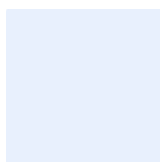




Project: Glen Innes Wind Farm
Section 75W Modification
Environmental Assessment

Reference: 236777
Prepared for: Glen Innes
Wind Power
Revision: 4
12 March 2014



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Executive Summary

Glen Innes Wind Power is seeking a modification to the approval for the Glen Innes Wind Farm to allow consideration of currently available improved efficiency turbines as the project progresses to the detailed design phase. The project was approved under Part 3A of the Environmental Planning and Assessment Act 1979 in August 2010.

The proposed modification would permit the option of installing the more efficient wind turbines that would produce more energy for the same capacity machines currently approved. An initial micro-siting of the layout of the turbines nominated in the approval is also included as part of this modification application. The ultimate development would be based on a commercial evaluation of the available options within the approved envelope.

No additional turbines are proposed as part of this modification application.

GIWP proposes to modify the approved project by:

- Providing for the installation of more efficient wind turbines.
- Micro-siting within the approved layout to accommodate the larger dimensions wind turbines

These modifications are considered to be minor in nature and consistent with the environmental effects assessed for the approved project. It is the purpose of this document to examine the key environmental issues in this regard.

These newer technology turbines, while having the same maximum power output as the approved project, have larger diameter rotors to enable more energy to be captured from the available wind resource. While the blades of these turbines rotate at a slower speed, their dimensions are outside the range assessed in the approved project.

The actual turbines installed on the site would be selected from the available turbines, including those assessed in this document.

The following summarises the outcome of the environmental assessment of the potential impacts of this proposal with regard to the key aspects of these changes in consideration of the requirements of *Draft NSW Planning Guidelines: Wind Farms 2011*.

Consultation

An outline of the consultation undertaken to date in relation to the approved project is included in Section 1. Additional consultation required by the conditions of approval is discussed in Section 5.1 and further activities will continue to be undertaken as the project progresses. The Department of Planning and Infrastructure require this modification request to be placed on public exhibition to inform its deliberations.



Legislation and planning

As the project was approved under the now repealed Part 3A of the Environmental Planning and Assessment Act, a modification is sought in accordance with the provisions of the former Section 75W of the Act. Other than noted, the requirements under other legislation have generally not changed since the project was approved and any undertakings to obtain licences or permits are the same.

A recent modification (Ref. MP07_0036 MOD 1) referred to as Modification1, approved extending the period during which commencement is required, within 12 months. This is consistent with similar approvals that have been granted for other wind farms in NSW.

Changes to the Protection of the Environment Operations Act mean that large wind farms are now classified under Schedule 1 of the Act as 'scheduled premises' that require an Environment Protection License. Therefore, GIWP will now require a license to operate the wind farm under the POEO Act.

This review has considered the requirements of the *Draft NSW Planning Guidelines: Wind Farms 2011* and the Glen Innes Severn Development Control Plan. The proposed modifications are generally consistent with these documents. Any inconsistencies are attributed to the approved wind farm and are not altered by the proposed modifications.

Landscape and visual amenity

Based on an updated assessment, it is concluded that the proposed modifications to the Glen Innes Wind Farm approval would not result in any significant increase in visual impact. Appropriate measures for the mitigation of visual impacts are included in the conditions of the August 2010 project approval.

The estimated maximum theoretical shadow flicker duration for the updated assessment predicted an exceedance of 30 hours per annum at two non-associated residences, Mayvona (uninhabited property) and Ilparran B. However, given the predominate wind directions for the wind farm, actual Shadow flicker arising from the operation of the project is unlikely to exceed the 30 hours/annum at any residence not associated with the project due to mitigating environmental factors such as cloud cover and the existing vegetative screening at both residences.

Provision is included in the existing consent conditions to ensure this limit is not exceeded.

The existing consent conditions for the external design of the turbines will minimise any potential for glare or reflection (blade glint).

Noise

Overall the predicted noise impacts of the higher efficiency wind turbines are lower than those in the *Supplementary noise assessment*, due to the specification of a lower noise wind turbine. Accordingly no changes to the approval conditions relating to noise are proposed.

Noise monitoring once the site becomes operational, included in the current conditions of approval, will need to be undertaken to confirm compliance with applicable noise criteria.

Health

No additional impacts on human health or safety were identified as a result of including the more efficient turbines in the approval.

Ecological issues

The potential impacts of the new turbine design on flora and fauna, including birds, bats and migratory species has been considered. No significant change in predicted impacts is anticipated. Adequate monitoring along with proposed mitigation measures and safeguards are included in the existing project approval.



Aviation

The locations of all turbines are identical to what was approved in August 2010, with the exception of two turbines which have been microsituated. No significant impact was identified in the original assessment and a review of the proposed modification concluded that the modifications are minor and are consistent with the approved project.

Greenhouse gases

The proposed higher efficiency turbines assessed have a capacity factor of up to 48% compared to the assessed capacity factor of up to 29% for the approved wind turbines. This change in efficiency would account for an estimated annual saving of almost 100,000 tonnes CO₂-e or an estimated saving of almost 600,000 tonnes CO₂-e from 2015 – 2020.

The proposed selection of these turbines would also allow for the supply of electricity to an estimated additional 12,780 homes per year.

Traffic and transport

In light of the proposed modification to permit the use of larger wind turbine components in comparison to the approved conditions, the preferred transport route and wind farm site access via the former Gwydir Highway was reviewed and remains unchanged. Therefore the traffic and transport impacts identified in the 2009 EIS along with the mitigation measures and safeguards and included in the conditions of approval remain unchanged.

A Swept Path Assessment undertaken as part of this report identified key locations along the preferred transport route where manoeuvring constraints exist for the transportation of the wind turbine components. The existing consent conditions include provision to ensure these issues are appropriately addressed. It is also noted that the recently approved Sapphire Wind Farm allows for up to 159 turbines with a maximum height of 157 m, turbines which are 7 m taller than those proposed for the modification for Glen Innes. The approved transport route for the larger Sapphire Wind Farm turbines includes a route through Glen Innes and along the Gwydir Highway and as such is similar to the route selected to transport the turbines to Glen Innes.

Telecommunications

The proposed modifications have been reviewed and it was concluded that they are unlikely to have adverse impacts on the interference of television and radio communications compared to the approved wind farm. The primary factor affecting signal interference is the location of turbines. The proposed modifications are considered substantially the same development and therefore no additional impacts were identified. Mitigation measures are included in the existing approval to manage any effects of the wind farm on Telecommunications

GIWF has consulted with NBN and has agreed to commit to undertake monitoring of digital interference prior to construction and prior to commencing operation of the wind farm. This will enable an assessment of the potential impacts of the wind farm following construction and what mitigation measures will be required if there is an impact. NBN has confirmed with GIWF that this monitoring and assessment is appropriate and acceptable to them



Conclusion

Based on the investigations and discussions contained in this document, the benefits of the currently available more efficient wind turbines have been demonstrated. It is recommended that the proposed modification to the project description be amended to include consideration of the more efficient larger turbines in accordance with the requirements of Section 75W of the Environmental Planning and Assessment Act.

It is concluded that the potential environmental impacts associated with the modification would be similar to those of the approved project.



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Glossary of Terms

Term	Definition
AHD	Australian Height Datum
AIHMS	Aboriginal Heritage Information Management System
AAAA	Aerial Agricultural Association of Australia
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACA	Australian Communications Authority
ACMA	Australian Communications and Media Authority
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AMG coordinates	Australian Map Grid coordinates
AS	Australian Standard
ASL	Above sea level
ASNZS	Australian Standard / New Zealand Standard
AusWEA or Auswind	Australian Wind Energy Association
AWEA	American Wind Energy Association
BOM	Bureau of Meteorology
BS	British Standard
BZE	Beyond Zero Emissions
CAMBA	China Australia Migratory Bird Agreement
CASA	Civil Aviation Safety Authority
CDMA	Code Division Multiple Access
CEMP	Contractor's Environmental Management Plan
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide equivalent
CEC	Clean Energy Council
CPI	Consumer price index
DCP	Development Control Plan
D-G	Director-General
DGRs	Director-General's requirements
DIICCSRTI	Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education
DPI	Department of Planning and Infrastructure
DRET	Department of Resources, Energy and Tourism
DTT	Digital Terrestrial Television

Term	Definition
DVB	Digital Video Broadcasting
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electric and Magnetic Field
EMI	Electromagnetic interference
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ERDA	Energy Research and Development Administration
FCAS	Frequency Control Ancillary Service
FM	Frequency modulation
FM Act	<i>Fisheries Management Act 1994</i>
GDP	Gross Domestic Product
GILALC	Glen Innes Local Aboriginal Land Council
GIS	Geographic Information System
GISC	Glen Innes Severn Council
GIWF	Glen Innes Wind Farm
GPS	Global Positioning System
GSM	Global System for Mobile communications
GSV	Ground surface visibility
GTA	General Terms of Approval
IEA	International Energy Association
INP	Industrial Noise Policy (NSW)
IPART	Independent Pricing and Regulatory Tribunal (NSW)
IPCC	International Panel on Climate Change
ISO	International Standards Organisation
ITU-R	International Telecommunications Union Recommendation
JAMBA	Japan-Australia Migratory Bird Agreement
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LOS	Line of Sight

Term	Definition
LPI	Land and Property Information
MCE	Ministerial Council on Energy
MF	Medium frequency
MGA	Map Grid of Australia
ML	Magnitude level (earthquake intensity)
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NHMRC	National Health and Medical Research Council
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NPWS	National Parks and Wildlife Service
NRET	NSW Renewable Energy Target
NSL	Noise Sensitive Location
NSW	New South Wales
OEMP	Operational Environmental Management Plan
OLS	Obstacle Limitation Surface
PEA	Preliminary Environmental Assessment
PFM	Planning Focus Meeting
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
RAAF	Royal Australian Air Force
REC	Renewable Energy Certificate
REF	Review of Environmental Factors
RFS	Rural Fire Service
RMS	NSW Roads and Maritime Services
RNE	Register of the National Estate
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
SIS	Species Impact Statement
SLM	Sound Level Meters
SWMP	Soil and Water Management Plan
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
TV	Television
UHF	Ultrahigh Frequency
UK	United Kingdom
VHF	Very High Frequency

Term	Definition
Vol	Volume
WTG	Wind Turbine Generator

Conversions/Units

Metric Units		Standard metric prefixes		
J	joule	K	kilo	10^3 (thousand)
L	litre	M	mega	10^3 (million)
T	tonne	G	giga	10^3 (billion)
G	gram	T	tera	10^{12}
Wh	watt-hours	P	peta	10^{15}
b	billion (1000 million)	E	exa	10^{18}

Orders of Magnitude

Unit	Amount	Energy consumed or generated
Watts (W/h)	100	energy use of a normal light bulb
Watts (W/h)	80-250	energy use of an average desktop computer
Watts (W)	745.7	1 horsepower
Kilowatt (kW/h)	1.3	energy use of a typical microwave oven
Kilowatt (kW)	1.5-5	power of home solar panel systems
Kilowatt (kW/h)	500	energy use of an average refrigerator each year
Megawatt (MW)	1	approximately 1360 horsepower
Megawatt (MW/h)	10.3	average energy use per person in Australia in 2010 (WBG, 2010)
Gigawatt (GW)	2.1	peak power generation of Hoover Dam
Gigawatt (GW)	18.3	peak power generation of the Three Gorges Dam
Terawatt (TW)	227	total energy use in Australia in 2010 (WBG, 2010)
Terawatt (TW)	300	power reached by an extremely high-power laser
Petawatt (PW)	1.1	currently the world's most powerful laser pulses
Petawatt (PW)	174	total power received by Earth from the Sun



1 Introduction

1.1 Background

The Glen Innes Wind Farm project is located on the Waterloo Range about 12 km west of Glen Innes, NSW (Figure 1.1). It was approved by the Minister for Planning in 2009 under Part 3A of the EP&A Act. The approval was modified in accordance with an Order issued by the NSW Land and Environment Court in 2010, following a challenge to the original consent.

This Environmental Assessment has been prepared by Aurecon on behalf of GIWP Pty in support of a proposal to modify the existing approval, to include provision for more efficient wind turbines that are now available as a result of technology improvements.

For projects approved under the now repealed Part 3A of the EP&A Act, proposals for modifications are considered in accordance with the requirements of Section 75W of the Act. The New South Wales Minister for Planning is the Approval Authority for this project.

This Environmental Assessment is intended to provide the Department of Planning and Infrastructure (DPI) with a sound basis for decision making concerning the proposed changes to the approved project. It provides a description of the environment and planning context for both the approved project and the proposed modifications.

The report includes an assessment of the key environmental issues and examines potential impacts of the proposed project modifications and where appropriate considers any additional measures to mitigate those impacts. A justification of the proposed project changes and the consultation undertaken or proposed for the project is also provided.

The Environmental Assessment of the proposed modifications aims to clearly demonstrate how State and regional planning issues, policies and guidelines are taken into consideration in regard to the proposed modification to achieve the objectives of the EP&A Act.

1.1.1 The Proponent

The proponent for the Glen Innes wind Farm is Glen Innes Wind Power (GIWP).

1.1.2 Major Project Approval 07_0036

A Project Application and Preliminary Environmental Assessment (PEA) were initially lodged with the then NSW Department of Planning (DoP) in March 2007. Based on the PEA, the Director-General of Planning issued assessment requirements for an Environmental Assessment on 1st May 2007.

An Environmental Assessment of the proposed project was placed on public exhibition in November and December 2008 and following consideration of submissions received and the proponent's response to these submissions, the Project received approval from the Minister for Planning on

2 October 2009 for the construction and operation of up to 26 wind turbines, with an installed capacity of up to 78 MW.

The infrastructure associated with the approved project includes a 33 kV/66 kV substation and facilities building, underground cabling between turbines and substation, and access roads.

The project application was supported by an Environmental Assessment which examined the potential environmental impacts of 27 wind turbines each with a generation capacity of between 2 MW and 3 MW. As discussed in the following section this approval subsequently modified based on the findings of a challenge in the NSW Land and Environment Court.

1.1.3 Approval as Modified by Order of NSW Land and Environment Court

NSW Land and Environment Court (L&E Court) case number 10926 of 2009 ([2010] NSWLEC 1281) considered the objections raised in relation to the project approval granted by the Minister for Planning and submissions received about the project prior to its approval.

A final ruling to uphold the appeal was made on 10 August 2010, subject to a number of resolutions and new conditions. The conditions of approval for the revised project included approval for the construction of 25 turbines and a slightly altered layout for the turbines and substation. A copy of the approval and conditions of consent for the approved project is provided in Appendix A. This document includes a map showing the revised layout, which is reproduced as Figure 1.1.

For the purpose of informing this assessment, a brief review of the objections raised and summary of the way in which they were addressed is provided Table 1.1.

Table 1.1: Summary of 2010 Land and Environment Court Case

	Issue raised	Court resolution
1.	Noise and visual impacts from the location of the turbines near properties: • Carrington Park (1a) • Waterloo Station (1b)	A revised layout was agreed upon that included minor relocations, alterations to a number of turbines in the southern end of the project, the deletion of one turbine and the non-reinstatement of another turbine that had been removed as part of the previous assessment process.
1a.	Noise and visual impacts of the turbines near a property known as 'Carrington Park' on Furracabad Road.	The court found that that there was no prospect of adverse noise impact on that property nor was there any likelihood of shadow flicker (both as a consequence of distance and direction). The court also determined that the turbines were located a distance where it would not be reasonable to assume that there was any unsatisfactory visual impact on Carrington Park. There were no alterations ordered for the project in relation to that property.
1b.	Noise and visual impacts of the turbines near a property named 'Waterloo Station' to the north-west of the northern end of the proposed wind farm.	The court found similar findings as with the Carrington Park property as outlined above. There were no alterations ordered for the project in respect to the Waterloo Station property. One of the alterations ordered as a result of issue no. 1 (relocating the substation to the south of the ridgeline in the vicinity) is expected to also benefit the visual impact of the Waterloo Station property.

	Issue raised	Court resolution
2.	The potential impact on the firm 'Super Air' and its pilots to lay fertiliser and other property improvement substances along the ridge tops in the vicinity of the wind farm.	Approval Condition 2.53 was amended to include provision for compensation to properties within a 2.5 km of the wind farm for any additional costs associated with aerial activities that were attributed to the wind farm.
3.	Objections from the Glen Innes Seven Local Council to the allocation of a proportion of the contribution to projects benefiting properties within 5 km of the project.	Condition 4.7 was adopted to ensure funding required to be provided by the proponent for community benefit purposes would be equally allocated to enhancement measures identified within 5 km of the Project with the other 50% allocated for projects for the remainder of the Glen Innes Community. The conditions of consent were altered to require the Guardians Inc. a group to be specifically consulted as part of any community consultation process in the development of the community enhancement program.

1.1.4 MP07_0036 MOD 1 – Modification 1

Following an application by GWP, the Department of Planning granted approval to MP07_0036 MOD 1 on 16 August 2013. The modification approved the extension of the project commencement date by 12 months. This is consistent with modifications that have been approved for other wind farm projects in NSW.

The modification was placed on public exhibition online between 31 July 2013 and 14 August 2013 and was notified in local newspapers. All agencies and persons that had made previous submissions to the approved wind farm were contacted and made aware of the submission period for MOD 1.

The submissions received included:

- six community submissions of objection
- one community submission of support
- six submissions from government agencies and/or organisations.

The government agencies did not object to the time extension. However, one requested reconsideration of the setback between residences and the wind farm; and another submission received from NBN Limited, raised concerns about possible interference with digital television reception and UHF/VHF bands.

1.2 Overview of approved wind farm

The approved wind farm permits the construction of 25 turbines at the locations shown in Figure 1.1. The nominal turbines considered for the approved project were up to 3 MW generating capacity, with a hub height up to 80 m and ultimate height of 130 m at the tip of the rotor. The approval also included provision for the wind farm to be interconnected by 132,000 volt underground cables that ultimately feed in to the NSW electricity grid through a new substation.

Approved construction works at the wind farm site include:

- site establishment and site preparation
- the installation of access tracks
- minor drainage works
- the wind turbines
- the erection of wind monitoring masts
- installation of electricity reticulation

- 
- construction of a substation and associated facilities and auxiliary services
 - building and installation of temporary site office facilities.

The temporary site office and amenities facilities would be installed at the commencement of construction and, following completion of the construction phase, removed and the site restored.

An outline of the proposed modification is provided in the following section with a more detailed comparison between the proposed modifications and the approved wind farm is provided in Section 3.

1.3 Overview of proposed modification

Since the project was approved there have been technological advances in wind turbine technology that allow more energy to be harnessed from the available wind resources under certain wind conditions, for units that have the same maximum power output. These improved efficiencies have been achieved by increasing area swept by the wind turbine, using a larger blade. This also requires a taller structure to accommodate the larger turbine blades. The blades of these turbines have a lower maximum rotation speed.

