage	Mitigated Consequence	Mitigated Likelihood	Mitigated Risk Rating
	Limitations on ability to fight fire in local area	O	3	E	Medium
Shadow Flicker	Significant Impacts on non-involved persons / dwellings	O	4	D	Low
Blade Glint	Annoyance and distraction to nearby persons	O	4	D	Low
Heritage	Impact on indigenous heritage values	C/O/D	4	D	Low
	Impact on non-indigenous heritage values	C/O/D	4	D	Low
Land Resources and Geotechnical	Significant soil loss and erosion	C/O/D	4	D	Low
	Landform stability failure	C/O/D	3	E	Medium
Hydrology	Deterioration of water quality	C/O/D	3	D	Medium
	Impacts on groundwater	C/O/D	3	E	Medium
	Impacts on water levels from extraction	C/O/D	4	C	Medium
	Water pollution from spills and leaks	C/O/D	3	D	Medium
Resource Impacts	Waste generation	C/O/D	5	C	Low

Notes: C = Construction, O = Operation, D = Decommissioning
The numbers under 'Mitigated Consequence' and letters under 'Mitigated Likelihood' are explained in previous tables.

The information in **Table 35** shows that risks associated with key environmental issues have been identified and considered, and that potential impacts can be effectively managed through the mitigation commitments made.

Consideration has been given as to whether there are other potential environmental impacts associated with the project which were not identified in the DGRs. The current assessment has adequately considered and addressed all known and perceived risks, including an assessment of any additional risks identified through the construction and operation of other operating wind farms.

UNION FENOSA
WIND AUSTRALIA

gasNatural fenosa

PALING YARDS WIND FARM

CHAPTER 24

STATEMENT OF COMMITMENTS

24 Statement of Commitments

Table 35 outlines the tasks and actions that the proponent is committed to undertaking if the project is approved. These commitments seek to ensure that further specific details are provided on certain aspects of the wind farm, and that relevant standards are met throughout the construction, operation and decommissioning phases.

In the table below, some commitments address more than one sector, such as vegetation replanting that assists in minimising visual impacts and improving biodiversity. Commitments have been included only once in the following table, in the sector deemed to be the most relevant.

Table 35 Statement of commitments

Sector	Issue	Commitment
General	Micrositing	1. Ensure that micrositing or any minor changes to the project do not create any material increase in overall environmental impact. In the event of any significant changes to the proposed wind turbine layout, an updated noise assessment and visual impact assessment will be submitted prior to construction.
Pre-construction compliance	Pre-Construction Compliance Report	2. The proponent will submit a Pre-Construction Compliance Report for each stage of the project to the Director-General at least two weeks prior to the commencement of construction of that stage (or such later time agreed to by the Director-General). The Pre-Construction Compliance Report will include details of the compliance with all pre-construction conditions of approval that are relevant for the specific stage(s) of the project.
	Construction Environmental Management Plan	3. The proponent will submit a Construction Environmental Management Plan (CEMP) for each stage of the project to the Director-General at least two weeks prior to the commencement of construction of that stage (or such later time agreed to by the Director-General). The CEMP will address the construction impacts of the relevant stage of the project including the specific matters set out below. The proponent will implement the CEMP of each stage of the project as approved by the Director-General
Pre-operational compliance	Operation Environmental Management Plan	4. The Proponent will prepare and implement an Operation Environmental Management Plan (OEMP) and submit it as a draft for approval to the Director-General at least one month prior to the commencement of operation (or such later time agreed to by the Director-General). The OEMP will address the operational impacts of the project including the specific matters set out below. The proponent will implement the OEMP as approved by the Director-General.
Economic and Social	Effect on local economy	5. Full time jobs and contractors for the construction and future decommissioning will be sourced locally if the skills and experience exist within the community.
	Economy and livelihoods	6. Assess the viability of conducting aerial agricultural operations on properties adjacent to the site, particularly by the use of helicopters. In the event the immediate neighbouring landowner(s) would require aerial agriculture spraying of their land adjacent to the project and there is an increase in cost associated with the proximity to turbines, the proponent will cover the reasonable cost increase for the

Sector	Issue	Commitment
		aerial agriculture activity. The landowner seeking compensation for the cost increase must demonstrate and justify this increase with previous records.
	Community Consultation	7. The proponent will develop and maintain a community consultation and engagement program aimed at: - Providing the community with factual information about the project; and - Gathering feedback from the community and stakeholders about their concerns and interest, which can be subsequently addressed in the approvals process. A dedicated email address, website and free call 1800 number will be available and responded to for the life of the project.
	Infrastructure	8. In relation to infrastructure in the local area, UWFA will: - Carry out a pre-construction road survey to determine existing conditions of local roads. - Carry out any upgrades and strengthening works as required by the Transport Management Plan to be prepared before works commence, along the access road network to provide safe construction access for the project. - Prepare and implement a Transport Management Plan to ensure local roads are not adversely impacted by heavy vehicles. - Notify the local community of changed traffic conditions and proposed road works via a newsletter or information line.
	Community amenity	9. To minimise potential noise impacts associated with night-time deliveries, prior notification will be provided to the affected public where night-time convoys are scheduled, and restrict use of exhaust/engine breaks in built up areas.
		10. Landscape screening or minor adjustments to wind turbine locations will be explored and implemented to ameliorate any identified visual impacts.
		11. Transmission lines will be sited sensitively to reduce visual impacts to residents where possible.
		12. Clearing for transmission lines will be kept to a minimum for safety requirements.
	Community Consultative Committee	13. In accordance with the Draft Guidelines, UFWA will establish a Community Consultative Committee (CCC). The purpose of the CCC is to provide a forum for discussion between the proponent, the community, Council and other stakeholders about the project, if the project is approved. The CCC would provide a forum for ongoing communication with the community during the construction, operation and decommissioning of the project.
	Potential	14. UFWA is exploring potential options to support the local