The Glen Innes site has wind characteristics such that it would benefit from the use of this new type of turbine. This modification is proposed in order that the more efficient wind turbines can be considered for the development.

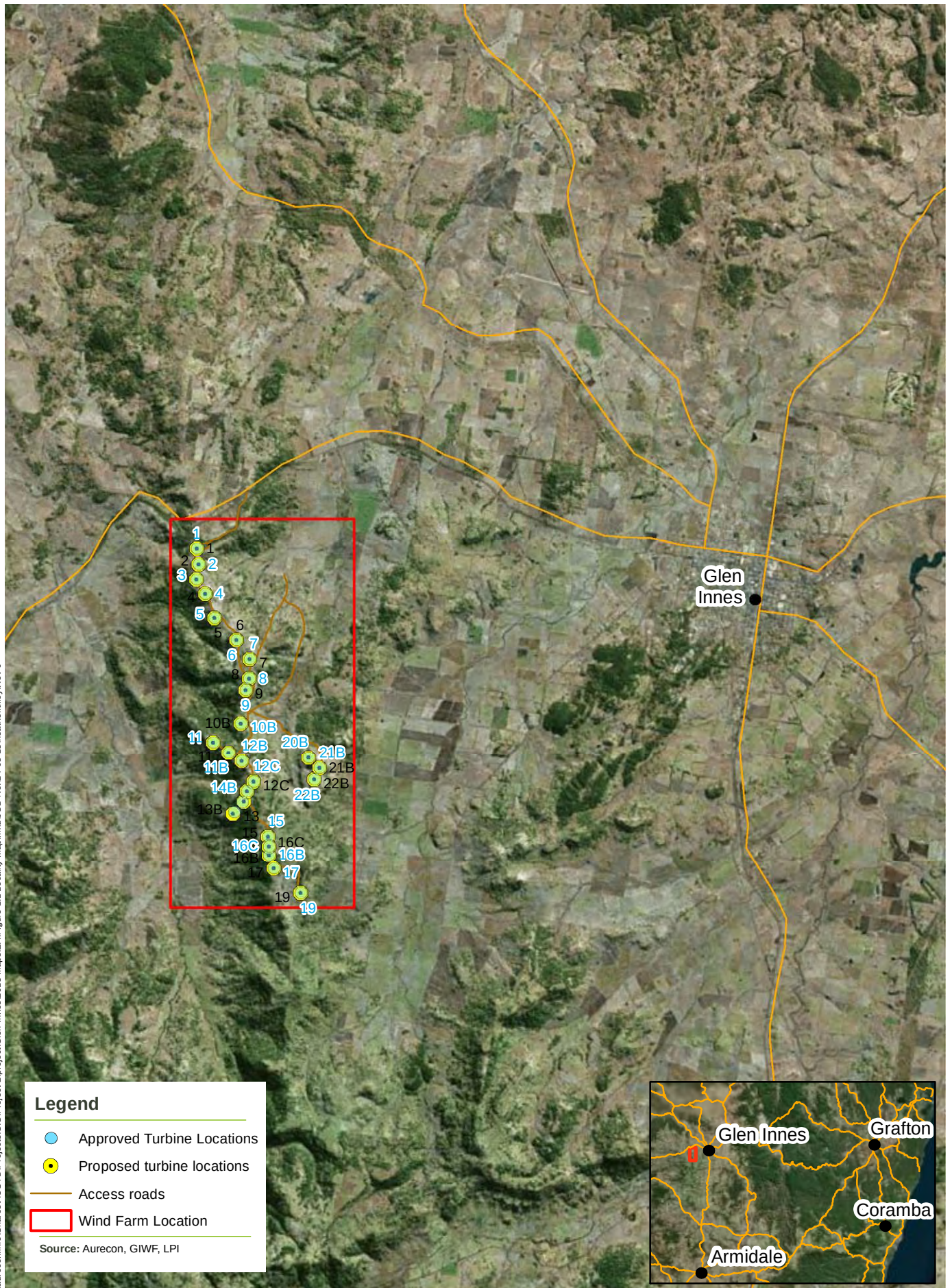
Specifically, based on currently available wind turbines, the more efficient machines have a tower hub height up to 89 m (compared to the up to 80 m tower height assessed in the approved wind farm) and a swept area diameter of 122 m (compared to the maximum diameter of 100 m assessed for the approved project).

Also, in order to accommodate the larger turbines, a minor adjustment to the agreed layout is proposed. As discussed within this document, the location adjustments are minor and are well within the micro-siting limit (100 m) defined by the Draft NSW Planning Guidelines: Wind Farms 2011.

The purpose of this document is to examine the key effects of the proposed modification to consider the potential impact of the changes, in support of an application under Section 75W of the EP&A Act (historical version) to modify the approved project.

Further discussion of the relevant planning framework that applies to this project is provided in Section 4.

\\aurecon.info\Shares\AU\SVD\Projects\GIS\Project-2\project\Glen-Innes\2013 Maps\EA\Figure 1.1 Locality Map.mxd\JOB No.14-08-13\header.tiff\Rev 0



1:120,000
0 2 4 km

Projection: GDA 1994 MGA Zone 56

Glen Innes Wind Farm **Environmental Assessment**

FIGURE 1.1: Locality Map



1.4 Objectives of the assessment

This Environmental Assessment has been prepared by Aurecon Australia Pty Ltd on behalf of GIWP Pty Ltd to assess the potential environmental impacts for significant issues associated with the proposed modifications.

In fulfilling the statutory requirements for Environmental Assessment, this report has been prepared to:

- Describe the proposed modifications involved
- Describe the need for the works and alternatives considered
- Assess the key environmental issues associated with the proposed modifications
- Consider the proposed modifications in relation to the principles of Ecologically Sustainable Development (ESD)
- Identify and review the statutory framework relating to the proposed modifications
- Identify feasible impact mitigation measures and assess their likely effectiveness
- Provide a framework for development of appropriate environmental management measures associated with the proposed modifications for implementation during the construction and operation phase

The structure of the Environmental Assessment is intended to assist the reader to gauge the potential impacts of the proposal. Specific key environmental issues are addressed in the following Chapters:

- Chapter 2: Identifies the context of the proposed modifications and their justification
- Chapter 3: Describes the proposed modifications compared to the approved wind farm
- Chapter 4: Outlines the planning approvals process required for the proposed modifications
- Chapter 5: Assesses the key environmental impacts associated with the proposed modifications
- Chapter 6: Summarises the conclusions of the assessment of the key environmental impacts of the proposed modifications

1.5 Contact details for further information

GIWP can be contacted as follows:

Mr Colin Paterson

Ph: (02) 9909 8970

Mob: 0439 379 171

Address: GPO Box N25 Grosvenor Place, SYDNEY 1220



2 Context of Proposed Modification

2.1 Wind farm objectives

GIWP's principal function is to develop and operate a commercially viable renewable energy project. In carrying out this function, GIWP aims to ensure that the wind farm will:

- a) operate efficiently and safely
- b) be developed in a way that is sensitive to the surrounding environment
- c) comply with undertakings, conditions of consent and statutory environmental requirements
- d) be integrated in to the community in a way that is sensitive to and has regard to the concerns that may arise for the life of the project.

2.2 Need for the proposed modification

2.2.1 Generic higher efficiency turbines

The driver for this proposed modification is to include the opportunity to improve energy yield from the approved wind farm using turbines that have the same maximum generating capacity but with better overall efficiency. This translates into a further incremental reduction in greenhouse emissions and a reduced cost of supplying wind power energy. In addition to the predicted higher energy yields, a wind turbine with specifications equivalent to the nominal unit would have lower noise emissions and higher reliability.

GIWP is applying for approval to make provision within the overall approval envelope to enable consideration of the use of the more efficient turbines that are currently available on the market. The assessment is based on the specifications for the Alstom ECO 122 – 2.7 MW wind turbine, which has become available since the project was assessed in 2008. The ECO 122 wind turbine model, or similar, has been specifically designed to service medium and low wind sites, such as is the case for Glen Innes.

Should the modification be approved, the actual turbines installed on the site would be selected from the available turbines, including those assessed in this document.

2.3 Context of Australia's clean energy future

The following sections provide a context for the role of wind farms within Australia. The wind farm has the potential to increase its efficiency by installing the proposed Alstom ECO 122 wind turbines in accordance with the revised layout.

2.3.1 Energy consumption and electricity prices

Data released by The World Bank in 2012 revealed that in 2010 Australians consumed a total of 226,956 gigawatt hours (GWh) of electricity as a nation and 10.3 megawatt hours (MWh) of electricity per capita.

The cost of producing electricity and subsequently consuming electricity has increased over the past decade primarily due to aged electricity networks (power poles and wires) requiring replacement and an increase in peak consumption demands. Historically, Australia has maintained stable and competitive electricity prices. However, the cost for household electricity has risen by approximately 70% over the past four years (DRET, 2012). The Australian Government aims to ease the price of electricity over the next few years by driving energy market reforms with the states to achieve objectives on efficient pricing, reliability and clean energy investment (DRET, 2012).

2.3.2 Intergovernmental Panel on Climate Change Reports

The Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report (4AR) in 2007 and is currently working on its fifth report (AR5) to be released late 2014. The 4AR provides comprehensive evidence of climate change impacts and the importance of mitigation to reduce any associated social, environmental and economic costs. The recommended approaches to reducing climate change impacts should be implemented locally and globally, these include:

- reducing our total consumption of energy
- adapting to the changing climatic conditions
- diversifying energy generation sources to reduce overall greenhouse gas emissions
- improving the efficiency of energy generation and energy use

The 4AR provides evidence of the significant increase in atmospheric greenhouse gases since pre-industrial times. It asserts the following findings:

- *“very high confidence that the globally averaged net effect of human activities since 1750 has been one of warming” and that “warming of the climate system is unequivocal”*
- *“carbon dioxide is the most important anthropogenic greenhouse gas” and “global increases in carbon dioxide concentrations are due to fossil fuel use and land use change”*
- *“global greenhouse gas emissions have grown by 70% between 1970 and 2004”*
- *“there is substantial economic potential for mitigation of greenhouse gas emissions over the coming decades”.*

2.3.3 National renewable energy targets

Australia has implemented legislation and established agencies to encourage investment in renewable energy through the Renewable Energy Target (RET), the Australian Renewable Energy Agency, the Clean Energy Finance Corporation and through carbon mechanisms.



The RET is to achieve 20% of Australia's electricity is provided by renewable sources by the year 2020. The introduction of a carbon price in 2012 was designed to complement the RET scheme and speed up the adoption of renewable energy technologies and help smooth the transition away from coal fired power in Australia.

The RET now operates in two parts:

1. Large-scale Renewable Energy Target (LRET) eg wind farms, solar thermal power plants
2. Small-scale Renewable Energy Scheme (SRES) eg rooftop solar panels, solar water heaters

Under the *Renewable Energy (Electricity) Act 2000*, the Climate Change Authority (CCA) is required to undertake a review of the RET every two years to ensure that the RET is meeting the original policy objectives in the most efficient and effective manner. The Federal Government's statutory review of the RET in 2012 reconfirmed that the scheme is working effectively and bipartisan support for the policy remains strong (CEC, 2012).

GIWP has responded to these initiatives by planning and developing the Glen Innes Wind Farm project.

2.3.4 NSW renewable energy targets

NSW Trade & Investment promotes the development of renewable energy as part of a portfolio approach to ensuring sustainable development in the New South Wales energy sector and reducing the state's greenhouse gas emissions.

A NSW Renewable Energy Action Plan is being developed to support the achievement of the national target of 20% renewable energy by 2020. The Plan positions NSW to increase the use of energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW.

About 6% of the state's total electricity usage is provided from renewable energy sources. The NSW Government supports achievement of the national target of 20% renewable energy by 2020. In 2012 renewable energy was derived from the following sources in NSW:

- Snowy hydro (4776 GW)
- Solar (922 GW)
- Small hydro (724 GW)
- Wind (714 GW)
- Bagasse (158 GW)
- Other biomass (241 GW).

2.3.5 Clean energy in Australia 2012

According to the Clean Energy Australia Report (CEC, 2012), the national RET is gaining momentum and there has been a fall in power demand over the past four years that can be partially attributed to the increased use of household renewable energy. Renewable energy such as solar, wind, hydro and bioenergy provided 13% of our electricity in 2012.

Wind power currently contributes 26% of the total renewable power generated in Australia and its contribution is continuing to increase. The launch of Macarthur Wind Farm in Western Victoria, the largest wind farm in the country (140 turbines producing 420 MW) in April 2013 will dramatically increase the amount of wind power generated in the future. Wind farms produced enough electricity to power the equivalent of more than a million Australian homes for the first time in 2012.

In NSW there is currently 282 MW of installed wind power capacity across nine projects with a total of 170 turbines (CEC, 2012). At 1 January 2013 there were 15 major renewable energy projects under construction, representing a total of 1,679 MW of generating capacity. These include the following:

Table 2.1: Major renewable energy projects under construction (CEC, 2012).

Fuel Source	Owner	Location	State	Expected Commission year	Installed capacity
Wind	AGL/Meridian Energy	Macarthur	VIC	2013	420 MW
	TrustPower Ltd	Snowtown 2	SA	2014	270 MW
	Acciona Energy	Mt Gellibrand	VIC	2015	189 MW
	Hydro Tasmania	Musselroe	TAS	2013	168 MW
	Goldwind Australia	Gullen Range	NSW	2014	165.5 MW
	Union Fenosa	Ryan Corner	VIC	2014	134 MW
	Union Fenosa	Crookwell 2	NSW	2014	92 MW
	Union Fenosa	Hawkesdale	VIC	2014	62 MW
	Verve Energy/Macquarie Council	Mumbida	WA	2013	55 MW
	Wind Farm Developments	Woolsthorpe	VIC	2013	40 MW
	NewEn	Salt Creek	VIC	2015	31.5 MW
Solar thermal	CS Energy	Kogan Creek	QLD	2013	44 MW
Hydro	Hydro Tasmania	Tungatinah upgrade	TAS	2013	6 MW
Landfill Gas	Veolia Environmental Services	Woodlawn Bioreactor (Unit 5)	NSW	2013	1.1 MW
Marine	Oceanlinx	Port MacDonnell	SA	2013	1 MW
Total capacity under construction					1,679 MW

As wind power is the lowest cost renewable energy technology that can be rolled out on a large scale, it has been the dominant form of renewable generation to receive early support under the Renewable Energy Target.

2.3.6 Glen Innes Wind Farm contribution

The Glen Innes Wind Farm's estimated potential net greenhouse gas emissions savings are described in Chapter 5. In summary, the approved project was estimated to have the potential to provide savings of 130,000 to 195,000 tonnes of greenhouse gas emissions each year it operates and up to 3.2 to 4.9 million tonnes over 25 years compared to electricity produced by the NSW 'pool' of generators, which is mostly fossil fuelled generators.

The proposed use of the ALSTOM 2.7 MW turbines which have a nominated capacity factor of 48% would account for an estimated annual CO₂-e saving of almost 100,000 tonnes or an estimated saving of almost 600,000 tonnes of CO₂-e from 2015 – 2020. The proposed selection of these turbines would also allow for the supply of electricity to an estimated additional 12,780 homes per year.



Accordingly approval to use the larger dimension turbines in the Glen Innes Wind Farm project is considered to be consistent with the National and State Government Objectives for sustainable production of energy and abatement of greenhouse gas emissions.



3 Details of Proposed Modifications

3.1 Project modifications

The proposed modifications would permit the option of installing wind turbines that produce more energy for the same maximum output than the approved turbines. This has been achieved by increasing the swept area and hence energy yield from the wind resource through the use of turbines with larger blades with lower rotation speeds.

An initial micro-siting of two turbines in the approved turbine layout is also included as part of this modification application. The ultimate development would be based on a commercial evaluation of the available options within the approved envelope.

No additional turbines are proposed as part of this modification application.

GIWP proposes that the approved project is modified by:

- Providing for the installation of more efficient wind turbines
- Micro-siting two of the turbines within the approved layout to accommodate the larger dimensions wind turbines

These modifications are considered to be minor in nature and consistent with the environmental effects assessed for the approved project. It is the purpose of this document to examine the key environmental issues in this regard.

The Table 3.1 provides a comparison of the proposed modifications with the approved Conditions of Approval, which were the subject of an Order issued by the Land and Environment Court in 2010.

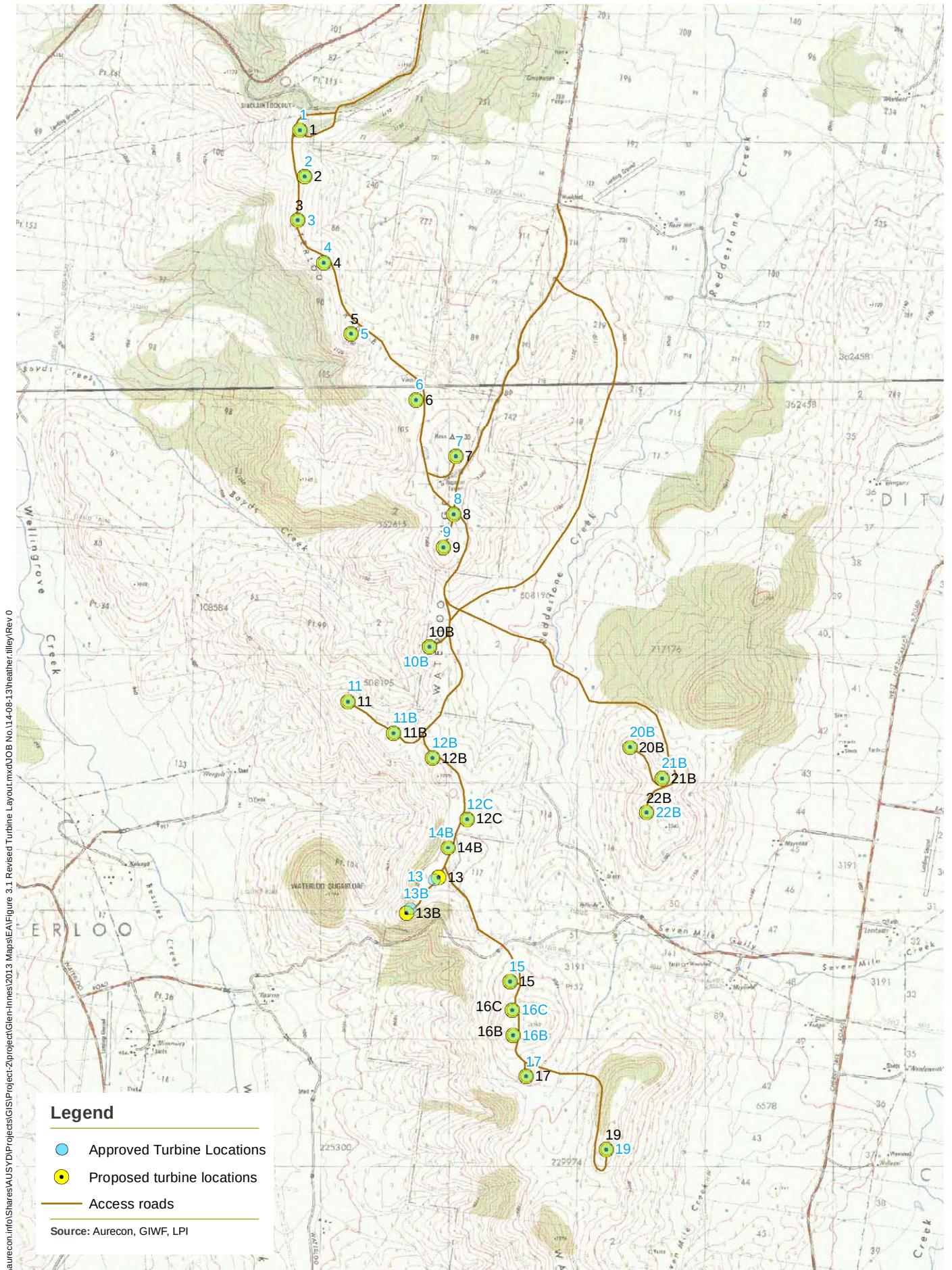
Table 3.1: Summary of proposed wind farm modifications

	Approved Conditions (2010 Land and Environment Court Decision)	Characteristics of nominal turbines for Proposed to be permitted in Approved Project
Wind farm generation capacity	75 MW	67.5 MW
Number of turbines	25	25
Transmission connection	66,000 or 132,000 kV	132,000 kV
Access tracks	Construction permitted in proposed locations with micro siting permitted	No change
Lighting	Low intensity security night lighting	No change
Shadow flicker limit	Up to 30 hours p.a.	No change
Vibration	Must comply with <i>Assessing Vibration, A Technical Guideline</i> (DECC, February 2006)	No change
Operational noise	Must not exceed 35 dB(A) at each of the residential receiver locations; or must not exceed the background noise level (L_{A90} (10 minute)) correlated to the integer wind speed at hub height at the wind farm site by more than 5 dB(A), whichever is greater	No change.
Transport access during construction	Temporary site access for construction must be via the former Gwydir Highway alignment (within Travelling Stock Route 67474)	No change
Access during operation	Access shall be via the former Gwydir Highway alignment. If this is not permitted, only Rose Hill Road may be used for access to the wind farm.	No change
*estimated value based on modelling for proposed modifications.		

A comparison of the turbine locations within the approved the wind farm layout is provided in Table 3.2 and shown in Figure 3.1.

Table 3.2: Proposed modified turbine locations (with August 2010 dataset used for baseline layout)

Label	Proposed eastings	Proposed northings	Distance moved (m)	Bearing
1	364943	6710288	0	-
2	364981	6709924	0	-
3	364926	6709583	0	-
4	365131	6709251	0	-
5	365343	6708692	0	-
6	365850	6708179	0	-
7	366162	6707735	0	-
8	366146	6707285	0	-
9	366063	6707025	0	-
10B	365955	6706247	0	-
11	365319	6705820	0	-
11B	365675	6705575	0	-
12B	365980	6705375	0	-
12C	366250	6704900	0	-
13	366026	6704440	43	NE
13B	365775	6704165	44	SW
14B	366100	6704675	0	-
15	366585	6703630	0	-
16B	366608	6703210	0	-
16C	366601	6703405	0	-
17	366712	6702887	0	-
19	367335	6702318	0	-
20B	367524	6705460	0	-
22B	367651	6704952	0	-
21B	367774	6705217	0	-
Bearing = direction in which the proposed turbine has shifted, eg. Turbine 13 has been shifted 43 metres in a north easterly direction.				



\\aurecon.info\Shares\AUS\YDI\Projects\GIS\Project-2\project\Glen-Innes\2013 Maps\EA\Figure 3.1 Revised Turbine Layout.mxd\DOB No.14-08-13\header.dlley\Rev 0



1:40,000
0 400 800m

Projection: GDA 1994 MGA Zone 56

Glen Innes Wind Farm **Environmental Assessment**

FIGURE 3.1: Revised Turbine Layout

3.2 Approach to review of potential effects

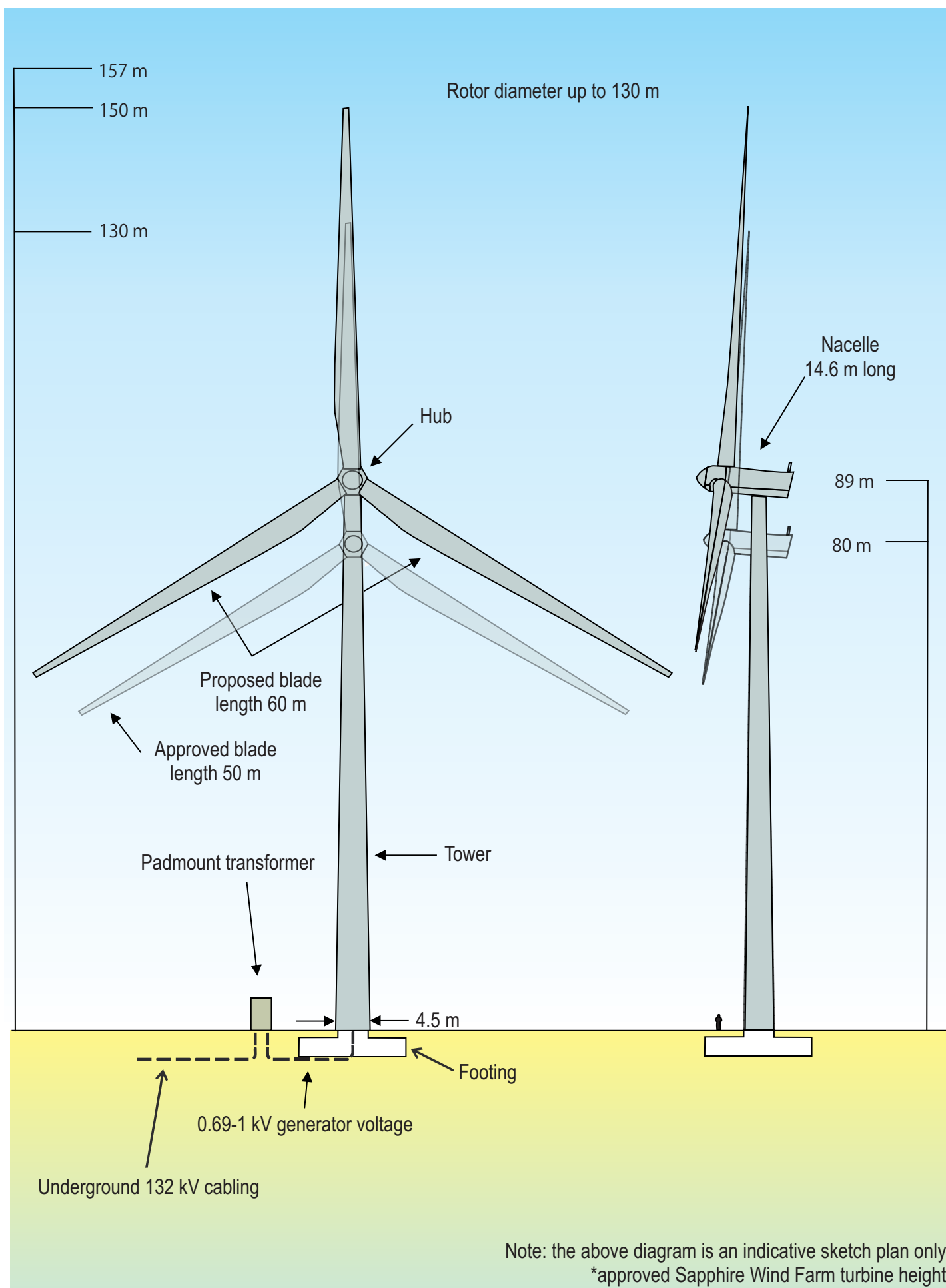
The Draft NSW Planning Guidelines: Wind Farms (the guidelines) have been prepared in consultation with the community and energy industry to provide a regulatory framework to guide investment in wind farms across NSW, while minimising and avoiding any potential impacts on local communities.

This assessment has been prepared in consideration of these guidelines, to the extent that they are applicable to the proposed modifications. This is discussed further in Section 4.3.

A comparison of the technical specifications between the approved turbines and the turbines assessed for this modification application is provided in Table 3.3. Please see Figure 3.2 for assistance with dimensions of A, B and D as outlined in the table (source: Alstom, 2011 – ECO 122: General Description).

Table 3.3: Comparison of approved and modified turbine specifications

	Approved Turbine Limits	Limits assessed for Proposed New Turbine	Difference compared to approved turbines
Model	unspecified	Equivalent to ECO 122	-
A- Hub height	80 m	89 m	11% taller
B – Max Blade Tip height	130 m	150 m	15% increase
Rotor diameter	100 m	122 m	22% increase
D- Rotor swept area	7,857 m ²	11 690 m ²	49% increase
Rated power	up to 3 MW	2.7 MW	within approved limit
Rated rotor speed (LSS)	up to 18 rpm	12.25 rpm	within approved limit
Rotor speed range (LSS)	up to 18 rpm	up to 12.25 rpm	within approved limit
Tower type	tubular tapered steel	tubular tapered steel	-
Footing	12,000 m ³ concrete 16 m diameter	14,125 m ³ concrete 18 m diameter	18% more concrete 13 % larger diameter
Control system	unspecified	variable speed and pitch control	-
Colour	off-white / grey	off-white / grey	-



4 Planning Framework

4.1 Key planning considerations

The Australian and New South Wales governments do not have specific legislation for the development of wind farms. Proposals are assessed in accordance with the provisions of the *Environmental Planning and Assessment (EP&A) Act 1979* (NSW).

Proposals are also required to have regard to the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Comm.) and to consider the need for approval under this legislation.

4.1.1 Environmental Planning and Assessment (EP&A) Act 1979

Projects approved under the now repealed Part 3A of the EP&A Act can be modified in accordance with the requirements of the then Section 75W of the EP&A Act. Section 75W of the *EP&A Act* (historical version) outlines the matters for which GIWP can apply for a modification to the Minister's approval under a Part 3A project. The relevant sections of Section 75W state:

(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.

4.1.2 Clause 116 of the EP&A Regulations 2000

Clause 116 of the EP&A Regulations 2000 requires that a modification application for a project that is subject to a consent Order issued by the Court, be assessed by the “*consent authority that dealt with the original development application from which that consent arose*”. As the project was assessed by the Minister for Planning under Part 3A of the EP&A Act, the application should also be determined by the Minister.

The following sections discuss the State and Commonwealth legislation that applies to the proposed modifications. The following tables also include an outline of the approvals that would be required by GIWP prior to development.

4.1.3 Protection of the Environment Operations Act 1997

Under the *Protection of the Environment Operations Act 1997* (POEO Act), all polluters must have a valid license to operate and discharge wastes to the environment if they trigger the scheduled activities in Parts 1 and 2 of Schedule 1. Scheduled premises include electricity works (wind farms) if



they were the subject of an approval granted under Part 3A of the EP&A Act before the repeal of that Part (or under that Part as continued on after that repeal by or under Schedule 6A to that Act).

Electricity generating works that produce electricity from wind energy were listed June 2013. Wind farms are now classified under Schedule 1 of the Act as 'scheduled premises' that require an Environment Protection License. Therefore, GIWP will now require a license to operate the wind farm under the POEO Act as part of the proposed modifications.

4.1.4 Commonwealth and NSW legislation

Legislation of relevance to the project that was not triggered by the proposed modifications is provided in Appendix I.

4.1.5 Local environmental plans

The project is located in the Glen Innes Severn Local Government Area (LGA) to which the Glen Innes Severn LEP 2012 applies. Provisions of other environmental planning instruments such as LEPs, do not specifically apply to projects assessed under Part 3A of the EP&A Act. However, Section 75J of the historical EP&A Act states that

"...the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved."

LEP Part 7 – local provisions

There are particular provisions and controls that are contained in the LEP which may be considered by the Minister in the determination of an application. Relevant clauses containing particular provisions and controls that might be considered are discussed in the following table.

Table 4.1: Glen Innes Severn LEP 2012

Section	Clause	The modification
5.9 Preservation of trees or vegetation	(3) A person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy any tree or other vegetation to which any such development control plan applies without the authority conferred by: (a) development consent, or (b) a permit granted by the Council.	While no additional clearing has been identified, any additional trees impacted by the proposal modifications relate to micro-siting which is permitted up to 100 m from the approved site under the <i>Draft NSW Planning Guidelines 2011</i> .
5.10 Heritage Conservation	Development consent is required for any of the following: (a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance): (i) a heritage item, (ii) an Aboriginal object, (iii) a building, work, relic or tree within a heritage conservation area, (b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item, (c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed, (d) disturbing or excavating an Aboriginal place of heritage significance, (e) erecting a building on land: (i) on which a heritage item is located or that is within a heritage conservation area, or (ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance, (f) subdividing land: (i) on which a heritage item is located or that is within a heritage conservation area, or (ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.	The project does not affect additional heritage items to the approved project.

Section	Clause	The modification
5.11 Bush fire hazard reduction	Bush fire hazard reduction work authorised by the <i>Rural Fires Act 1997</i> may be carried out on any land without development consent. Note. The <i>Rural Fires Act 1997</i> also makes provision relating to the carrying out of development on bush fire prone land.	Bushfire hazard management is already a requirement of the approved project. This will not change with the proposed modifications.
7.1 Flood Planning	(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development: (a) is compatible with the flood hazard of the land, and (b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and (c) incorporates appropriate measures to manage risk to life from flood, and (d) is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and (e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.	The proposal is not predicted to increase the risk of flooding to the wind farm or the surrounding area. The bulk of the wind farm project is located on the elevated Waterloo Range that is well drained and not subject to flooding.

Section	Clause	The modification
7.2 Drinking Water Catchments	(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider the following: (a) whether or not the development is likely to have any adverse impact on the quality and quantity of water entering the drinking water storage, having regard to the following: (i) the distance between the development and any waterway that feeds into the drinking water storage, (ii) the on-site use, storage and disposal of any chemicals on the land, (iii) the treatment, storage and disposal of waste water and solid waste generated or used by the development, (b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development. (4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that: (a) the development is designed, sited and will be managed to avoid any significant adverse impact on water quality and flows, or (b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	The proposed modifications are not within the Drinking Water Catchment as shown on Map Sheet DWC_003 of Glen Innes Severn LEP 2012. The proposed modifications do not significantly impact surrounding local water resources. All waterways will remain protected from impact through the implementation of erosion and sediment control measures as detailed in the environmental assessment and conditions of consent for the approved project.
7.3 Essential Services	Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required: (a) the supply of water, (b) the supply of electricity, (c) the disposal and management of sewage, (d) storm water drainage or on-site conservation, (e) suitable road access.	An updated traffic assessment was conducted as part of this environmental assessment to ensure the new turbines were still acceptable for the approved road access routes. It has been concluded that the proposed modifications will not result in any significant changes to the approved access to be used for the construction and operation of the project.

Section	Clause	The modification
7.4 Airspace operations	(3) The consent authority may grant development consent for the development if the relevant Commonwealth body advises that: (a) the development will penetrate the Limitation or Operations Surface but it has no objection to its construction, or (b) the development will not penetrate the Limitation or Operations Surface. (4) The consent authority must not grant development consent for the development if the relevant Commonwealth body advises that the development will penetrate the Limitation or Operations Surface and should not be constructed.	The proposed modifications will result in taller turbines being installed. As such, the application should be referred to Glen Innes Severn Council, CASA, Airservices Australia, Department of Defence and Aerial Agricultural Association of Australia. The issue of air safety in respect of the local airfields and the Glen Innes aerodrome is further discussed in Chapter 5.

Land zoning

Under the Glen Innes Severn LEP 2012 the land on which the proposed wind farm and substation will be located is now zoned RU1 - Primary Production. The proposed project constitutes development that may be carried out with the consent of the Council.

Reference is made in this Environmental Assessment to the LEP in terms of planning provisions that may be considered by the Minister in assessing the project under Part 3A of the EP& A Act.

The objectives applicable to Zone RU1 are set out in Table 4.2 together with an assessment of the relevance to the project. The project is considered to be consistent with the zone objectives.

Table 4.2: Relevance of the development to Zone RU1 objectives

Objectives of zone	Glen Innes Wind Farm Project
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The proposed modifications fulfil a need to supply more electricity from renewable energy sources as a means to reduce the carbon intensity of electricity generation. The existing grazing activities within the zone will continue and the landowners will benefit through income from leases for the wind farm and improved access infrastructure. Pastoral activities will be unaffected on neighbouring lands by the proposed modifications.
To encourage diversity in primary industry enterprises and systems appropriate for the area.	The proposed modifications will not alter the extent of the approved wind farm. This achieves the objective of adding to the diversity of the primary industries of the area. Currently the other primary industry currently within the area is agriculture. There are other enterprises within this zone that include an aerodrome, bed and breakfast accommodation and telecommunications facilities.
To minimise the fragmentation and alienation of resource lands.	The proposed modifications involve the installation of taller wind turbines. The proposed modifications would not result in fragmentation or alienation of resource lands. The modifications will not affect the continued use of the land for its existing use of grazing. No permanent watercourses will be affected by the proposed modifications and no wetlands are present at or adjacent to the site.
To minimise conflict between land uses within this zone and land uses within adjoining zones.	The project is compatible with the existing rural land use.

4.2 Consideration of relevant guidelines and policies

4.2.1 Draft NSW Planning Guidelines: Wind Farms

The NSW Planning Guidelines: Wind Farms (the guidelines) have been prepared in consultation with the community and energy industry to provide a regulatory framework to guide investment in wind farms across NSW, while minimising and avoiding any potential impacts on local communities. 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.

- Provide guidance on how to measure and assess potential environmental noise impacts from wind farms.

These guidelines are predominantly designed to inform wind farm applicants, along with consent authorities and other regulators who consider these applications. Please see Table 4.3 below for compliance with these guidelines.