Sector	Issue	Commitment
	Community Enhancement Fund	community surrounding the site, including the potential establishment of the Oberon Community Enhancement Fund for community groups and organisations. The door-knock survey which UFWA representatives and environmental consultants undertook asked respondents to suggest community funding projects that they would like to see occur if the project went ahead.
Visual	Visual impact to nearby properties	15. Screening planting will be undertaken by the proponent in locations agreed between the proponent and local landowners where the planting is seen as effective and is desired by the landowner to limit the view to the proposed wind turbines. It will involve a variety of dense native vegetation, including both trees and shrubs, and will be carried out at no cost to the landowner.
		16. The wind generator blades, tower and nacelle will be treated/painted with a non-reflective white or off white colour and matt finish to reduce glare and minimise blade glint.
		17. No advertising, signs or logos will be mounted on turbine structures, except those required for safety purposes.
		18. Site control building and facilities will be designed and constructed sympathetically with the nature of the locality.
		19. Substations will be located away from direct views from roads and residential dwellings.
		20. Safeguards will be implemented to control and minimise fugitive dust emissions.
		21. The height of earth stockpiles will be restricted to minimise visibility from outside the site.
		22. Activities that require night time lighting will be minimised, and low lux (intensity) lighting designed with the light projecting inwards will be used where necessary to minimise glare at night.
		23. Cut and fill for site tracks will be minimised and disturbed soils will be revegetated as soon as possible after construction.
		24. Revegetation of disturbed areas will be undertaken to ensure effective cover is achieved.
		25. Options for planting screening vegetation in the vicinity of nearby residences and along roadsides will be explored to screen potential views of turbines.
		26. Works to minimise visual impacts will take into consideration the consultation with local residents and authorities.
		27. Should obstacle lighting be required, the lighting will comply with CASA standards to minimise unnecessary light spill. The downward component of light will be restricted to either,

Sector	Issue	Commitment
		or both, of the following: - Such that no more than 5% of the nominal intensity is emitted at or below 5° below the horizontal; and - Such that no light is emitted at or below 10° below the horizontal.
		28. The transmission line route selection process will avoid sensitive view locations and loss of existing vegetation where possible.
		29. Wherever possible, transmission lines infrastructure angle positions will be selected in strategic locations to minimise potential visual impact and to provide a maximum setback from residential dwellings and road corridors.
		30. Suitable component materials with low reflective properties will be selected for the substation and transmission lines.
		31. Suitable storage areas for materials will be selected with minimum visibility from residences and roads, with plant screening used where necessary.
		32. Strategic tree or shrub planting will be undertaken where necessary between view locations and the transmission line.
	Cumulative visual impact to nearby properties	33. Should obstacle lighting be required, the flashing of obstacle lights of wind farms within close proximity will be synchronised to each other (wherever possible) to minimise visual impact.
Noise	Construction noise	34. Standard construction hours will apply to the project, as outlined below, - Monday to Friday: 7:00am to 6:00pm - Saturdays: 7:00am to 1:00pm - Sundays: No construction In the event that it is required to undertake other works outside the above construction hours, prior approval will be obtained from the relevant authority.
	Blasting	35. The proponent will ensure that any blasting complies with the ANZECC guideline.
	Operational Noise	36. The proponent will undertake routine noise monitoring, assessment and reporting at compliance critical locations.

Sector	Issue	Commitment
		37. If undue turbine noise impacts are identified during operations due to temperature inversion, atmospheric stability or other reasons, then adaptive management' measures may be implemented to mitigate or remove the impact. This process may 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 undue impacts. - Operating turbines in a reduced 'noise optimised' mode during identified times and conditions (sector management). - Providing acoustic upgrades (glazing, façade, masking noise etc) to affected dwellings. - Turning off turbines that are identified as causing the undue impact during identified times and conditions.
		38. During commissioning the actual received turbine noise level will be verified and determined through extensive monitoring.
		39. The proponent will ensure that operational noise levels will comply with the South Australia EPA Environmental Noise Guidelines principal acceptability criteria that the wind farm LA90 (10 min) noise should not exceed the greater of an amenity limit of 35 dBA or the pre-existing background noise by more than 5 dBA at each integer wind speed from cut in to rated power at any non-host property or residential receiver where noise agreements (in accordance with Section 2.3 of the SA EPA Guidelines) have not been entered into with the property owner.
		40. The proponent will ensure that the operational noise levels comply with the World Health Organization (WHO) *Guidelines for Community Noise* of 45 dBA or the pre-existing background noise by more than 5 dBA (whichever is the higher) for any host property or residential receiver where noise agreements (in accordance with Section 2.3 of the SA EPA Guidelines) have been entered into with the property owner.
		41. When the turbine model is known, a Noise Management Plan will be prepared and implemented as part of the OEMP to ensure that if the selected turbine does not comply under the predictive noise modelling, mitigation will be undertaken so that SA EPA Guideline standards are met.

Sector	Issue	Commitment
		42. In circumstances where undue turbine noise impacts are identified during operations then an *'adaptive management'* approach will be implemented to achieve compliance with the applicable noise limits. This will include: - Identifying exactly what conditions or times lead to undue impacts. - Operating selected turbines in a reduced 'noise optimised' mode during identified times and conditions (sector management). - Providing acoustic upgrades (glazing, façade, masking noise etc) to affected dwellings. - Turning off turbines that are identified as causing the undue impact during identified times and conditions.
		43. If a turbine model that is ultimately selected that has not been assessed as part of the noise impact assessment, further noise modelling for that turbine will be undertaken.
Health	Health and safety of persons	44. The proponent will provide accessible information to the public on wind farm impacts including the benefits, and project details, process and updates.
		45. The wind generator blades, tower and nacelle will be treated/painted with a non-reflective white or off white colour to reduce glare and minimise blade glint.
		46. Warning signs will be installed to alert the public to the risk of unauthorised site entry.
		47. Access to the wind turbines and associated infrastructure will be restricted to reduce personal injury and public hazards, including: - Locked access to towers and electrical equipment. - Warning signs with postings of 24-hour emergency numbers. - Fenced storage yards for equipment and spare parts.
		48. Wind turbines will be equipped with sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
		49. Cable markers will identify the path of the underground cabling to prevent accidental digging around the cable trenches.
		50. The turbines and associated infrastructure will be regularly maintained by the proponent as part of the operation of the wind farm.
		51. Noise levels will comply with the applicable noise guidelines, unless an agreement is in place with the effected landowner(s), and in any case should not be more than the 45dB(A) noise limit (for indoors) recommended by the World Health Organisation (WHO) publication Guidelines for Community Noise.

Sector	Issue	Commitment
		52. Shadow flicker at any dwelling will not exceed 30 hours per year unless an agreement is in place with the effected landowner(s).
	Blade Throw	53. Choose turbine models meets the relevant standards including: • IEC 61400-23 [Wind turbine generator systems, Full-scale structural testing of rotor blades]; and • IEC 62305-1 / 3 / 4 [Protection Against Lightning].
		54. Incorporate lighting protection and safety shutdown systems.
		55. Repair any degradation to the blades.
		56. Install fencing and signage to discourage unauthorised access to the wind turbines.
Flora and Fauna	Loss of biodiversity	57. Where trees are removed the relevant land owner will be consulted and a suitable native species which does not affect the wind resource will be planted in place of the removed vegetation.
		58. The southern sub-option for the northern transmission line will be selected as this option would minimise clearing of native vegetation.
		59. The proponent will develop an offset package in accordance with the Principles for the use of biodiversity offsets in NSW.
		60. The CEMP will contain mechanisms to prevent the spread of weeds and animals. Mechanisms may include: - Machinery wash downs - Staff training - Soil and fill screening - Other commonly used techniques - Coordinated management regimes managed by the wind farm developer.
		61. Bat Monitoring and Habitat Tree Inspections - Once the access roads and access tracks are pegged by surveyors potential habitat trees (that require removal) will be identified by an ecological survey. - These trees will be stage watched at dusk using infra-red spotlights and anabat detectors to determine usage by any threatened microchiropteran bats. - Accessible tree hollows that require removal will be inspected for fauna by infrared telescopic camera prior to removal to ensure that no species are present in the hollow are harmed during removal.
		62. Bird Monitoring and Bat Strike Monitoring - An additional baseline pre-commissioning survey will

Sector	Issue	Commitment
		be undertaken at each turbine site during the spring/summer season. This will provide baseline data for the bird and bat strike monitoring study which will be undertaken during the first year or the operation of the wind farm. - The recording of calls utilising Anabat recorders will enable information such as time of flybys and also if any feeding buzzes are recorded. This will allow area usage data to be gained (by species) and also active use data through feeding buzz recording. Activity levels can then be used to modify wind farm management if required.
		63. A Vegetation/Ecological Restoration Plan will be developed as part of the CEMP and will address the post-construction works to be undertaken to rehabilitate the areas that are disturbed as part of the construction works once construction is finalised. Detailed surveys before any vegetation is removed will record any microhabitat features and provide a detailed plan outlining areas of impacts at a micro level. This will allow for placing of sediment and erosion control fence designs to reduce any indirect impacts on vegetation.
		64. A Riparian Vegetation Management Plan will be developed as part of the CEMP and will address the issues associated with the proposed creek crossings where any native vegetation is proposed to be disturbed.
		65. An Erosion and Sediment Control Plan will be prepared to avoid and reduce disturbance to drainage lines within the site. Runoffs from work sites will be managed by appropriately designing the wind farm access tracks and other infrastructure by incorporating erosion and sediment control methods during the construction and operational stages.
		66. An Ecological Restoration Plan will be prepared that will outline the specific measures for rehabilitation, including: - revegetation (including use of locally occurring species); - instructions for how to reuse cleared vegetation in situ (including the spreading of mulched vegetation over cleared areas); - areas of pasture should be re-seeded with pasture grass species removed; and - areas where crane pads have been sited in native vegetation should be mechanically loosened with machinery to alleviate compaction, enhancing seed germination potential in loose soil and micro-topography to enhance seed retention from surrounding woodland areas.
		67. A Native Vegetation Management Plan will be prepared to ensure minimal removal of native vegetation for the construction of the wind farm infrastructure, and measures to ensure native vegetation in the vicinity of the development footprint are not affected.