Table 4.3: Draft NSW Planning Guidelines Wind Farm Checklist

Issues and potential issues for considerations	Comment
Consultation • Form a Community Consultation Committee. • Document the consultation process undertaken, including stakeholders consulted. Identify and tabulate issues raised by stakeholders during consultation. Describe how issues raised have been addressed. • Consult with all neighbours with dwellings within 2 km of a proposed wind turbine. Identify the neighbours' issues and potential approaches to mitigate any adverse impacts. • Consider seeking agreement with neighbours with dwellings within 2 km of a proposed wind turbine.	• The formation of a community consultation committee is a requirement under the approved MPO7_0036. The committee has not been established as yet but this will still be pursued should the proposed modification be approved. A committee will be formed to utilise the A\$75,000 payments for community projects each to be decided. Advertisements seeking nominations in accordance with the <i>Draft NSW Wind Farm Planning Guidelines</i> (the 'Guidelines') would be placed in local newspapers, online and on community notice boards pending the construction stage of the project. • The community consultation process was documented in the original EA for the approved project and in the L&E Court case of 2010. Due to the proposed modifications involving minimal environmental impacts, members of the community were not consulted about the modifications. • The neighbours with dwellings within 2 km of the wind farm turbines have not been consulted in relation to the proposed modifications. It is anticipated that the DPI will require formal consultation in relation to this application. • The L&E Court issued conditions for community information, consultation and involvement. This includes: – Members of the community having access to all reports produced or procured during the commissioning, operation and decommissioning phases of the project; – Hard copies of the Community Information Plan are to be issued to dwellings within 3 km of the wind farm by request; – Having a complaints register available 24/7 for the community. The conditions also outline a community enhancement program that ensures 50% of \$75,000 will be allocated to enhancement measures identified within 5 km of the wind farm.

Issues and potential issues for considerations	Comment
Landscape and visual amenity • Provide photomontages from all non-host dwellings within 2 km of a proposed wind turbine. • Identify the zone of visual influence of the wind farm (no less than 10km) and likely impacts on community and stakeholder values. Consider cumulative impacts on landscape and views. • Outline mitigation measures to avoid or manage impacts.	• Photo-montages have been prepared to compare the approved turbines to the proposed turbines. These have been prepared at the same locations as the approved wind farm and have taken the neighbouring properties into consideration. Photo-montages are available in the Visual Assessment provided in Appendix D of this document. • The zone of visual influence was assessed beyond 10 km of the wind farm to include neighbouring lookout points that are potentially impacted by the proposed turbines. The potential impacts on community and stakeholder values are available in the Visual Assessment provided in Appendix D of this document. • Mitigation measures to avoid or manage impacts associated with the proposed turbines are available in the Visual Assessment provided in Appendix D of this document.
Noise • Undertake assessment based on separate daytime (7am to 10pm) and night-time periods (10pm to 7am). • Predict noise levels at all dwellings within 2 km of a proposed turbine. • Consider special audible characteristics, including tonality, amplitude modulation, and low frequency noise (apply penalties where relevant). • Outline measures to avoid, minimise, manage and monitor impacts.	• Separate daytime (7am to 10pm) and night-time (10pm to 7am) periods for the proposed turbines were assessed in the Noise Assessment provided in Appendix E of this document. • The predicted noise levels at dwellings within 2 km of a proposed turbine were assessed in the Noise Assessment provided in Appendix E of this document. Overall the predicted noise impacts are lower than those in the <i>Supplementary noise assessment</i> of 2010 due to the specification of a lower noise wind turbine. Please refer to the report for specific details of calculations and standards used to obtain results. • The noise assessment considered tonality, amplitude modulation and low frequency. Options are possible to reduce the sound level from individual turbines if the show higher than expected/allowed sound levels. On site monitoring and checking when operation starts is required and will confirm the results. Details are provided in Appendix E of this document. • Measures to avoid, minimise and monitor impacts include regular noise monitoring of the wind farm and adjusting the operation strategy as necessary. The current expected noise will be at or under the figures in Table 1 of the draft guidelines. This is discussed in Section 5.3 of this environmental assessment and the full noise report of the proposed modifications is in Appendix E.

Issues and potential issues for considerations	Comment
Health Consider and document health issues, focusing on neighbours with dwellings within 2 km of proposed wind turbines.	Health issues were reviewed prior to the approved DA and found to be adequate for approval. Subsequent third party industry reports have shown that the detrimental effects attributed to wind farms have been proven not to exist. An overview of existing evidence between wind farms and health effects is provided in Section 5.4 of this document.
Ecological issues Consider potential impacts on birds and bats, particularly migratory species and outline the proposed monitoring and mitigation strategy	- This formed part of the approved DA application documents and were deemed compliant. No change in potential impacts is foreseen as a result of the proposed modifications. Please refer Section 5.5 of this document. - The proposed monitoring and mitigation strategy is outlined in the approved documents and is explicitly stated in the approval conditions from the L&E Court and DGR.
Aviation safety - Outline current agricultural aerial uses on neighbouring properties. - Consider the potential for the proposed wind farm to impact on aviation safety associated with agricultural aerial uses consistent with the draft guidelines.	- Current agricultural aerial uses were included in the original EA and are discussed briefly in Section 5.6 of this document. - The landowners who form part of the wind farm have agreed that agricultural spraying can continue. As a result of the L&E Court case and agreement was made with the pilots that new routes and heights may need to be utilised for the aerial spraying but any extra costs involved with this would be compensated by Glen Innes Wind Power. The proposed modifications will have no agricultural aviation effect on non-wind farmer neighbouring properties.
Bushfire hazard Consider bush fire issues consistent with the draft guidelines, including the risks that a wind farm will cause bush fire and any potential impacts on the aerial fighting of bush fires.	Bushfire consultation with NSW Rural Fire Service was undertaken at the time of original submission for the approved DA. The proposed modifications will have no additional potential impacts on bushfires. The proposed taller turbines would have a negligible impact on the aerial fighting of bushfires compared to the approved project. GIWP will liaise with the RFS to provide a bushfire activation plan which will outline procedures in the event of a fire event on the wind farm as consistent with good industry practice.
Blade throw - Assess blade throw risks consistent with the draft guidelines. - Outline measures to avoid, minimise, manage and monitor impacts.	- Blade throw is a highly rare issue in wind farms. All turbines and blades are built to the latest IEC 6140-23 standards. This is documented by the turbine suppliers through a third party certification process. - To minimise, manage and monitor impacts, control mechanisms monitor all turbine components and are programmed to respond to abnormal instances. All turbine components will be regularly maintained at the wind farm as part of preventative maintenance procedures.

Issues and potential issues for considerations	Comment
Economic issues - Consider whether the wind farm use is consistent with relevant local or regional land use planning strategies. - Consider potential to impact upon mining/petroleum leases and exploration licences. - Consider any potential impacts upon property values consistent with the draft guidelines, including properties within 2 km.	- The wind farm has been approved and was consistent with relevant local planning requirements at the time of submission. Glen Innes Severn Council has since adopted a new LEP and a DCP for wind farms. This document assesses the suitability of the proposed modifications against these two criteria in Section 4.2. The proposed modifications do comply with the new planning instruments. - The proposed modifications will have no additional impact on mining or petroleum leases and exploration licenses. Provision is included in the approved conditions of consent in relation to this issue. - Third party reports from valuation experts have attested to there being no negative impact on property values from approved wind farms. The NSWLEC Court Senior Commissioner Tim Moore made mention that questions of diminution of value were not matters that the NSWLEC court could lawfully take into account in proceedings for opposition to approval for the wind farm (whether or not they would occur, a matter about which he made no comment). The proposed modifications would not be expected to have any additional impact upon property values due to their minimal environmental impacts compared to the approved project.
Decommissioning - Include a Decommissioning and Rehabilitation Plan in the EA, including proposed funding arrangements. - Confirm that the proponent not the landowner is responsible for decommissioning.	- The original EA discussed decommissioning the wind farm. The proposed modifications would not result in changes to the decommissioning or rehabilitation of the wind farm site. - It is confirmed that GIWP is responsible for the decommissioning of the wind farm should it be required. This is also outlined in the individual landowner agreements.
Monitoring and compliance program Outline program to monitor environment performance to ensure compliance including mechanisms for reporting outcomes and procedures to rectifying non-compliance – including any provisions for independent reviews.	Environmental monitoring and compliance programs have been addressed in the original EA approval documentation and are explicitly set out in the order by NSWLEC and the conditions of approval issued by the Minister for Planning. These will not change as a result of the proposed modifications.
Council planning controls Outline whether the proposal is consistent with any relevant provisions of the relevant council's Development Control Plan and list any variations.	This is an approved project and is generally consistent with the local Council's wind farms DCP. Please refer Section 0.2.

4.2.2 Glen Innes Severn Council Specific DCP Wind Power Generation

The Council has implemented Development Control Plan (DCP) to guide wind farm developments. The intention of this DCP is to give the community and potential developers guidelines for wind farm developments to allow better decision making on such proposals. This DCP applies to wind power generation turbine(s) or towers with a peak capacity of power rated output greater than 10 kW.

The objectives of this DCP in relation to wind power generation proposals are:

- To provide development controls and guidelines that assist in achieving the objectives of the relevant Local Environmental Plan(s).
- Provide information to be included and assessed with each development application for commercial wind power generation.
- To minimise potential land use conflicts.
- Ensure road and access issues are identified as significant aspects of gaining consent for a wind farm.
- To ensure that adequate provisions are made to restore developed land at the end of the project's useful life.

The DCP states that where a typical wind farm (eg approximately 120m in height to the blade tip) is lodged with Council, properties within a 5 km radius of the development will be notified of the development application. All submissions received will be presented to the Council (or Minister) for their consideration in the assessment and determination process. Where Council is the consent authority,

Council will hold a notification and submission period of not less than 60 days and will require the developer to hold a minimum of one public information night during the exhibition and submission period. The developer should consider additional consultation with the community and affected property owners. The consent authority for the Modification Application is the Minister and as such these consultation methods do not apply to the application. However, the minister may take Council's consultation requirements as part of this DCP into consideration prior to determining the application.

The following table outlines the planning and environmental controls as set out in the Wind Power Generation DCP that GIWP must take into consideration with the application.

Table 4.4: Planning and environmental controls within the Glen Innes Severn Council - Wind Power Generation DCP

DCP – planning and environmental controls	The proposal – Glen Innes Wind Farm
1. The development should be sited and carried out to minimise impacts on, or restrictions to normal grazing, farming, forestry practices	The proposed modifications involve the installation of more efficient wind turbines. There will be no change to existing grazing or forestry practices when compared to the approved project. The existing consent conditions state: <i>“If any aerial agricultural activity is demonstrated to be disrupted on any property surrounding the site, being any non-associated property having a boundary located within 2.5 km of a turbine constructed in accordance with this Project, due to the operation of the turbines, the Proponent shall fully fund to the affected landowner, the cost difference between the current aerial agricultural activities:”</i> GIWF will discuss this condition with the relevant parties should this become an issue.
2. The development should be carried out in a way that minimises any adverse effects on adjoining land and the development site, particularly in the way of: i. Land degradation; ii. Alteration to drainage patterns; iii. Pollution of ground water; iv. Spread of noxious plants and animals; and v. Bushfire hazard. vi. Amenity of adjoining/adjacent/affected landowners	The proposed modifications (installation of taller turbines) will not have adverse environmental impacts to controls (i)-(vi) in addition to the approved project. These controls were assessed in the 2008 environmental assessment.
3. The developer must assess the visual impact of the project including an assessment of scenic value. The developer must consult with the Council and the community on appropriate visual impact and their mitigation measures.	A Visual Assessment has been completed as part of the EA for the project and the effect of the proposed modifications reviewed (provided in Appendix D with a brief overview provided in Section 5.2). The existing conditions of approval make provision for affected neighbors to request landscaping treatments to mitigate any negative impacts attributed to the wind farm.
4. In addition to point 3 above, the developer must assess the cumulative impact of the development in regard to existing wind farms or identified sites of proposed wind farms. Council does not favour large expanse of ridgelines being covered with wind farms and turbines.	The wind farm was approved in 2010 to have wind turbines installed along the ridges of the Waterloo Range. There are no additional turbines being proposed for installation along the ridgeline.

DCP – planning and environmental controls	The proposal – Glen Innes Wind Farm
5. Proposed wind turbines shall comply with the South Australian EPA Wind Farms Environmental Noise Guidelines. Note that where noise levels are found to exceed EPA guidelines, Council will require remediation work such as cessation or decommissioning of the turbines to reduce the noise impacts on sensitive receptors such as non-related dwellings	The proposed wind turbines do not exceed South Australian EPA Wind Farm Environmental Noise Guidelines. The noise impacts of the proposal have been assessed in the Noise Assessment report provided in Appendix E and have been summarised in Section 5.3.
6. Where visible from a non-related dwelling or immediate surrounds, the development shall not be located within 15 times the blade tip height or 2.0 km's (whichever is the greater) of any dwelling not associated with the development or 15 times the blade tip height or 2.0 km's (whichever is the greater) from a reasonable, practical and suitable dwelling site on any lot that has been created for the purpose of a dwelling. Where turbines are proposed to be significantly higher than such properties/dwellings or where the turbines will dominate the immediate view from the dwelling or dwelling lot, increasing these separation distances is recommended.	The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
7. The development shall not be located within two times the height of the turbine (including the tip of the blade) from a formed public road. The applicable road authority may require a greater distance.	The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
8. The development shall not be located within two times the height of the turbine (including the tip of the blade) from a non-related property boundary.	The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
9. Turbine locations shall be located sensitive to non-related dwellings surrounding the development. Existing and proposed screenings could be used to minimise visual impacts to non-related properties – Note that due to the height of turbines, screening is not the preferred choice of dealing with visual impact. The developer's priority should be endeavoring to position the turbines in locations with low visual impact to nearby properties, especially existing dwellings and lots provided for dwellings.	This issue was addressed in the approved EA and NSWLEC case of 2010. The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.

DCP – planning and environmental controls	The proposal – Glen Innes Wind Farm
10. Turbine locations are to be sensitive to existing related dwellings on the subject site. Issues of excessive noise, shadow flicker, and general proximity to turbines should be minimised.	This environmental assessment thoroughly discusses issues of noise, shadow flicker and other issues that affect sensitive receivers (as a result of the proposed taller turbines) in Chapter 5. Mitigation measures have been implemented to ensure these impacts are acceptable. The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
11. Turbine locations should not surround a non-related property. Where a non-related property has turbines adjacent to more than one axis of the property, there should be sufficient setbacks/distances to the development to minimise the visual impact of that property.	The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
12. A communications study should identify the existing status of communications and detail the proposed method of dealing with potential communication interference. Developers are advised that many parts of the Glen Innes Local Government Area have very poor radio, TV, mobile phone, two-way reception and the like. The development should not detract from the reception of any of these or other communication methods. Where necessary, it may be required to install additional services (boosters/communication towers/ re-transmission towers etc) to maintain such services in the vicinity of the development. Where this is determined to be necessary, the work and equipment shall be at the developer's cost.	An investigation into communications within the area dealing with potential communication interference was been completed in the approved EA. The proposed modifications do not alter the approved turbine locations. Minor adjustments to the layout will occur within micro-siting limits of 100 m.
13. The construction phase of the wind farm shall occur only on identified roads/routes. Construction vehicles, including concrete trucks, carriers of turbine components, and related heavy vehicles (including relevant contractors) shall only travel the approved road. This route shall be identified in the development application for each of the construction components and/or contractors.	Construction vehicles will travel via the approved roads via routes that have been set out in the updated Traffic Assessment Report (Appendix G). This report is also summarised in Section 5.14.
14. Council requires substantial investigations into the roads chosen for the preferred route. Detailed road condition reports will be required as part of any consent. Council may require the use of the Australian Road Research Board 'laser car' and 'gypsy camera' for this purpose. Full details will also be required of the source of any natural materials to be used for construction of internal roads and other infrastructure.	The roads chosen for the approved project will not be altered by the proposed modifications. This was assessed in the updated Traffic Assessment Report (Appendix G). This report is also summarised in Section 5.14.

DCP – planning and environmental controls	The proposal – Glen Innes Wind Farm
15. Council will require road works to cope with the over size and overweight traffic movements related to the construction of a wind farm. Bonds will also be required for any potential damage to roads during the construction phase. The road works and bond amounts will be determined by Council professional staff, but will be determined generally by the length of road and condition of road surface/base bridge, drainage etc relevant to the selected route. Where road works are determined necessary for the development, costs associated with the road works shall be the developer's responsibility.	An updated Traffic Assessment Report (Appendix G) has been completed to assess the impacts of over size and over-weight traffic movements during construction of the wind farm. This report is also summarised in Section 5.14.
16. Internal roads (roads within the property subject to the development) shall be the responsibility of the developer. Council will require proof that they have been adequately designed and constructed for their purpose. Council (and often other State Government Agencies) shall be provided with adequate information about the environmental aspects of the internal road construction.	GIWP acknowledges that they are responsible for roads within the property subject to development. The proposed modifications do not affect the layout of the approved access roads.
17. All infrastructure related to the wind farm should be included in the development application. Management of temporary facilities, waste, numbers of contractors/employees, etc, should be part of the Development Application information. All infrastructure should be located in low visual impact locations and interconnection cables/wiring and the like should be underground	All infrastructure for the wind farm was addressed in the approved project. The proposed modifications involve the installation of taller wind turbines which is discussed throughout this document.
18. Developers must consider and refer to the Planning NSW Environmental Impact Assessment Guidelines for wind farms, the NSW Wind Energy Handbook, Best Practice Guidelines for implementation of Wind Energy projects in Australia (AusWEA), S.A. EPA Wind Farm Noise Assessment Guidelines and all other relevant polices and legislation applicable to the proposed modification. Reference to relevant Council policies and documents should also be made. Particular reference must be made to "Wind Farms & Landscape Values Foundation Report" and any subsequent documents arising from this report or produced by the Department of Environment & Heritage relative to wind farm developments.	This environmental assessment has been completed for the Modification Application in accordance with the relevant statutory legislation, planning guidelines and all other relevant policies associated with wind farms in NSW. Not all of the listed documentation was consulted for this application as the wind farm is substantially the same development. The key environmental impacts of the proposed modifications have been assessed in this report.
19. Council prefers to have a viewing area where safe vehicle and pedestrian movements can view the wind farm in a safe manner. The developer should liaise in this regard with Council Engineering staff and the RTA.	The consent conditions include for the provision of a viewing area which is to be developed in consultation with Glen Innes Severn Council. This is not affected by the proposed modifications.

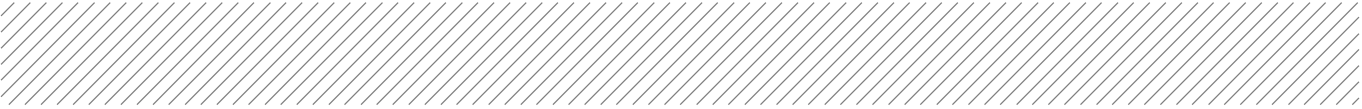
DCP – planning and environmental controls	The proposal – Glen Innes Wind Farm
20. Within six (6) months of the wind turbine generators become redundant, any rights of carriageways that were constructed to enable maintenance to be conducted on the wind turbine generators are to be extinguished by the developer, unless otherwise agreed with the landowner.	This is not changed by the proposed modifications.
21. Within six (6) months of the Wind Turbine Generators becoming redundant, they are to be fully dismantled and removed from the site by the developer or current operator of the development at the time	This is not changed by the proposed modifications.
22. Bushfire Threat Assessment is to be prepared by a suitably qualified Bushfire Consultant, addressing, but not limited to, the risk of bushfire originating from the development site and the potential for harm/damage should a bushfire encroach on the site	Bushfire management is provided for in the existing approval. It is not changed by the proposed modifications.

4.2.3 Property leases

GIWP has entered into leases with the landowners of the properties on which the wind farm development is to be located. Under the terms of these leases GIWP Pty Ltd has the consent of the landowners to lodge the Modification Application and the supporting Environmental Assessment. These leases provide landowner agreement for GIWP to construct, operate and decommission the wind farm on these properties, provided all appropriate approvals are also obtained. Property details of affected landowners are provided in the following table.

Table 4.5: Property details for land on which the wind farm is located

Property or landowner	Land title details		Turbine / Mast numbers	No. of turbines
	DP	Lot		
Rural Lands Protection Board	Wattle Vale Travelling Stock Route (TSR) 67474 including the former Gwydir Highway alignment		N/A	N/A
R & E Sheedy	753274	72	N/A	N/A
	753274	89	Nil	0
	753319	Pt 90	1, 3, 5, M1	3
	753319	86	2, 4	2
	753319	105	6, 7	2
	562615	2	8, 9	2
Telstra	562615	1	N/A	N/A
Nant Pastoral	1096761	1	20B, 21B & 22B, M2	4
	508195	2	Nil	0
	753270	116, 118	Nil	0
	508196	2	10B	1
J Bower	1004132	1332	11, 11B, 12B & 12C, M4	4
D Hartmann	1004132	1331	13, 13B, 14B	3
Allan Fletcher	753270	117	N/A	N/A
	596311	2	15, 16B & 16C, 17,19, M3	6
Total number of turbines				25
Notes:				
- N/A is applicable where property leases are required only to access the site or any other property where a wind turbine and mast is not required for construction. - M1 to M3 are GIWP's existing meteorological monitoring masts and may be retained as permanent masts. M4 is owned by the DWE, is not part of the project and will need to be removed before construction of Turbine 12B. - Telstra property Lot 1 DP562615 has a telecommunications facility located on it that is not part of the Project. The property lease is required to access the site via an easement from Rose Hill Road. - Telstra property Lot 1 DP562615 has a telecommunications facility located on it that is not part of the Project. The property lease is required to access the site via an easement from Rose Hill Road. - The properties owned by the Rural Lands Protection Board and the property owned by Allan Fletcher (Lot 117 DP753270) are being used for site access only. - R & E Sheedy property Lot 72 DP753274 is for the substation.				



5 Environmental Assessment

The following sections consider the potential impacts on the environment as a result of the proposal to include the more efficient wind turbines.

5.1 Consultation

The guidelines require that proponents must undertake a comprehensive and genuine community consultation and engagement process. Key requirements for proposed wind farms include:

- For the department to place any application for a Site Compatibility Certificate on its website and for issues raised to be considered in determining whether to issue the certificate
- For the applicant to form a Community Consultation Committee early in the process to provide for early input in the assessment and, if the development application is approved, to maintain effective communication with the community during the wind farm's construction and operation phases.
- For the applicant to demonstrate in the environmental impact statement that effective consultation has occurred prior to lodgement of the application and that issues raised as a result have been addressed in the assessment. Without this being adequately demonstrated, the application will not be accepted.
- For the department to exhibit the development applications for a minimum of 60 days instead of the minimum statutory 30-day period.

These consultation requirements are directly applicable to new wind farm proposals. Consultation for the GIWF occurred in 2008 and 2009 during the time of the original environmental assessment and NSWLEC case. The guidelines have been considered in relation to consultation for the proposed modification.

5.1.1 Previous consultation for the approved wind farm

The Environmental Assessment was placed on exhibition from 5th November 2008 to the 17th December 2008. The public exhibition period was extended from the minimum period defined in the EP&A Act of 30 days to 6 weeks by agreement between the Department and the proponent. That extension was provided to enable an extended time for review by relevant stakeholders. The extension of time granted supplementary submissions to 16 January 2009.

Submissions were received from a total of 29 respondents being individuals or organisations. In summary the responses included:

- 19 objections
- Two submissions related to aerial agricultural issues – from AAAA and SuperAir
- One was from Glen Innes Severn Council (GISC) as the local government authority
- Four were from NSW government agencies – DECC, DWE, RTA and RFS

- One was from a Non-Government Organisation (NGO) – Nature Conservation Council (NCC)
- Two were from supporters, one from a local wind farmer property and the other from a supporter of renewable energy developments.

A submissions report was prepared in May 2009 to respond to all concerns raised during the submission period. In some cases, additional advice was sought from the specialists involved in the preparation of the Environmental Assessment to respond to particular technical matters raised by the respondents.

Further, the NSWLEC decision of 2010 involved consultation with community members to resolve items of dispute. The outcomes of this case included community information, consultation and involvement within the conditions of approval for the wind farm. These conditions include:

- Members of the community having access to all reports produced or procured during the commissioning, operation and decommissioning phases of the project;
- Hard copies of the Community Information Plan are to be issued to dwellings within 3 km of the wind farm by request;
- Having a complaints register available 24/7 for the community.
- A community enhancement program that ensures 50% of \$75,000 required to be contributed by GIWP will be allocated to enhancement measures identified within 5 km of the wind farm.

The formation of a community consultation committee is a requirement under the Project approval MPO7_0036. A committee will be formed to utilise the A\$75,000 payments for community projects each to be decided. Advertisements seeking nominations in accordance with the Draft NSW Wind Farm Planning Guidelines (the 'Guidelines') would be placed in local newspapers, online and on community notice boards pending the approval of the modification.

5.1.2 Current Consultation Activities

Information Day

An information day to inform the broader local community of the proposed modifications, and to discuss progress of the development of Glen Innes Wind Farm was held on 3 December 2013. Activities relating to the information day are summarised below:

- Advertisements were placed in the local newspaper, the Glen Innes Examiner, on 19 and 21 November 2014 informing the community of the information session to be held at the Glen Innes Library (Appendix I).
- In addition to this, letters were sent to residents within a 2 km radius of the windfarm inviting them to attend the information session.
- Approximately 15 people attended the information day.
- A number of variation and site specific posters were placed on display at the information session as discussion points along with a variety of maps and reports to provide background information for visitors (See Plate 1).
- The first edition of the Glen Innes Wind Farm Project Newsletter was published and was available as a handout at the information session (Appendix I). The rest were left with at the Glenn Innes library for general viewing and to take away. As GIWF progress with the development, the newsletter will be updated on a regular basis and it will be distributed via mailings both in physical and electronic format.

- Discussions were held with the Landscape Guardian Representative, Phil Evans about new tip heights and Consultation Committee representation
- Concerns raised at the information day were mainly around the introduction of a different turbine and variation to the approved tip height. The visual and audible impacts were queried by several people, however acknowledgement and acceptance was displayed after describing:
 - 1) that the nacelle was only 9m higher
 - 2) the audible impact would in fact be less than what is currently approved, and
 - 3) after 4 years of development a more appropriate turbine now exists, and is similar to the approved tip heights at Whiterock (150 m) and Sapphire (156 m) wind farms.

Most of the attendees indicated support for the project, with requests to be involved in either the Community Consultation Committee (CCC) or in the considerations for the allocation of funds for the community enhancement projects.



Plate 1 – Information day posters and reports

Specific Consultation as requested by DOP&I

Discussions were undertaken with DOP&I regarding an application for the proposed modification. A preliminary environmental assessment was submitted to the DOP&I on 1st November to support the proposed modification application based on a consideration of the key issues and the early discussions with the Department. In a letter dated 12 November 2013, GIWF was requested by DOP&I to provide additional information focusing on consultation, visual amenity, noise impact, aviation and traffic. This environmental assessment has been revised to take into account the requirements of this letter. The following activities were undertaken in response to the DOP&I comments:

- Letters were sent to residents within a 2 km radius of the windfarm informing them of the pending variation submission and the requirement that GIWF perform additional photomontages at these sites.

- The DOP&I requested additional photomontages from all potentially affected non-associated residences within 2 km of a proposed wind turbine. GIWF consulted with four additional neighbouring land owners to offer the preparation of photomontages. A summary of the consultation is provided below:
 - After personal discussions the resident of Wattle Vale declined the need for a photomontage, as it was very clear what he could see and that no additional photomontages would change that.
 - The residents of Rivoli did not reply to the letter, but allowed the consultant to take pictures when approached directly.
 - The owner of Green House and Mayvona did not reply however access was gained to Green House via the current tenants on the land.
 - No response was obtained from the owners of Cherry Tree owners, who now live in Cairns.
 - The owner of Ilparran requested that an additional photomontage be prepared for Ilparran B. GIWF also undertook further consultation with the owner onsite. GIWF and the owner agreed that where possible visual mitigation through landscape measures will be undertaken at the farm around the house. It was also agreed that noise loggers would be installed at the property during construction and operation to check and monitor noise levels around his house. It was agreed that we would perform more research into these options in the New Year.

Community Consultation Committee

- Eight Board positions were offered, including:
 - 1 independent chair
 - 1 developer representative
 - 1 Council representative
 - 1 land owner representative
 - 1 Landscape Guardians representative and
 - 3 community member representatives.
- GIWF called for expressions of interest (EOI) for three community member representatives by 29 November 2013. This was published in the Glen Innes Examiner on 19 and 21 November 2013 (Appendix I). Eight EOIs were received – seven interest parties were interviewed on 4 December, one over the phone on 8 December 2013.
- A targeted recruitment for the independent chair included Tony Windsor and other independent, respected and impartial parties within Glen Innes and Inverell. Two formal interviews were undertaken on 3 and 4 December 2013.
- Council requested a formal letter, and their representative will be determined internally. This will be announced formally after the next Council Meeting in February 2014.
- A meeting with all project land owners was held on 3 December 2013 to agree on their representative.
- Discussions with two of the Landscape Guardians were held throughout the weeks of 25 November 2013 and 2 December 2013 to determine their representative.
- The final make-up of the CCC was confirmed on 16 December 2013.
- The first meeting has been scheduled for the week of 17 February 2014. Exact date to be agreed with the parties.
- All successful parties to the CCC have been notified verbally and will be followed up in writing by 20 December 2013.



Consultation with Glen Innes Severn Council

Consultation was undertaken with Glen Innes Severn Council on 3 December 2013. The meeting was arranged to bring the council up to date with progress of the wind farm development and to inform them of the proposed modification submission.

GIWF also discussed the requirement for the Council to nominate a representative for the CCC. The Council requested additional information for inclusion as a discussion point at the next council meeting. This was provided.

Transport issues related with transporting the new sized turbine and in particular the extended sized blades through the town to the site were discussed. It was acknowledged that that transport of the larger blades to the Sapphire wind farm would be along the same route. Council requested a copy of the revised transport plan (provided in Appendix G) which would be included in the infrastructure committee meeting in early 2014. A copy of the report was sent to Council on 12 December 2013.

Potential sponsorship by GIWF of the Celtic Festival in 2014 was also discussed. A meeting with the Tourism Manager to discuss this in more detail will be arranged.

5.1.3 Conclusion

In accordance with the planning guidelines:

- A Site Compatibility Certificate is required for new projects where land owner agreement within 2 km is not unanimous. This project is already approved.
- The CCC has currently been established with the first meeting scheduled for February 2014.
- A summary of previous consultation for the approved wind farm has been provided. These were addressed in the submissions report of May 2009 and resolved in the NSWLEC decision of 2010.
- The original EA was exhibited for an extended period beyond the minimum statutory requirements. It was displayed for 60 days instead of 30 days.

The decision to publicly display this environmental assessment is at the discretion of the Department of Planning. The environmental assessment is considered to be generally compliant with the Draft Planning Guidelines with regards to the proposed modification which is to be considered separately to the approved wind farm.

5.2 Landscape and visual amenity

The guidelines require a comprehensive assessment of the impact of proposed wind farms on the landscape character, landscape values, visual amenity and any scenic or significant vistas to be undertaken. They place a particular focus on neighbours' houses within 2 km of a proposed wind turbine that do not host the wind farm facility. The guidelines state the assessment should include:

- A description of the assessment methodology and a clear justification of it including discrete justification of the methodology for assessing impacts at neighbours' houses within 2 km of a proposed wind turbine.
- A description of all relevant components of the project, including turbine heights and layout – here micro-siting or a range of turbines is proposed, the assessment should be based on the 'worst case' layout and turbine height.
- A description of the landscape including key features.
- A description of the visibility of the development.

- Photomontages of the project and associated transmission lines taken from:
 - potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights) within 2 km of a proposed wind turbine or other associated infrastructure (note that the number of photomontages may be reduced in less sensitive landscapes such as industrial areas),
 - urban settlements, and
 - significant public view points including roads, lookout points and walkways.
- Identification of the zone of visual influence of the wind farm (no less than 10 km).
- A description of the significance of the landscape values and character in a local and regional context.
- A description of community and stakeholder values of the local and regional visual amenity and quality and perceptions of the project based on surveys and consultation.
- Assessment of cumulative impacts on the landscape and any cumulative visual impacts from transmission line infrastructure and any surrounding approved or operational wind farms in the locality.
- If a turbine is proposed within 2 km of a neighbour's house, the landowner's consent must be obtained or a Site Compatibility Certificate obtained from the relevant Joint Regional Planning Panel focusing on visual amenity issues. Photomontages depicting how the turbine(s) will appear from each neighbouring house within 2 km of a turbine must be provided during the Gateway and in the assessment.

The approved wind farm included a comprehensive visual assessment in the original EA prior to these guidelines being prepared. An assessment of the effect of the proposed modification has been prepared to allow comparison with the original assessment and is discussed in this document.

5.2.1 Visual assessment for the modification

The Visual Impact Report (Appendix D) provides an assessment of the proposed modifications to the Glen Innes Wind Farm project in the context of the existing development consent. It addresses the visual impact of the changed dimensions of the more efficient turbines being considered. The findings of this assessment are summarised in this Section.

The key function of the assessment is to enable comparison with the assessment provided for the approved project. Accordingly, the assessment revisits the description of the local landscapes provided in the original EA, it considers the visual features of the proposed changes to the wind farm development and reviews the changes to the visual catchment of the Glen Innes Wind Farm resulting from the proposed changes, consistent with the original EA and the Submissions Report prepared in 2009.

The assessment includes simulated views of the wind farm with the new micro-sited turbines from representative and potentially impacted viewpoints and compares these with simulations presented in the 2008 Environmental Assessment and the additional simulations provided in the Submissions Report prepared in 2009.

The report reviews the changes in the visual impacts for a number of issues raised in the planning guidelines including:

- Landscape analysis of main landscape elements present at the landscape locality
- Visibility of the wind farm assessed using set criteria including:

- The distance from the wind farm (for the nearest wind turbine)
- The spatial extent of the visible turbines (referred to here as the wind farm view angle)
- The number of turbines visible
- The visual catchment of the wind farm to identify the areas surrounding the project area from which the development may be partially or completely visible.
- Community concerns about visual impacts of wind turbines are discussed in respect to submissions received during the public exhibition of the original EA and nationwide opposition identified by the CSIRO (2012).
- Six representative viewpoints were used to prepare photomontages for this assessment with the objective of providing comparative material for the current form of the wind farm and that described in the 2008 Environmental Assessment and 2009 Submissions Report. These will provide local stakeholders with realistic representations of the appearance and scale of the proposed modifications in comparison with the approved project (See Appendix D).
- New photomontages for three residential dwellings located within 2 km of a wind turbine were prepared (See Appendix D)
- A shadow flicker model was calculated to a distance of 1,047 m and 2,000 m and calculations were performed at 10 minute time intervals with a resolution of 10 m. The turbine orientation was set with the rotor plane facing the azimuth at 180°. A digital terrain model was used to calculate turbine and sun visibility with visibility line-of-sight algorithm checks set at every 10 m.
- Blade glint is managed by ensuring that the finish on the turbine blades will reduce the extent of the effect.
- Mitigation measures to minimise visual impacts.

5.2.2 Approved mitigation measures

As discussed in the EA for the approved project, the three bladed turbine design and the chosen off-white colour are accepted as being the most visually acceptable turbine arrangement and colour. However, due to their size and prominent position the wind turbines will be difficult to screen at the site. Existing trees and other features at some surrounding locations may partially obstruct views of the wind farm.

The measures to further mitigate the visual impact that have been incorporated in the wind farm development as proposed and adopted for the approved project will include:

- Use of underground cabling between turbines;
- Access roads located to limit their visibility, to the extent practicable;
- The turbine and its components come in an off white finish;
- Consultation with Council over where vegetation screening of the wind farm should be positioned along public roads;
- No additional external night lighting will be associated with the increased turbine size;
- Tree planting as outlined in the Conditions of Consent Section 2.1. Taking into consideration that the average distance between dwellings within 3 km of a turbine is approximately 2,115 m, and the vertical view angle of an individual turbine would increase by 0.54°, typical landscape treatments used to visually screen the turbines will have to increase in height marginally. For example:
 - To provide complete screening of a turbine with blade tip height increasing by 20 m, for screening planted 100 m from a viewpoint, the landscape treatment would have to increase in height by approximately 0.94 m.

- To provide screening from the increased hub height of 9 m, screening planted 100 m from a viewpoint, for screening planted 100 m from a viewpoint, the landscape treatment would have to increase in height by approximately 0.42 m.
- Landscape treatment heights would decrease where screens are planted closer to a viewpoint and where distance between the turbine and viewpoint is larger;
- Landscape treatment heights would increase where screens are planted further from a viewpoint and where distance between the turbine and viewpoint is smaller.

Shadow Flicker

Several possible methods for mitigating shadow flicker in situations where the 30 hour per year limit is exceeded, were discussed in the EA for the approved project, they include:

- Screening of the view to the wind turbine that is causing the flicker, for example through additional landscaping devices such as vegetation planting. If there is no line-of-sight to the wind turbines, there will not be any flicker effect;
- Curtains and other window screening devices can be used during the short periods of shadow flicker to prevent shadow flicker from entering a room;
- It is possible to implement a turbine shut-down protocol and switch off any turbines that are causing more than 30 hours of theoretical shadow flicker per year. "Flicker timers" can be used which are able to automate this process.