Sector	Issue	Commitment
		All environmental controls will be audited for compliance regularly during construction and after commissioning. This would include micro mapping of vegetation around each turbine to avoid any unnecessary removal of vegetation and also the access tracks. This would also allow for vegetation planting species when the wind farm is decommissioned.
		68. Vegetation clearing will be undertaken with the following measures: - all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna; - the area to be cleared at the site will be clearly demarcated using flagging or fencing, and mapped on construction plans, to prevent breaches of the construction boundary; - laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat; - vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible; - care will to be taken when working near wooded areas to prevent damage to adjacent tree roots and indirect impact to habitat areas; - trenches will be excavated at least 15 m away from the base of trees where possible to prevent root damage; - where practical, suitable fencing to be erected along trenches to prevent fauna falling in; - habitat features such as logs, large rocks and fallen hollows within the proposed clearance footprint will be relocated to adjacent areas to supplement habitat where possible; - any individual hollows removed will be replaced with artificial hollows within adjacent suitable habitat; - Environmental Compliance Manager or field officer qualified in the handling of fauna to be present on-site during clearing to capture and re-release fauna (where appropriate); - regular checking of trenches by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP; - pre-clearance surveys (including diurnal and nocturnal) undertaken to determine if roosts, nests or dens are present in any trees proposed for clearing; - implement a two stage approach to clearing works; o non-hollow bearing trees will be cleared before habitat trees to allow fauna an opportunity to move from the hollow bearing trees and allow time to concentrate rescue efforts on the trees that are most likely to be inhabited; and o hollow bearing trees will be felled after a minimum 24 hour delay after clearing of non-habitat trees. - native vegetation that is removed will be chipped and

Sector	Issue	Commitment
		mulched for on-site use where practical; - where practical, native vegetation greater than 3 m in height to be retained during transmission line construction; and - rehabilitation of internal access roads that are not required following construction to be undertaken.
		69. A Weed Management Plan will be prepared to ensure that the construction and operation of the project does not contribute or cause an increase in the weed species within the site. The plan will put in place control measures for minimising weed during and after construction. Plans for revegetation of disturbed areas will reduce opportunities for weed species to take hold. Wash bays will be sited so trucks and machinery can be washed down to prevent weed seed being spread both onto and off site. Weed management will be undertaken with the following measures: - where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the site; - piling of soil that may contain seeds of exotic species at least 50 m away from creeks, drainage lines and other areas of native vegetation, to prevent spread into adjacent areas during rainfall or wind events; - topsoil recovery will be undertaken in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation; - all construction staff and sub-contractors educated on noxious weeds present at the site and ways to prevent spread; - where practical, topsoil that has very few weeds to be harvested to salvage the native soil seed bank and reintroduced into disturbed areas. Otherwise, revegetate with locally native endemic species characteristic of the cleared vegetation type; - control of perennial weed grasses within the disturbance zone for 3 to 5 years after construction; - where practical, and in consultation with host landowners, manage stock access during periods of revegetation; and - imported soil and rubble to be certified as free of weeds and weed seeds.
		70. A Bat and Avifauna Management Plan will be prepared to manage and mitigate any bird and bat strikes resulting from the operation of the project. Carcass search protocol will be implemented to identify more accurately the mortality rates of the bats and birds within the site. Identification of any species lost along with the data gained from Anabat recording would enable adaptive management of the project if required. A specific Bird and Bat Monitoring Plan will be developed.

Sector	Issue	Commitment
		The Bird and Bat Monitoring Plan will: - outline the required monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required in order to achieve the objectives of the plan - outline the roles and responsibilities for the proponent, operator and agencies in implementing, assessing and enforcing the plan. - be developed in consultation with OEH - determine the frequency of report strike data during the preparation of the monitoring programme. The adaptive management measures that could be implemented will be negotiated with OEH when significant strike rates are detected. Bird and bat strike monitoring will be undertaken with consideration for the monitoring guidelines provided by the Australian Wind Energy Association.
	Impacts from temporary facilities	71. All temporary and construction facilities will be located so as to avoid vegetation loss and the land will be rehabilitated to its former state at the conclusion of the construction stage.
		72. Where possible, raw materials for the concrete batching plant will be sourced on site, with all materials brought in from external sources being as clean as possible to minimise the potential of introducing weeds to the site.
		73. The water for the concrete will either be sourced on site subject to a separate licence issued by the NSW Office of Water, or transported to the site via tanker trucks.
	Landscape impacts resulting from de-commission	74. At the completion of the wind farm's operating life, the turbines will either be replaced or the land will be rehabilitated to its previous or better condition.
		75. Tracks considered surplus to the farmers' requirements will be rehabilitated and revegetated by introducing soil, mulch and grass seeds or local prevenance.
Aeronautics	Creation of hazard	76. Once the turbine locations are finalised, the proponent will notify the RAAF Aeronautical Information Service (AIS) of the location and height details of the turbines.
		77. The rotor blades, nacelle and the supporting mast of the wind turbines will be painted white, off-white or a light grey colour.
		78. An aeronautical study to determine the requirement for obstacle lighting, in the form of a detailed and thorough risk assessment using internationally recognised standards, will be prepared once the final approved turbine layout and design turbine height are known.
		79. An assessment will be undertaken in consultation with applicable stakeholders prior to construction as to whether marking or lighting will be required to enhance the level of safety.

Sector	Issue	Commitment
		80. If required, medium intensity obstacle lighting will be installed: - To identify the perimeter of the wind farm; - At longitudinal intervals not exceeding 900m; - So that they are synchronised to flash simultaneously (both within the wind farm and with other wind farms in the vicinity); and - So that any wind turbines of significantly higher elevation are also identified. The obstacle lights will have the characteristics specified in MOS 139, Chapter 9.
		81. A monitoring, reporting and maintenance program will be established in accordance with the requirements set out in MOS 139, Chapter 9 to ensure the ongoing availability of obstacle lights.
		82. The obstacle lighting (if required) layout will meet the CASA objectives of: - Defining the "general definition and extent of the objects" for each cluster or linear array; - Lighted turbines to be spaced "at longitudinal intervals not exceeding 900 m" for each cluster or linear array ; and - Lighting the most prominent (highest for the terrain) turbine in each cluster or linear array.
		83. Marking the wind monitoring towers according to the requirements set out in MOS 139 Section 8.10 will be considered.
		84. Marking of electricity transmission lines: - Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations will be marked in accordance with MOS 139 Section 8.10, or - Alternatively, the AAAA endorsed power line marker reportedly developed in conjunction with Country Energy will be installed.
		85. The need for obstacle lighting will be reviewed at regular intervals by the proponent.
Transport	Safety and asset protection	86. A detailed Transport Management Plan will be developed as part of the CEMP to include the finalised transport details and include management and mitigation measures for the project. This will be prepared before the construction phase of the project and will form the foundations for all traffic related activities.
		87. Traffic generation numbers and proposed routes will be finalised and included in the Transport Management Plan.
		88. The haulage contractor will be confirmed and Haulage Transport Plan prepared, prior to the finalisation of the

Sector	Issue	Commitment
		Transport Management Plan.
		89. The proponent will liaise with appropriate road authorities.
		90. The design of access points will be finalised and included in Transport Management Plan.
		91. The design of the internal site tracks network will be finalised prior to the construction phase.
		92. An existing conditions and roadside vegetation assessment will be undertaken and included in Transport Management Plan.
		93. If required by the Transport Management Plan, intersection and road upgrades along OD route to safely accommodate the manoeuvrability of these vehicles will be implemented.
		94. Carry out a pre-construction road survey to determine existing conditions of local roads.
		95. Carry out any necessary upgrades and strengthening works along the access road network to provide safe construction access for the project.
		96. Prepare and implement a traffic management plan to ensure local roads are not adversely impacted by heavy vehicles.
		97. Notify the local community of changed traffic conditions and proposed road works via a newsletter or information line.
	Traffic flow and capacity	98. Access tracks will only intersect with government roads at nominated access points.
Telecommunications	Television signal strength reduced	99. In the event that TV interference is an issue during wind farm construction or after wind farm commissioning, the following options are recommended, in approximate order of increasing cost: - Realigning the householder's TV antenna directly towards their existing transmitter. - Tuning householder's antenna into alternative sources of the same or suitable TV signal. - The installation of more directional and/or higher gain antenna at the affected residence. - Relocating the antenna to a less affected position. - The installation of a digital set top box (and UHF antenna if required). - The installation of cable/satellite TV at the affected residences. - Installation of a TV relay station. In the event that digital TV does not provide an acceptable amelioration option, satellite television represents another potential option.