5.2.3 Assessment of change in visual impact

A perspective of the vertical scale of change by including provision for the more efficient turbines is provided in Section 3 of this report (Figure 3.2).

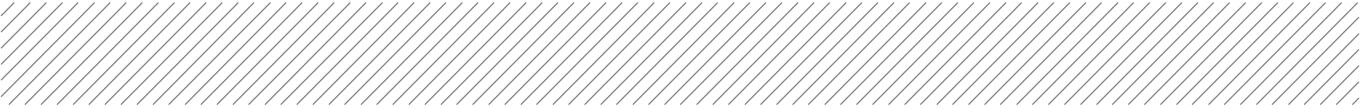
The proposed modification does not significantly alter the approved layout of the wind farm, with two turbines being micro-sited. Therefore, the horizontal view angles remain unchanged for the majority of viewpoints

As described in the original EA, the wind turbines would be expected to have minor impacts on residents in the immediate vicinity of the wind farm if left unmitigated. The increase in the maximum blade tip height by 20 m would, on average, occupy an additional 0.60° of the cumulative vertical field of view for these residences.

Within a given landscape, the visual impact would normally decrease, where the distance between a viewer and the wind farm development increases. Beyond about 3 km, there is only a small decrease in the vertical view angle as distance increases. The increase in turbine dimensions would become indiscernible at these distances. The increase in vertical view angles could be mitigated with vegetative screening and landscape treatments as already recommended by the existing Conditions of Approval.

The updated assessment of maximum theoretical shadow flicker duration predicted an exceedance of 30 hours per annum at two non-associated residences Mayvona and Ilparran B. However, it is anticipated that actual Shadow flicker arising from the operation of the project would not exceed 30 hours/annum at any residence not associated with the project due to environmental factors such as cloud cover and existing vegetative screening at both residences.

Nevertheless, shadow flicker monitoring at Ilparran B residence and the Mayvona residence (should it be occupied) has been recommended to ensure the proposed modifications would be in line with the current conditions of consent. As discussed in the EA for the approved project, methods are available for mitigating shadow flicker to ensure compliance with the condition of consent.



The existing consent conditions for the external design of the turbines will minimise any potential for glare or reflection (blade glint).

5.2.4 Conclusions

As noted in the submissions report, the visual impact of the approved wind farm development was an issue which raised a significant proportion of submissions from the local community and is considered a key issue of concern for neighbours.

Based on the assessment conducted, it is concluded that the proposed modifications to the Glen Innes Wind Farm development would result in little change to the overall visual impact of what was approved in August 2010.

Please see Appendix D for the full report.

5.3 Noise

The Noise Guidelines have been developed to provide greater clarity and rigour regarding the assessment and on-going regulation of wind farm noise including:

- low frequency noise
- tonality
- excessive amplitude modulation (including the van den Berg effect)
- auditing and compliance issues

An updated Noise Assessment has been undertaken for the proposed modification and compared to the noise assessment undertaken for the approved wind farm. This assessment is include in Appendix E and summarised below.

5.3.1 Noise assessment

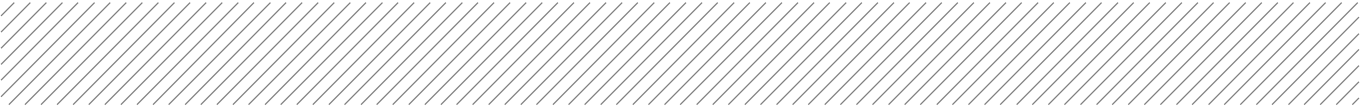
The wind farm noise emissions were based on the Alstom ECO 122 2.7 MW wind turbine generators with the noise emissions peaking at a hub height wind speed of 10 m/s. The noise predictions were carried out using the SoundPLAN developed model for the original assessment. The change in the hub height and adjustments in locations of some wind turbines and receiver locations were incorporated into the model.

Two sets of noise predictions have been carried out for this assessment. One set of predictions was carried out implementing original input conditions into to the noise model algorithm, as was used in the original environmental noise assessment in 2008.

A second set of predicted noise levels was calculated based on more conservative modelling inputs as developed in the UK in 2009, modelling which was also included in the supplementary noise assessment prepared in 2010.

In addition, to ensure that the requirements of the Draft NSW Planning Guidelines were addressed, day and night time specific regression analysis was undertaken and special noise characteristics (including low frequency noise and tonal noise emissions) were assessed.

The inputs into the model are consistent with the original modelled results and ensure consistent results when comparing the changes between the original and supplementary assessments and comply with the 2003 SA EPA Wind Farm Noise Guidelines.



The predicted noise levels determined using the ISO 9613 algorithm have been validated to agree to within 2 dBA of noise levels measured under practical “worst case” conditions at distances of up to 1,000 m from a noise source (Bass et al (1996)).

5.3.2 Modelling results

Original model inputs and predicted noise levels – ECO 122 wind turbines

Noise levels for the modified turbine and revised layout are shown in Table 9 of Appendix E.

The predicted noise levels using the original ISO 9613 model inputs did not show any exceedances of overall noise criteria for integer hub height wind at the updated location of the turbines and Alstom ECO 122 wind turbines operating at maximum noise emission levels.

The predicted noise impacts are lower than the *Supplementary noise assessment* due to the use of quieter wind turbines. The predicted noise levels satisfy both the overall noise criteria as well as day night specific assessment criteria.

Updated model inputs and predicted noise levels – ECO 122 wind turbines

Noise prediction calculations were undertaken in accordance with the ISO 9613-2 algorithm. This model uses input conditions which provide a more conservative approach to the noise predictions when compared to the original methodology. The updated model input conditions and limitations associated with the use of the model are discussed in detail in Appendix E.

The predicted noise impacts are generally lower than the *Supplementary noise assessment* due to the use of quieter wind turbines, however, under the updated model input conditions increased noise levels are predicted at Highfields and Mayvona (See Table 5.1).

Table 5.1: Predicted noise exceedance of overall amenity criteria based on updated model inputs

Receiver	Predicted L _{Aeq,10min} (dBA) at various hub height wind speeds (m/s)										
	4	5	6	7	8	9	10	11	12	13	14
Highfields											
Predicted noise *	23	25	29	32	35	37	37	37	37	37	37
<u>Criteria</u>	35	35	35	35	35	36	38	40	42	44	46
Exceedance	-12	-10	-6	-3	0	1	-1	-3	-5	-7	-9
Mayvona **											
Predicted noise *	24	25	29	33	36	38	38	38	37	37	37
<u>Criteria</u>	35	35	35	35	35	35	36	38	40	43	46
Exceedance	-11	-10	-6	-2	1	3	2	0	-3	-6	-9

Note: * Highlighted noise levels equal or exceed the overall design (noise amenity) criteria

** Mayvona is a vacant residence

The biggest increase in the predicted noise levels relates to the change in the ground absorption effect, with the ground no longer providing up to 2 dB attenuation, instead it generates an additional up to a 2 dB due to the reflection effects.

Day and night noise criteria

The predicted noise levels using the original ISO 9613 model inputs did not show any exceedances of the daytime and night time noise criteria for integer hub height wind at the updated location of the turbines and Alstom ECO 122 wind turbines operating at maximum noise emission levels.

The predicted noise levels using the updated conservative model inputs showed some minor exceedances of the noise criteria at Highfields, Mayvona and Ilparran A & B.

Table 5.2: Details of instances where predicted noise exceeds the amenity criteria based on updated model inputs

Receiver	Predicted L _{Aeq,10min} (dBA) at various hub height wind speeds (m/s)										
	4	5	6	7	8	9	10	11	12	13	14
Highfields											
Predicted noise	23	25	29	32	35 ^N	37 ^N	37 ^N	37	37	37	37
<u>Night Criteria</u>	35	35	35	35	35	35	35	38	40	44	48
Exceedance	-12	-10	-6	-3	0	2	2	-1	-3	-7	-11
Mayvona **											
Predicted noise	24	25	29	33	36 ^{DN}	38 ^{DN}	38 ^{DN}	38 ^N	37	37	37
<u>Day Criteria</u>	35	35	35	35	35	35	36	38	40	43	46
Exceedance	-11	-10	-6	-2	1	1	0	-2	-4	-6	-8
<u>Night Criteria</u>	35	35	35	35	35	35	35	35	38	41	46
Exceedance	-11	-10	-6	-2	1	3	3	3	-1	-4	-9
Ilparran A & B											
Predicted noise	22	24	28	31	34	36 ^N	37 ^N	36	36	36	36
<u>Night Criteria</u>	35	35	35	35	35	36	37	38	39	40	40
Exceedance	-13	-11	-7	-4	-1	0	0	-2	-3	-4	-4

Note: ^D – noise levels equal or exceed the daytime criteria, ^N – noise levels equal or exceed the night time criteria

** Mayvona is a vacant residence

5.3.3 Special noise characteristics

To ensure that the requirements of the Draft NSW Planning Guidelines were addressed, special noise characteristics (including low frequency noise and tonal noise emissions) were assessed. The following summarises the results of this assessment.

- **Low frequency noise:** The guidelines outline low frequency noise criteria of 65 dBC for daytime and 60 dBC for night time. If the wind turbine noise emissions exceed these noise levels a more detailed assessment is required.

All of the noise levels satisfy the daytime criteria of 65 dBC and night time criteria of 60 dBC, therefore no further investigation is required.

- **Tonality:** The guidelines outline criteria for audible tones from the operation of wind turbines at the sensitive receiver. These are based on the definition outlined in *NSW Industrial Noise Policy*. A 5 dBA penalty would be applied to the overall noise prediction if any of the defined conditions are satisfied.

The one-third octave band noise levels from the wind turbines at each sensitive receiver were assessed and no presence of tonality was identified in the predicted noise results.

- **Excessive Amplitude Modulation:** Amplitude modulation refers to the aerodynamic noise from the turbine blades at the blade pass frequency (typically at approximately 1 Hz). This is related to the rotational speed of the turbine. When the noise emission from the wind turbines has modulation of greater than 4 dBA at the blade pass frequency, a 5 dBA penalty should be applied to the overall predicted noise levels.

Currently there are no methods to predict whether excessive amplitude modulation would occur. The assessment is limited to measurements of an operational wind farm.

5.3.4 Conclusions and recommendation

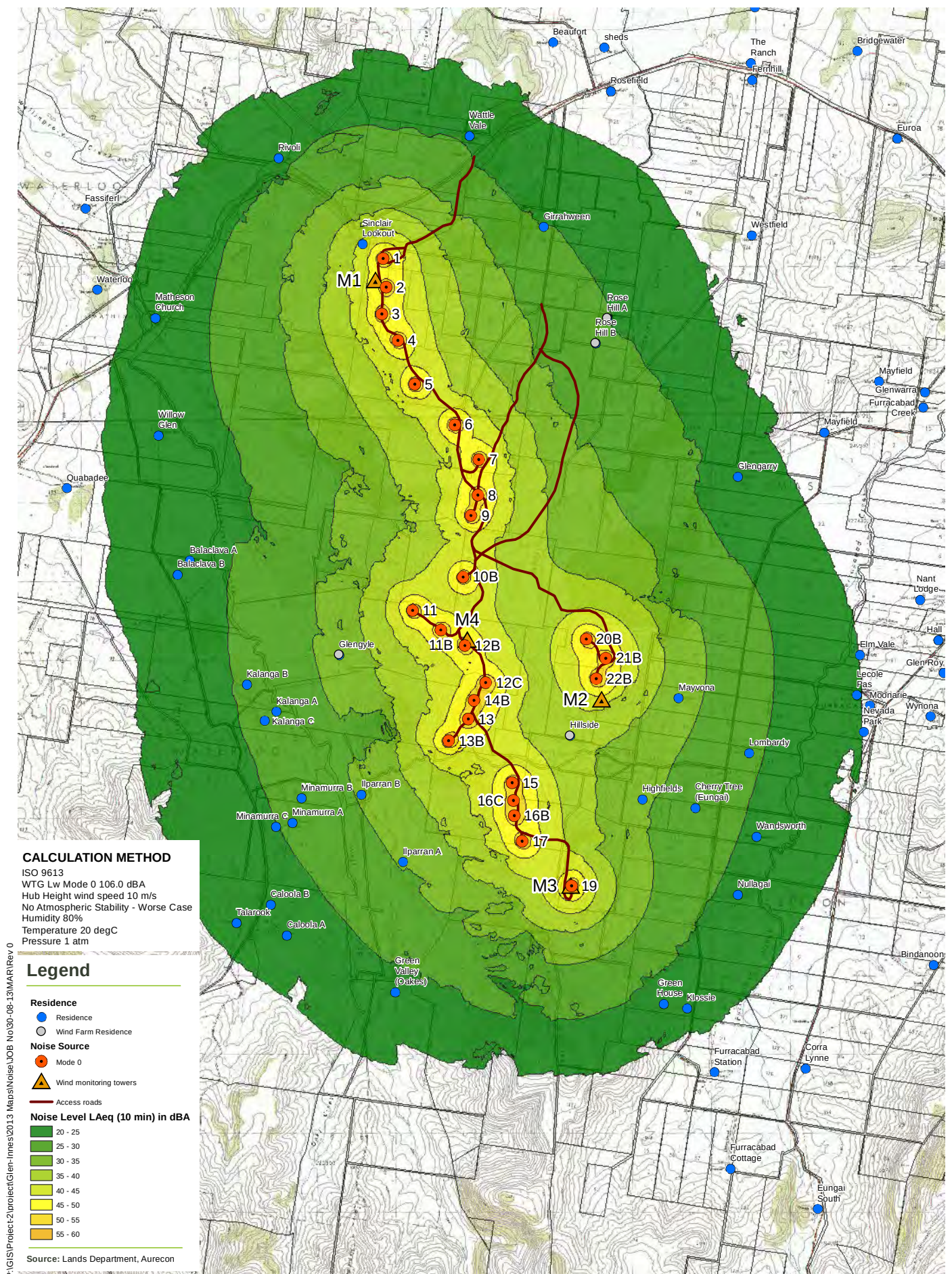
The original ISO 9613 noise model results show that the wind farm can be operated to achieve compliance at all non-wind farmer receiver locations for overall noise criteria as well as day and night specific criteria.

Noise predictions using the updated conservative modelling inputs showed exceedances of the applicable overall noise criteria at two non-wind farmer locations, one of which is a derelict non-inhabited residence. Exceedances were predicted at the same two non-wind farmer locations when assessed against night time noise criteria.

Turbine operating modes can be changed to control noise emissions from the wind turbine(s) and ensure compliance. Although using changed operating modes reduces the emitted noise; it also reduces the power generated by that turbine. An operational strategy was developed utilising lower noise operating modes of some turbines to show compliance with the overall noise criteria at all locations as well as an operational strategy to satisfy the night time noise criteria. However the implementation of the lower noise operating modes using real-time wind and stability data would only be required during conditions that are favourable for noise propagation towards the sensitive receivers such as downwind or during the occurrence of stable atmospheric conditions.

Two operating modes have been specified to satisfy the noise criteria. These are outlined as follows:

- Mode 1 – Maximum sound Power output of Lw 104 dBA at hub height wind speeds 8 – 11 m/s
- Mode 2 – Maximum sound Power output of Lw 100 dBA at hub height wind speeds 7 – 11 m/s.



SCALE 1:65,000 @ A4

0 0.5 1 Kilometres

Projection: MGA

Glen Innes Wind Farm **Environmental Assessment**

FIGURE 5.1: Noise Assessment of high efficiency turbines

5.4 Health and safety

5.4.1 Background

The approach to health issues in the guidelines were developed in consultation with the NSW Ministry of Health. The guidelines adopt a precautionary approach for the consideration of health issues. This includes requiring proponents to explicitly consider health issues as well as comply with stringent operational performance criteria including stringent noise criteria.

The principal safety issues identified in connection with the proposed modifications relate to:

- Noise
- Aviation
- Shadow flicker
- Physical safety associated with the turbines
- Electric and magnetic fields
- General health effects

The following information discusses these health concerns with relevance to the proposed modification.

Noise

The proposed turbines were assessed for noise impacts in Section 5.3 and a separate report is provided in Appendix E. The results concluded that the proposed turbines would have less impact on sensitive receivers than approved for the wind farm.

Shadow flicker

The proposed turbines were assessed for visual impacts in Section 5.2 and a separate report is provided in Appendix D.

The updated assessment of maximum theoretical shadow flicker duration is predicted to exceed 30 hours per annum at the non-associated residences Mayvona and Ilparran B. However, it is anticipated that actual Shadow flicker arising from the operation of the project would not exceed 30 hours/annum at any residence not associated with the project due to environmental factors such as cloud cover and existing vegetative screening at both residences.

Shadow flicker monitoring at Ilparran B and the Mayvona residence has been recommended to ensure the proposed modifications would be in line with the current conditions of consent. As discussed in the EA for the approved project, methods are available for mitigating shadow flicker to ensure compliance with the condition of consent.

Physical safety associated with the turbines

A commitment to health and safety within the industry has ensured that there are minimal physical safety issues associated with wind turbines. Safety features include:

- The modular design ensures easy assembly, transportation and logistics
- The nacelle is made up of three independent elements: the central nacelle, two lateral housings and the hub. Increased dimensions allow technicians full internal access and ensure easier and safer maintenance without cranes
- A maintenance trolley inside the frame eases transport of components.



Electric and magnetic fields

Electric and magnetic fields were assessed in the original EA. Wherever electrical equipment operates, electric and magnetic fields (EMFs) are created in the surrounding environment. Over the past 30 years the question has been raised as to whether or not these fields may be harmful to human health. Despite extensive research and numerous public inquiries, adverse health effects have not been established but the possibility has not been ruled out.

The main sources of EMFs that will be associated with the proposed modification will be the electrical equipment within the turbine structures. The EMFs associated with the proposed turbines will be well within the relevant health standards and in many cases will be localised to areas not often frequented by people. On this basis, the possibility of human health effects due to EMF is not considered to be an issue for the proposed modification.

General health effects

Wind farms in Australia have gained extensive media coverage, have been challenged in court cases, have been the focus of a senate inquiry and remain a focal point of community discussions regarding precautionary measures of health and safety. There are nearly 200,000 wind turbines operational all over the world with many turbines in close proximity to people's homes. After reviewing critical literature conducted by leading health and research organisations from all over the world, including Australia's National Health and Medical Research Centre, the UK Health Protection Agency and the US National Research Council, it has been concluded that there is no direct link between wind farms and health effects (CEC, 2013b). Multiple scientific, thorough, peer-reviewed studies on wind farm noise that have found that infrasound from wind farms is not detrimental to personal health (CEC, 2013b).