Sector	Issue	Commitment
	Potential interferences to proposed future NSW RFS P2P link	100. Further consultation with NSW RFS will be undertaken to confirm whether interferences to the proposed future NSW RFS P2P link will occur, and whether the tower or interfering turbines should be relocated.
Fire	Increased risk of fire ignition or spread	101. As part of the OEMP, a Fire Management Plan will be prepared in consultation with State and local rural fire services, and DoPI, and in accordance with *Planning for Bushfire Protection 2006*. This would address safety, communication, site access and emergency response protocols. .
		102. The proponent will consult with the RFS during periods of high fire danger, and generally to ensure the RFS are familiar with the development.
		103. The proponent will consult with the RFS in regard to the adequacy of bushfire prevention measures to be implemented on site during construction, operation and decommissioning.
		104. Consultation with the NSW PWS on the management of bushfires in the adjacent National Park.
		105. Consult with the RFS during periods of high fire danger.
		106. Inform RFS and any aerial agriculture operators on the location of the wind turbines, transmission lines and monitoring masts.
		107. Development of workplace health and safety protocols to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.
		108. On-site vegetation management during construction and operation to minimise potential sources of fuel.
		109. Re-organisation of construction activities during periods of high fire danger, including ceasing use of explosives, and management of hot work activities such as welding or cutting.
		110. Use of materials and equipment during operation that minimise the likelihood of fire.
		111. Maintenance of vehicles to minimise sparking from exhaust systems.
		112. Automatic shutdown of any overheating turbine mechanism.
		113. Shut down of turbines during a bush fire in the area.
		114. Lightning protection on each turbine.
		115. Under-grounding of electrical and communication cables where practicable.
		116. Access to adequate water supply, with water access points be located in safe, easily identifiable areas and accessible in

Sector	Issue	Commitment
		all weather conditions by equipment up to 15 tonnes.
		117. A turning circle with a minimum radius of 10 metres will be provided for fire appliances at all water access points.
		118. The location and number of tanks or other water supply points will be determined in consultation with the NSW RFS.
		119. Careful storage and handling of flammable materials and ignition sources brought onto the site, as per manufacturer's instructions.
		120. Storage of appropriate fire fighting equipment onsite during the construction phase, ensuring that a minimum of one person on site is trained in its use.
		121. Periodical inspection of overhead transmission easements to monitor any regrowth of encroaching vegetation.
		122. Vehicle turn-around facilities to be provided at every turbine tower site.
		123. 5-metres wide internal access tracks to be provided that are driveable and permanently clear of vegetation for heavy fire-fighting equipment up to 15 tonnes.
		124. Provision of wind turbine access tracks that continue onto adjacent paddocks and are not dead-ended.
		125. Implementing a wide fuel break in accordance with RFS, Council and State Government recommendations to slow the spread of fire.
		126. Any vegetation plantings to have low fire resistance.
Shadow Flicker	Impacts on persons / dwellings	127. Screening structures or planting of trees to block shadows cast by the turbines will be installed where needed.
		128. Use of non-reflective paint on turbine blades.
		129. Turbine control strategies which shut down turbines as necessary will be used.
Heritage	Impact on heritage items	130. A comprehensive Cultural Heritage Management Plan will be prepared in consultation and collaboration with the Registered Aboriginal Parties to reduce and mitigate the impacts of the project on any artefacts which may be detected within disturbance zones. If it is not practicable to locate infrastructure so as avoid objects / artefacts then cooperation with the Registered Aboriginal Parties will be undertaken to determine the management option for these objects / artefacts (i.e. collection for education purposes or moving the objects / artefacts slightly to outside the zone of disturbance). The movement of identified objects is considered to be a suitable mitigation measure in most cases as the distances involved would not be significant, and many of the objects may have been moved in the past via water movement, erosion or vehicle/tractor movements such as road grading

Sector	Issue	Commitment
		and cultivation of the ground.
		131. The Cultural Heritage Management Plan will also outline management strategies for the management of any potential unrecorded sites which are identified within the site during construction of the project. In accordance with the Draft NSW Wind Farm Planning Guidelines, the construction program control measures will include provision to temporarily halt the excavation of a specific site in the event that a previously unidentified Aboriginal object(s) and historic relic is uncovered. All works likely to affect the object/relic would cease and the OEH officers and the Registered Aboriginal Parties notified. Works will not recommence at the specific site until an appropriate strategy for managing the object/relic has been determined in consultation with OEH and the Aboriginal stakeholders and a permit or written authorisation has been obtained from OEH.
		132. Avoid, as far as practicable, impacts on the known archaeological sites. If impacts to any further sites which are identified cannot be avoided then further investigation would be required in consultation with the Registered Aboriginal Parties and OEH. This would include sub-surface digs and analysis
		133. As the detailed design of the proposed access tracks and electrical connections were not available at the time the field surveys were conducted, potential deviations to the surveyed routes may be made during detailed design to reduce impact(s) on the land.
		134. Once the proposed access track locations and other disturbance areas are pegged on the ground, additional targeted surveys of these areas will be undertaken. Where these additional targeted surveys identify any further sites, test pits will be undertaken in order to determine the extent of significance of any sites which would be potentially impacted.
		135. The final micrositing of the proposed infrastructure will be undertaken in consideration of utilising and upgrading as much as possible the existing farm access tracks where possible to achieve an overall site plan which minimises unnecessary new soil disturbance.
		136. A minimum distance or separation buffer of 100 meters will be maintained from any turbine and site P8. If the separation distance is not practical, then a sub-surface investigation should be undertaken for any turbine proposed within 100m of site P8.
Land Resources and Geotechnical	Soil loss and stability of landform	137. The Soil and Water Management Plan, will be prepared as part of the CEMP and will detail the measures and techniques to preserve soil resources.
		138. Further detailed subsurface geotechnical investigation and analysis will be conducted to provide information for the detailed design of footings, access road, slope stability, and other associated infrastructure.

Sector	Issue	Commitment
		139. Access roads will be designed to stay on the ridge crests and remain clear of potential land slips.
		140. If crossing a potential land slip is required then the road formation will be designed to remove any potentially unstable material and found on stable bedrock.
		141. Site works, including excavation and filling, will be planned accordingly to reduce the risk of high concentrated surface water runoff.
		142. Remove any soft, wet, and highly compressible material or topsoil material and organics.
		143. Assess moisture contents of the bulk excavated soils and weathered rock. For compaction of any materials other than free draining sands, the moisture content will be in range OMC +/-2% (wet/dry), where OMC is the optimum moisture content at Standard Compaction.
		144. The complete surface of the sub-grade will be test rolled in order to detect the presence of any soft or loose zones, which will be excavated out and replaced with approved filling. Test rolling will be carried out with a smooth drum roller with a minimum static weight of 8 tonne.
		145. For pavements, the natural foundation soil will be compacted to a minimum dry density ratio of 98% Standard for clay soils or a minimum density index of 75% for sand soils.
		146. For pavements, approved filling excavated from site, will be placed in layers not exceeding 250mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% Standard or a minimum density index of 75% for filling greater than 0.5m below top of finished subgrade level. The final upper 0.5m of filling sub-grade will be compacted to a minimum dry density ratio of 100% Standard or 80% density index. Where filling has a clay content, moisture content within the filling will be maintained within OMC -2% (dry) to OMC +2% (wet) during and after compaction.
		147. All filling beneath structures and footings will be compacted to a dry density ratio of at least 100% Standard or relative density index of at least 80%. This compaction will apply to all filling extending from a nominal horizontal distance of 2m at the edge of each structure with a nominal zone of influence of 1H:1V down and away from the proposed sub-grade level.
		148. Any compaction of silty or sandy clay foundation soils at or close to footing formation level will be sealed or covered as soon as practicable, to reduce the opportunity for occurrence of desiccation and cracking.
		149. Level 1 testing and supervision of filling, in accordance with AS3798, is recommended where the filling is to be used for support of structural loads, within the 2m horizontal distance and spread from structures as outlined above.

Sector	Issue	Commitment
		150. All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, will be processed so that individual particles are in the order of 100mm or less.
		151. All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, will be processed so that individual particles are in the order of 100mm or less.
		152. Approved rock filling excavated from site will be placed in layers not exceeding 300mm loose thickness with care taken to minimise the occurrence of voids. Fine sands and dispersive clays will not be included in the fill due to the susceptibility to erosion.
		153. Where pavements are proposed over bulk rock filling, it is recommended that the rock fill will be covered with a non-woven, needle punched, continuous filament polyester geofabric of sufficient strength to avoid punching failure.
		154. Place a minimum 0.5m thick cover of granular bridging on the geofabric in two layers of 250mm loose thickness, to provide sub-grade support for the pavement. The bridging layers will be compacted to a minimum dry density ratio of 100% Standard or 80% density index.
		155. Granular bridging or sub-grade filling will comprise engineered fill material.
Hydrology	Deterioration of water quality	156. A detailed Soil and Water Management Plan (SWMP) will be prepared prior to construction commencing. The SWMP will be prepared by a suitably qualified person, such as a soil conservationist.
		157. Progressive Erosion and Sediment Control Plans will be prepared as the project progresses to address management requirements at individual work sites.
		158. The wind farm and transmission line will be designed and constructed to minimise land disturbance and therefore reduce the erosion hazard.
		159. The construction activities will be staged to minimise the duration and extent of land disturbance.
		160. Topsoil resources will be managed to minimise the risk of erosion and sedimentation, and maximise reuse of topsoil during rehabilitation.
		161. Upslope (clean) stormwater will be diverted around the disturbed site capture sediment-laden runoff from within the disturbed site for diversion to sediment control devices.
		162. The site will be promptly and progressively rehabilitated as works progress.
		163. Erosion and sediment control devices will be inspected and maintained for the duration of the project.

Sector	Issue	Commitment
		164. The construction of new vehicle watercourse crossings will be avoided.
		165. Any water crossings would be designed to minimise impacts on existing banks, water flow, animal passage and on the movement of flows.
		166. Land disturbance within 20 m of minor streams (first and second order watercourses) and 40 m of third order or higher watercourses will be avoided.
		167. Appropriate procedures will be in place for the transport, storage and handling of fuels, oils and other hazardous substances, including availability of spill cleanup kits.
		168. Disturbance during transmission line construction will be minimised by using existing access tracks and roads, and avoiding construction of a permanent access track along the transmission line easement.
		169. Appropriate stormwater, collection, treatment and recycling at the concrete batch plant will occur in accordance with relevant best practice guidelines and any requirements of the NSW Office of Environment and Heritage.
	Water extraction	170. Water will be reused where possible to reduce water consumption (as detailed in the Water Management Plans to be included in the CEMP and OEMP).
		171. Over-extraction of surface water or groundwater will be avoided to prevent adverse impacts on environmental flows and water availability for existing licensed users.
		172. Any necessary water access licenses will be obtained.
Resource Impacts	Waste generation	173. Portable toilets will be provided in the temporary construction area.
		174. During decommissioning, all materials will be removed from the site and recycled appropriately.
	Building Materials	175. The existing 60m monitoring masts will be removed and reused elsewhere once the construction phase is complete.
		176. Where possible, the existing footings, access tracks and other infrastructure would be reused for any replacement turbine(s) during the operation phase.
Decommissioning and Rehabilitation	Responsibility for decommissioning	177. The proponent is responsible for the decommissioning of the wind farm infrastructure, and the landowner is not liable for this obligation (this is demonstrated in the land lease agreements with each of the wind farm participating landowners as shown in the Decommissioning and Rehabilitation Plan (DRP)). 178. The DRP will be reviewed and revised as required every 5 years for the duration of the project. During each review, the effectiveness of the plan will be re-assessed against its objectives, and cost estimates