In 2012, the NSW Health Department provided written advice to the NSW Government that stated existing studies on wind farms and health issues had been examined and no known causal link could be established (CEC, 2013b). NSW Health officials stated that fears that wind turbines make people sick are "not scientifically valid" and that the arguments mounted by anti-wind farm campaigners are unconvincing. The officials wrote that there was no evidence for "wind turbine syndrome", a collection of ailments including sleeplessness, headaches and high blood pressure that some people believe are caused by the noise of spinning blades (CEC, 2013b).

Research by the University of Auckland and the University of Sydney have found that anxiety and fear about wind turbines spread by anti-wind farm groups can cause people to develop symptoms (CEC, 2013b). This means that discussion within communities about the alleged health effects of wind farms may trigger the very symptoms about which residents are concerned. This effect may be reduced by balanced reporting in the media (CEC, 2013b).

Senate inquiries into social and economic impacts of wind farms

Early in 2011, the Federal Government called for submissions to a senate inquiry into '*The Social and Economic Impact of Rural Wind Farms*'. In 2012 the federal government completed an inquiry into a bill titled '*Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012*'.

'*The Social and Economic Impact of Rural Wind Farms*' inquiry of 2011 resulted in the Committee making some of the following recommendations:

- Further consideration be given to the development of policy on separation criteria between residences and wind farm facilities.
- Recommends that the Commonwealth Government initiate as a matter of priority thorough, adequately resourced epidemiological and laboratory studies of the possible effects of wind farms

on human health. This research must engage across industry and community, and include an advisory process representing the range of interests and concerns.

- Recommends that the NHMRC review of research should continue, with regular publication.
- Recommends that the National Acoustics Laboratories conduct a study and assessment of noise impacts of wind farms, including the impacts of infrasound.
- Recommends that the draft National Wind Farm Development Guidelines be redrafted to include discussion of any adverse health effects and comments made by NHMRC regarding the revision of its 2010 public statement.

The *Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012*' inquiry (of 2012) found the following:

"The number of health-related complaints about wind farms is small in proportion to the number of people living near these facilities. The numbers also vary greatly from one facility to the next, for reasons not apparently related to the number of residents in the area"

Overall, the Senate committee found that wind farms do not create health problems:

"The committee concludes that, while it is possible that the human body may detect infrasound in several ways, there is no evidence to suggest that inaudible infrasound (either from wind turbines or other sources) is creating health problems. In contrast, there is an established literature confirming the existence of psychogenic, or nocebo, effects in general, and at least one study suggesting they may be responsible for symptoms in some wind turbine cases."

5.4.2 Conclusion

No additional impacts on human health or safety were identified as a result of installing the proposed turbines.

5.5 Ecological issues

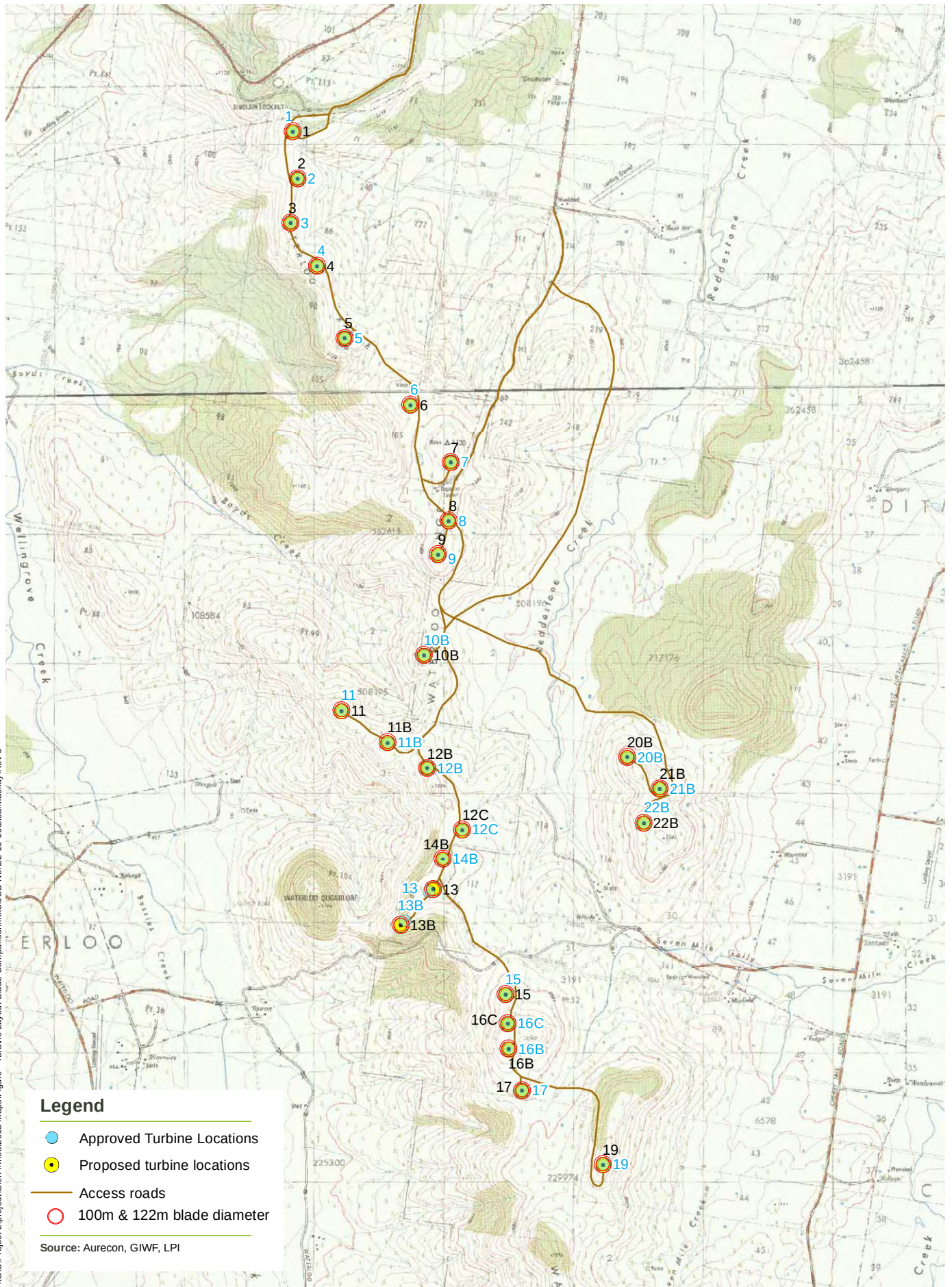
The guidelines state that the assessment should include an ecological assessment considering terrestrial and aquatic (where relevant) ecosystems, including consistent with DEC (2005) *Guidelines for Threatened Species Assessment* (in the case of wind farm proposals classed as State significant development). Comprehensive ecological studies were conducted for the original EA of the approved wind farm. These have been used as the basis for the proposed modification and an updated desktop assessment was prepared in 2013 to assess the impacts of installing larger turbines.

The proposed modifications involve the option to install taller turbines and a revised turbine layout within micro-siting limits (100 m within of the boundary of the approved location). Any clearing undertaken will be consistent with descriptions and undertakings in the approved wind farm or proposed modifications.

The footprint of the wind farm is relatively small, given the extent of the project and the large area over which it is dispersed. This is mainly because existing farm tracks are to be utilized for access purposes wherever possible and, elsewhere, the shortest possible practicable routes have been selected to minimise clearing.

The following Figure 5.1 also provides an indication of the horizontal extent of the turbines (layout) and the sweep of the rotors, allowing for rotation through 360 degrees for all wind directions along with the minor changes in the location of two turbines and the difference horizontal width of area swept by the more efficient turbines compared to the approved envelope.

P:\GIS\Project-2\project\Glen-Innes\2013 Maps\Figure - Turbine Layout Blade Comparison.mxd JOB No.122-10-13 Lisa Mackay/Rev 0



1:40,000
0 400 800m

Projection: GDA 1994 MGA Zone 56

Glen Innes Wind Farm **Assessment**

FIGURE 5.2: Comparison of change in horizontal swept area through 360 degrees

5.5.1 Previous surveys 2007

Kevin Mills and Associates (KMA) were engaged to assess the flora and fauna, excluding bat fauna. Greg Richards and Associates (GRA) were engaged to assess bat species in 2007. The desktop review by KMA identified 106 native species and 85 exotic flora species at the wind farm site in 2007. A targeted search in 2007 found zero threatened flora species at the wind farm site and it was concluded that they were unlikely to occur within cleared sites and or heavily grazed areas. Most of the grassland in the project area is a mixture of native grassland and native pasture.

The desktop review for fauna species in 2007 revealed two threatened fauna species within 10 km of the wind farm site- the Koala and Black-necked Stork. The field survey by KMA found zero threatened fauna species at the wind farm site in April 2007. However, based on the results of the habitat assessment and the previous occurrence of threatened species in the local area, KMA concluded that some could occur during other periods of the year. Potential fauna species include the Eastern Falsistrelle, Eastern Bentwing-bat and woodland birds such as the Diamond Firetail and Speckled Warbler. GRA identified three vulnerable bat fauna at the wind farm site during the field survey including: the Large-eared Pied Bat, Eastern Falsistrelle and Yellow-bellied Sheathtail Bat.

KMA considered that the amount of native vegetation and habitat to be cleared for the development of the wind farm to be negligible in a micro, local and regional context, and the impact on flora and fauna was expected to be correspondingly small.

KMA expects that the impact of blade-strike on birds at the approved wind farm will be negligible; the project area is a dry upland location a considerable distance from any large water bodies and no turbines are in gaps between mountain ranges. The use of underground cables between the wind turbines avoids this risk of collision with power lines within the site.

Threatened Species Conservation Act 1994

KMA indicated that no endangered populations under the TSC Act occur on the land to be disturbed by the wind farm. No threatened plant species were found in the area and none are expected to occur on any site impacted by the approved wind farm.

KMA concluded that the development of the approved wind farm is not likely to have a significant impact on any threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995*, or their habitats, and the preparation of a Species Impact Statement (SIS) was not warranted.

GRA undertook Part 5A assessments (Seven Part Test of Significance) in relation to the following threatened bat species:

- Large-eared pied bat (*Chalinolobus dwyeri*)
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*)

In each case, GRA found that the operating wind farm would not have a significant impact on these species and a Species Impact Statement was not warranted for any of the three species.

Environment Protection and Biodiversity Conservation Act 1999

KMA has assessed the approved wind farm as not likely to have any effects on the Regent Honeyeater, should it occur in the project area. The potential habitat of this species, primarily Yellow Box trees will not be removed. The proposed wind farm as not likely to have any effects on the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland endangered ecological community should it occur in the project area. None of this community will be removed.

The wind farm is not likely to have any effects on internationally protected migratory species due to the wind farm not containing "important habitat" for these species or having an "ecologically significant proportion" of a population of such species.

KMA assessed the development of the proposed wind farm as not likely to have a significant impact on any threatened species, migratory species or communities listed under the *Environment Protection and Biodiversity Conservation Act, 1999*. Referral to the Minister for assessment and approval was therefore not warranted.

GRA assessed the impact of the wind farm on bat species. The Large-eared pied bat (*Chalinolobus dwyeri*) is listed as vulnerable under the EPBC Act. GRA has assessed that the project is not likely to have a significant impact on this species.

5.5.2 Desktop reviews 2013

Changes relevant to flora and fauna

Micro-siting of turbines at the detailed design stage of the project to avoid impacts is envisaged in the original EA. This provision remains for the modifications considered in this assessment. The micro-siting of T13 and T13B in consideration of the larger turbines is less than that considered in the Draft Wind Farm Guidelines (up to 100m) and does not encroach on sensitive locations identified in the original assessment.

The main difference between the currently approved project and the provision to permit consideration of the newer more efficient turbines is the larger swept area at a lower rotation speed. The issue of concern in this regard is whether this would result in a significant change in impacts on avifauna.

The following table provides a comparison of the general specifications of proposed higher efficiency turbine model with the nominal turbine model that was approved:

Table 5.3: General wind farm specifications

Component	Approved Wind Farm	Proposed Modification	Change
Number of Turbines	25	25	0%
Hub Height	80 m	89 m	11%
Maximum blade tip height	130 m	150 m	15%
Minimum blade tip height	30m	27.5 m	-8%
Rotor diameter	100 m	122 m	22%
Swept Area per turbine	7,854 m ²	11,882 m ²	52%
Total Swept Area for Wind Farm	196,350 m ²	297,057 m ²	51%
Rated rotor speed	18 rpm	12.25 rpm	-32%
Max Tip speed	94 m/s	78 m/s	-17%

As can be seen from the above this represents an increase in the turbine hub height of 9 m (11%), a blade diameter increase of 22 m (22%) and a subsequent maximum blade tip height increase of 20 m (15%). Based on this the swept area of the turbines would increase by 51% and the maximum speed of rotation would decrease by about 32% with a corresponding approximate decrease maximum tip speed of about 17%.

Atlas of NSW Wildlife database search 2013

The Atlas of NSW Wildlife provides a listing of flora and fauna which is protected under the *Threatened Species Conservation Act 1995*. A search for threatened flora and fauna data occurring within the Project area was undertaken on 24 June 2013 using the Atlas of NSW Wildlife database. The following results were returned:

Two sightings of Austral Toadflax (*Thesium australe*) occur 93 m and 193 m north of the access road off Fossickers Way leading to Turbine 1. These records are dated 1986 and 1990 and would have been assessed in the previous surveys conducted in 2007 by KMA and GRA.

There are no other recorded sightings of flora or fauna known to occur within the project area since 2007 (Appendix H).

EPBC Protected Matters Search Tool 2013

The approved wind farm previously assessed the impacts of disturbance to flora and fauna under the EPBC Act. A search of the EPBC Protected Matters Search Tool was undertaken on 24 June 2013 to determine the presence of nationally significant flora or fauna since the 2007 surveys. The search was conducted on the extent of the Project area with a 1 km buffer.

This search revealed the presence of:

- endangered ecological communities (Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland, New England Peppermint (*Eucalyptus novaanglica*) Grassy Woodlands) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland).
- 29 threatened species
- 13 migratory species.

The previous surveys conducted in 2007 noted the presence of New England Peppermint trees and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. There was no direct reference to Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland, in this assessment. The threatened species and migratory species were addressed in the previous surveys of 2007 (Appendix H).

5.5.3 Consideration of impacts

Collision risk of avifauna with wind farms

The consideration of risk of avifauna (birds and bats) collisions at wind farms is based on a knowledge and understanding of the behaviours and likely avoidance rates of the avifauna expected to occur at wind farms. This is initially undertaken subjectively by credible specialists who make an assessment as whether the observed species and their levels of occurrence and behaviours are sufficient warrant further detailed investigation. Initially this is a qualitative assessment of avifauna collisions according to components of the wind turbine structures.

The specialist assessments for the Glen Innes Wind Farm concluded that the potential impacts on avifauna were sufficient and apart from monitoring following construction, to confirm the predictions, did not require further assessment.

The basis of the assessment provided by the specialist consultants is not changed by the inclusion of larger wind turbines at the same locations.



In circumstances where the perceived risk is such that further investigation is warranted, the risk to the viability of bird populations and/or listed endangered or threatened species impacts is assessed through the application of quantitative collision risk models or utilisation studies based on observation and perceived levels of risk based, on expert opinion. With regard to bats more detailed assessment would involve additional monitoring and specialist consideration of species behaviours to understand the likely impacts better.

For the zone within rotor-swept height, likely bird collisions for species will depend on the utilisation rates of each species within the area swept by the rotor and the likelihood that a particular species of bird is at risk of collision with turbines. Impacts using models are projected based on observed densities and assumed collision rates for the species of concern (I Smales et al 2005).

Where data are not available because a species is not recorded from a site, or where data are too few and are thus an unreliable basis for extrapolation, a well-informed scenario is used.

The risk assessment accounts for a combination of variables that are specific to the particular wind farm and to birds that inhabit the vicinity.

The variables as described in Smales et al (2005) are:

- The numbers of flights for each bird species below rotor height, and for which just the lower portion of turbine towers present a collision risk.
- The numbers of bird flights at heights within the zone swept by turbine rotors, and for which the upper portion of towers, nacelles and rotors present a collision risk.
- The numbers of movements-at-risk of collision. This parameter would be recorded for each species during timed Point Counts, which are then extrapolated to determine an estimated number of movements-at-risk for each species for an entire year. Account is also taken of whether a particular bird species is a year-round resident or annual migrant.
- The area of tower (m² per turbine), nacelle and stationary rotor blades of a wind generator that present a risk to birds. As birds to move toward wind turbines from any direction and the turbines move around based on wind direction, the models will normally use an area derived from consideration of the maximum area presented by the turbine (where the direction of the bird is perpendicular to the plane of the rotor sweep) and the minimum area presented by the turbine (where the direction of the bird is parallel to the plane of the rotor sweep).
- Any research for individual turbine makes and models.
- The additional area (m² per turbine) presented by the movement of rotors during the potential flight of a bird through a turbine is determined according to the length and flight speed of the bird species in question.
- A calculation, based on the total number of turbines proposed for the wind farm, of the number of turbines likely to be encountered by a bird in any one flight. This differs according to whether turbines form a linear or a clustered array on the landscape.

Threatened Species Conservation Act

Kevin Mills and Associates (KMA) in the assessment of flora and fauna excluding bats in the EA (Aurecon 2008) concluded that the development of the proposed wind farm is not likely to have a significant impact on any threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995*, or their habitats, and the preparation of a Species Impact Statement (SIS) is not warranted.

Greg Richards and Associates (GRA) in the assessment of potential impacts on bats in the EA (Aurecon 2008) concluded that the operating wind farm would not have a significant impact in relation to the following threatened species and that a Species Impact Statement was not warranted for:

- Large-eared pied bat (*Chalinolobus dwyeri*)
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*)

Environment Protection and Biodiversity Conservation Act

KMA assessed the development of the proposed wind farm in the EA for this project (Aurecon 2008) as not likely to have a significant impact on any threatened species, migratory species or communities listed under the Environment Protection and Biodiversity Conservation Act, 1999.

GRA assessed the development of the proposed wind farm in the EA for this project (Aurecon 2008) and concluded that the project is not likely to have a significant impact on the Large-eared pied bat (*Chalinolobus dwyeri*) which is listed as vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act.

A referral under the EPBC Act to the Minister for assessment and approval is therefore not recommended.

5.5.4 Conclusion

The proposed modifications involve provision for the installation of taller turbines with a larger swept area rotating at a slower speed. Micro-siting (less than 50 m) of two turbines has also occurred at two sites (described as T13 and T13B).

An assessment was conducted for this document to consider if additional investigations or mitigation measures are required to address potential impacts on flora and fauna, including threatened species, ecological communities or their habitats. No increase in impact on flora or fauna is predicted as a result of this.