Sector	Issue	Commitment
		and funding arrangements will also be reviewed by an independent consultant. 179. The proponent commits to undertaking all decommissioning and rehabilitation works outlined in the DRP within the 18 months after the end of the wind farm's operational life (including any replacement of the turbines as contemplated by commitment 108 below). 180. During the operational life of the project, any turbine that cannot be repaired and is deemed permanently unworkable (due to environmental, social, economic or other unforseen issues) will be decommissioned and dismantled, and its location rehabilitated within 18 months.
	Landscape impacts resulting from decommissioning	181. At the completion of the wind farm's operating life, the turbines will either be replaced or the land will be rehabilitated to its previous or better condition.
		182. Tracks considered surplus to the farmers' requirements will be rehabilitated and revegetated by introducing soil, mulch and grass seeds or local prevenance.
	Recycling	183. During decommissioning, all materials will be removed from the site and recycled appropriately.

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CHAPTER 25

CONCLUSION

25 Conclusion

This Environmental Assessment has detailed and assessed a proposal by Union Fenosa Wind Australia Pty Ltd, the proponent, and its successors and assigns to develop a wind farm with up to 55 turbines, known as the Paling Yards Wind Farm project.

The EA has found that the project would have a range of negative and positive impacts on the site and region, and that, with appropriate conditions and mitigations measures detailed, the negative impacts can be minimised.

In relation to the positive impacts, the EA found that if approved the wind farm would:

- generate 65 full time positions during construction, and 11 full time ongoing positions during the operation;
- invest $287 million in the economy;
- generate up to 550,833 Megawatt hours (MWh) of clean, renewable energy per year, enough to power up to 85,344 households; and
- displace 535,961 tonnes of greenhouse gases or the equivalent of taking 123,778 cars off the road.

Most notably, the project would make a small but important contribution to reducing the dangerous impacts of anthropogenic climate change, such as droughts, floods, extreme weather events and sea level rise.

In relation to the negative impacts, the EA found that the wind farm has the potential to have a low to moderate impact on landscape values, have a limited impact on local communications facilities, increase noise for some receivers, and result in the clearing of non-significant vegetation.

These risks can be minimised by the extensive range of management plans that would be prepare before construction, further study, and ongoing monitoring on the compliance of the wind farm when constructed to established standards. These commitments are detailed in **Chapter 24 – Statement of Commitments**.

The EA also found that the project is compatible with the existing land uses of the area and complies with relevant planning and environmental controls applicable to the site. As a result, it is regarded that the project is in the public interest.

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CHAPTER 26

REFERENCES

26 References

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APPENDIX 1

LETTER FROM DoPI & CHECKLIST

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APPENDIX 2

DIRECTOR-GENERAL REQUIREMENTS

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APPENDIX 3

LOT DETAILS

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APPENDIX 4

DECOMMISSIONING & REHABILITATION PLAN

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APPENDIX 5

SOCIO-ECONOMIC IMPACT ASSESSMENT

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APPENDIX 6

LANDSCAPE & VISUAL IMPACT ASSESSMENT & SHADOW FLICKER IMPACT ASSESSMENT

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APPENDIX 7

NOISE IMPACT ASSESSMENT

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APPENDIX 8A

FLORA & FAUNA IMPACT ASSESSMENT & THREATENED SPECIES IMPACT ASSESSMENT

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APPENDIX 8B

SUPPLEMENTARY FLORA & FAUNA IMPACT ASSESSMENT

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APPENDIX 9

AERONAUTICAL IMPACT ASSESSMENT

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APPENDIX 10

TRANSPORT IMPACT ASSESSMENT

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APPENDIX 11

ELECTROMAGNETIC INTERFERENCE IMPACT ASSESSMENT

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APPENDIX 12A

CULTURAL HERITAGE IMPACT ASSESSMENT

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APPENDIX 12B

SUPPLEMENTARY CULTURAL HERITAGE IMPACT ASSESSMENT

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APPENDIX 13

GEOTECHNICAL IMPACT ASSESSMENT

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APPENDIX 14

HYDROLOGICAL IMPACT ASSESSMENT

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APPENDIX 15

NEWSLETTER

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APPENDIX 16

ADVERTISEMENTS

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APPENDIX 17

DOOR-KNOCK CONSULTATION MEETING RECORD TEMPLATE