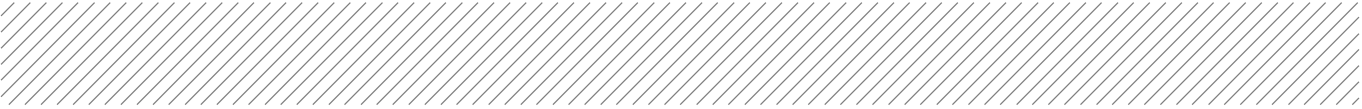
The issues considered and hence findings in relation to the NSW TSC Act and the Commonwealth EPBC Act remain unchanged and are adequately addressed by the existing project approval. The greatest potential impact from the inclusion of larger turbines with lower rotation speeds is for additional impacts on avifauna.

While changes in the relationship between swept area and speed of rotation from including the more efficient turbines could result in some increased avifauna mortalities, the general conclusions from the previous assessment (Aurecon 2008) that:

“the impact of blade-strike on birds at the Glen Innes Wind Farm will be negligible; the project area is a dry upland location a considerable distance from any large water bodies and no turbines are in gaps between mountain ranges”

“Monitoring of bat species at the Glen Innes Wind Farm shows that areas with open habitat, where turbines will be located, were not utilised by the threatened species present in the area. Studies of bat flight behaviour in the vicinity of turbines showed that only a small percentage are involved in collisions some exhibit avoidance behaviour and the bulk appear to stay clear of the turbines indicating an awareness of the turbines (Horn and Arnett, 2005 in GRA 2008)”

still applies to the project.



Adequate safeguards to protect flora and fauna including threatened species and their habitats is included as part of the approved project. Accordingly no further action in addition to the consent conditions is considered warranted. With regard to flora and fauna, the minor nature of these proposed modifications is not expected to have adverse impacts on flora and fauna as assessed in the approved project.

5.6 Aviation safety

The assessment seeks to ensure that the aviation related planning guidelines relevant to wind farms in NSW have been adhered to and that the operations of the identified aviation stakeholders will not be adversely impacted by the proposed modifications to Glen Innes Wind Farm.

Civil aviation

The proposed modifications will increase the height of the turbines by 9 m in hub height and 20 m in blade tip height. It is expected that the light planes using the local air fields are relatively manoeuvrable and, with knowledge of the revised turbine locations, these aircraft will be able to continue to use the local airfields without any increase in air safety risks.

Under Civil Aviation Safety Regulations any person who proposes to construct a structure, the top of which will be greater than 110 metres above ground level, must inform the CASA of that intention and the proposed height and location of the structure.

The approved wind farm did not require lighting to be installed on the turbines. It is not expected that the new turbines will require lighting due to the minor modifications proposed.

Glen Innes Aerodrome

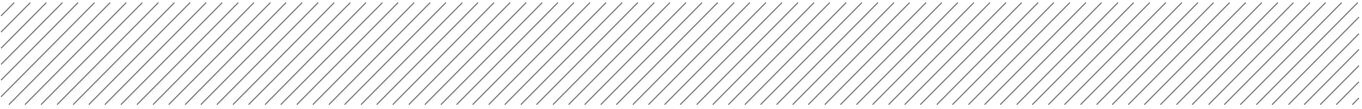
There is no regular commercial airline servicing the Glen Innes aerodrome and there is accordingly, minimal daily air traffic. Each aerodrome has an Obstacle Limitation Surface (OLS) surrounding the wind farm and proposed tall structures surrounding the aerodrome must be assessed to determine whether they impinge the OLS. Council were contacted in relation to the OLS for the approved wind farm, however, they were not consulted in relation to the proposed modifications. This is because the taller turbines are considered minor in nature to the approved project. Council's response previously stated that the wind farm is clear of the obstacle restriction area and the proposed structures will not infringe the Glen Innes Obstacle Limitation Surface (OLS).

Aerial agricultural operations

The proposed turbines are not considered to be safety hazards to aerial agriculture operations as the structures are readily visible and the pilots can readily avoid them. It is noted that where the aircraft undertaking the aerial agriculture operations are reloading at a local airfield close to the wind farm that their take off with a full load will involve a more gradual ascent than would otherwise be the case. Also, they may not be quite as manoeuvrable under full load conditions and some variation to their normal pattern of aerial spreading may be needed.

Recreational activities

Recreational use of air space can involve hot air balloons, micro-light and ultra -light aircraft, gliders and parachuting. While these activities could occur within the locality no such activities have been observed during site visits. The wind farm and the proposed turbines will be readily apparent to participants in such activities who will be able to avoid the turbines.



Defence Force low altitude flights

The Department of Defence operates low level flights at various rural locations and needs to be aware of the locations of any tall structures. The Department of Defence advised in 2007 that the wind farm was outside any areas affected by the Defence (Areas Control) Regulations (DACR) and that the wind farm would not affect existing Defence communications. The Department requested that the colour used for the wind turbines ensures that they are conspicuous and does not allow the turbines to blend into the ground.

The Department of Defence will be advised of the final locations for the turbines both prior to and following their construction.

Records of data

CASA, Airservices Australia and the Department of Defence (Royal Australian Air Force (RAAF)) all maintain databases and or maps of objects or structures that may be relevant to the safety of flying operations.

Prior to construction of the proposed wind farm, GIWP will provide a plan of the final locations of the wind turbines and details of the height of each wind turbine so that these organisations can record the details in their databases and on relevant maps. The “as constructed” details will also be provided to these organisations once construction is complete.

5.6.1 Mitigation measures

Aeronautical navigation aids

The World Aeronautical Chart (WAC) 3357 Armidale published by Airservices Australia is designed for pre-flight planning as well as pilotage. Glen Innes Wind Farm will need to inform Airservices Australia once construction of the wind farm commences so that a Notice to Airmen (NOTAM) can be issued until this change is accurately reflected in the WAC.

Air traffic services

Prior to the commencement of construction and operation of the wind farm, GIWP will provide the following information to CASA, Royal Australian Air-Force-Aeronautical Information Service, Airservices Australia and known users of privately owned local airfields:

- As constructed coordinates in latitude and longitude of each wind turbine;
- Final height of each wind turbine in AHD; and
- Ground level at the base of each wind turbine in AHD.

This would be no different from what was approved in August 2010.

Aerial agricultural operators

Currently, the landowners who form part of the windfarm have agreed that aviation spraying can continue and in agreement with the pilots, new routes and heights may need to be utilised for the aerial spraying, and if there is any extra costs involved, the wind farm will compensate the landowners. It is anticipated this would not affect neighbouring properties.



5.6.2 Conclusion

The Aviation Assessment examined the potential aviation related impacts associated with the increase in turbine dimensions for the Glen Innes Wind Farm located on the Waterloo Range in NSW. Having regard to the foregoing, it is considered that the proposed modification will not present a hazard to aviation.

Whilst the wind turbine model selected for the proposed modification of Glen Innes Wind Farm is larger than what was previously approved for the project, the wind turbines selected would not penetrate any OLS or PANS-OPS surfaces. As blade tip heights remain below navigable airspace levels (500 ft), there is currently no legal requirement for the installation obstruction lighting at Glen Innes Wind Farm.

Furthermore, the Civil Aviation Regulations require that, unless it is necessary for take-off and landing, or special circumstances, an IFR or Night VFR aircraft must not be flown at a height of less than 1,000 ft above the highest obstacle within 10 nm (18.5 km) radius of the aircraft in flight.

Other than the two turbines which have been micro-sited, the locations of all other individual turbines are identical to what was approved in August 2010. No significant impact was identified in the original assessment and no additional impact is expected as a result of the proposed modification

5.7 Bushfire hazard

Bushfire consultation with NSW Rural Fire Service was undertaken at the time of original submission for the approved wind farm. The proposed modifications will have no additional potential impacts on creating bushfires.

The proposed larger turbines would have a negligible impact on the aerial fighting of bushfires compared to the approved project. GIWP will liaise with the RFS to provide a bushfire activation plan which will outline procedures in the event of a fire event on the wind farm as consistent with good industry practice and the approval conditions.

The conditions of approval ensure that GIWP must comply with any reasonable request of the local RFS to reduce the risk of bushfire and to enable fast access in emergencies. GIWP must ensure there is appropriate fire-fighting equipment held on site to respond to any fires that may occur at the site during construction and operation of the project. They must also assist the RFS and emergency services as much as possible if there is a fire on-site during the project.

5.8 Blade throw

The design and construction of modern wind turbines is tightly controlled to internationally recognised IEC standards. Although there have been very limited instances where turbine blades have failed in the past, the likelihood of a blade failure is very low and the overall risk is low.

All turbines and blades are built to the latest IEC 6140-23 standards. This is documented by the turbine suppliers in their compliance certification which is assessed by third party assessors.

To minimise, manage and monitor impacts, control mechanisms monitor all turbine components and are programmed to respond to abnormal instances. All turbine components will be regularly maintained at the wind farm as part of preventative maintenance procedures.

5.9 Economic issues

The nature of the proposed modifications involves the option to install slightly larger turbines and a revised turbine layout. These modifications would not have any additional impacts on social or economic factors relating to the approved wind farm.

The original EA for the approved wind farm concluded that the development was likely to have a minor social and economic impact on the towns of Glen Innes and Inverell.

5.9.1 Wind farm investment in Australia in 2012

The total cumulative capital investment in wind farms in Australia as at June 2012 was estimated at just over \$7 billion with some \$4.25 billion estimated to be spent in Australia (CEC, 2012). The Australian investment includes the manufacture of the towers that support the wind turbine generators (WTGs) and blades, the civil, electrical and other site works including most of the installation and supporting labour, local transport, and employee support services such as accommodation and food. The major imported items include most of the plant and equipment related to the WTGs and the blades.

A report by the CEC (2012) focused on wind farm investment indicated positive employment benefits from the construction and operation of wind farms. The report stated several important economical findings in reference to an example 50 MW wind farm. These findings include:

- Construction could lead to potential local personal expenditure of \$25,000 per person per annum. If, for example, a wind farm had an average construction workforce of some 35 over a two year construction period then the expenditure in the region would be some \$875,000 in total per annum on accommodation, food and other services
- The same wind farm could employ between 5 and 6 fulltime staff for operations and maintenance with a potential ongoing expenditure of \$125,000-150,000 per annum.
- Suppliers and services are to be sourced locally wherever possible such as transport, plant hire and materials such as crushed rock, cement, sand and gravel, thereby stimulating the local economy.

The construction of an example 50 MW installed capacity wind farm may generate the following employment benefits to Glen Innes:

Table 5.4: Estimated direct, flow-on and total employment for construction to operation of a 50 MW wind farm

	Local/Regional	State	National
Construction per 50 MW			
Direct Employment	48	147	238
Production Induced Impact	51	163	255
Consumption Induce Impact	61	194	302
Total Employment Including Indirect Jobs	160	504	795
Operations per 50 MW			
Direct Employment	5	7	16
Production Induced Impact	3	5	12
Consumption Induce Impact	4	7	16
Total Employment Including Indirect Jobs	12	19	44
Life cycle of 50 MW wind farm			
Total Employment Including Indirect Jobs	172	523	839

Source: CEC, 2012

5.9.2 Existing land use

Land use around the wind farm is mainly pastoral activities with some rural residential activity. In addition, mining has occurred at various locations around Glen Innes, including former alluvial mining activity in Reddestone Creek immediately to the east of the wind farm site. The mining has predominantly involved extraction of sapphires and in some places further to the north, tin from alluvial deposits in rivers flowing from the adjacent uplands.

The land on which the wind farm and substation will be located is zoned RU1 - Primary Production in the LEP. The wind farm development is able to co-exist with the existing use of the land for grazing and is considered as consistent with the productive use of the natural resources of the locality including harnessing the wind energy resource at the locality.

The pastoral and residential activities will continue and will not be significantly affected by the operation of the wind farm with taller turbines. The installation taller turbines will not limit the future use of the land for grazing. The proposed modifications are considered substantially the same development and therefore no additional impacts were identified.

5.9.3 Financial contributions

The outcome of the 2010 Land & Environment court case resulted in the allocation of fifty/fifty funding for community benefit purposes. Thus the funding would be split 50% to enhancement measures identified within 5 km of the Project and 50% to the remainder of the Glen Innes Community. GIWP has committed to a community fund of \$75,000 per annum.

The conditions of consent require GIWP to contribute \$75,000 per annum to the Community Enhancement Program commencing upon commissioning of the project until the end of its life. The contribution shall be adjusted annually to take account of any increase in the Consumer Price Index (All Groups Index for Sydney) over time, commencing at the September 2010 quarter.

5.9.4 Conclusion

The approved wind farm was considered to benefit the local economy through providing income to landowners at the site and contributions to the community. It was likely to provide a small boost to local businesses and provide a range of employment opportunities for locals.

The proposed modifications will not change these expected benefits and will not have additional impacts on the local economy.

5.10 Decommissioning

The proposed modifications would not result in changes to the approved decommissioning or rehabilitation for the wind farm site. Please refer to the conditions of consent for the approved project and for MOD 1 in Appendix A for understanding of the requirements for decommissioning required by GIWP.

The guidelines require that the proponent/wind farm owner rather than the “host” landowner must retain responsibility for decommissioning. Additionally, the guidelines require applicants to include a Decommissioning and Rehabilitation Plan in their environmental assessment report. Where this is deemed to be inadequate, but the Development Application is granted consent, a condition of consent will be imposed requiring the proponent to pay a decommissioning bond.

At the end of its economic life the wind turbine equipment will either be replaced with comparable new equipment or the wind farm will be decommissioned. Decommissioning will involve dismantling and removal of the above-ground equipment and site rehabilitation. Turbine footings will remain buried at a level below the ground surface acceptable to the landowner. Access tracks may be retained depending on the landowners' wishes.

It is confirmed that GIWP is responsible for the decommissioning of the wind farm, not the landowner, should it be required. This is also outlined in the individual landowner agreements.

5.11 Monitoring and compliance program

The guidelines state that if a proponent's development application is granted consent, conditions will be specified as part of the consent requiring proponents to undertake compliance monitoring and auditing. The wind farm has already gained approval and must undertake compliance monitoring and auditing. This will not change following the approval of the proposed modification.

A number of requirements are applied to new wind farm projects regarding auditing and compliance particularly in relation to noise including:

- Conditions of consent will require the applicant to prepare and submit a Noise Compliance Report within 12 months of the commencement of operation of the wind farm
- Noise monitoring must be undertaken during ‘worst case’ periods (which would include during any temperature inversions).
- Special audible characteristics such as excessive amplitude modulation (including the van den Berg effect) together with cumulative impacts must also be considered.
- The proponent must make the noise compliance report publicly available.
- Neighbour can write to the Director General of the Department of Planning and Infrastructure to request independent noise monitoring at their house.

All monitoring and compliance regarding noise emissions resulting from the proposed modification are discussed in Section 5.3 of this document.

5.12 Council planning controls

The proposed modifications are compliant with the council LEP and generally compliant with the Wind Power Generation DCP. Any inconsistencies with council planning controls are the result of the approved wind farm and are not due to the proposed modifications. Please refer to Section 0 and 4.2.2 for details of compliance with the LEP and DCP respectively.

5.13 Greenhouse issues

The installation of larger turbines is not expected to significantly increase the amount of greenhouse gasses generated during construction of the wind farm.

The Clean Energy Australia Report 2012 by the Clean Energy Council (CEC 2012) provides a brief summary on the displacement of greenhouse gases through efficient wind energy production:

As more wind capacity penetrates the grid, the emission intensity of electricity production delivered via the grid falls because the new zero emission wind capacity, which has very low marginal cost, displaces emission producing thermal capacity, which is either coal-fired, gas-fired or distillate-fired. The type of thermal plant that is displaced by wind capacity, also known as the marginal plant, has a large impact on the resulting emission savings since the various thermal plants have very different emission intensities. For example, coal-fired plant burning brown coal produces emissions at the rate of 1.2 t CO₂e/MWh to 1.6 t CO₂e/ MWh, whereas the latest combined cycle gas turbine (CCGT) plant produces emissions at a rate of about 0.4 t CO₂e/MWh. The abatement intensity of new wind capacity could therefore vary by a factor of 3 or 4, depending on which plant in the system is marginal.

Table 5.5: Average abatement achieved by 100 MW wind farm at 35% capacity factor in NSW (CEC, 2012)

Region	Abatement Intensity (t CO ₂ e/MWh)	Emissions Abated (t CO ₂ e p.a.)	Equivalent cars removed from road
NSW	0.89	273,900	63,700

The proposed modifications to install the ECO 122 turbines would ensure higher yields of wind energy were delivered to the grid than the approved wind farm. This would have a beneficial effect on the abatement of greenhouse gases associated with the project and the abatement of coal-fired electricity being drawn from the grid.

5.13.1 Estimate of greenhouse gas savings

The estimates in the original EA included a life cycle analysis conducted by reference to the Australian Greenhouse Office Emission Factors and Methods Workbook, European Wind Farm life cycle assessments and the typical equipment specifications for the project to determine the carbon dioxide equivalent emissions (CO₂-e). This assessment was completed for each phase of the wind farm's life cycle and the following results were obtained.

Table 5.6: Life cycle analysis to determine the carbon dioxide equivalent emissions (CO₂-e)

Process	Emissions (tonnes CO ₂ -e)	% of total
Development planning	5	0.01
Material manufacturing	25,195	68.74
Materials Transportation	243	0.66
Site preparation earthworks	122	0.33
Clearing of vegetation and loss of sink	0	0.00
On-site construction and assembly	13	0.04
Operations & maintenance	10,817	29.51
Decommission, dismantle and remove	258	0.70
TOTAL	36,653	100

For the purpose of this assessment, the more recent NSW Office of Environment and Heritage (OEH) online greenhouse gas (GHG) savings tool for wind farms has been utilised. The tool is available on the OEH website¹.

The tool estimates CO₂-e savings by the year 2020 based on the location and specifications of the wind farm. By calculating the emissions savings factor tonnes of (CO₂-e) per estimated energy output (MWh) employed by the OEH model and applying the capacity factor of the proposed turbines through each of the development phases, the GHG emissions savings were estimated. The emissions savings in for each of the development phases are outlined in the following table.

Table 5.7: Emissions savings in for each of the development phases

Parameters	2008 EIS 54 MW	2008 EIS 81 MW	2009 NSW LEC Approval	2013 Modification
Number of turbines	27	27	25	25
Turbine capacity (MW)	2	3	3	2.7
Capacity Factor	0.29	0.29	0.29	0.48
Total estimated annual wind farm energy output (MWh)	137,182	205,772	190,530	283,824
Estimated emissions avoided from 2015 - 2020 (tonnes of CO ₂ -e)	878,889	1,318,333	1,220,679	1,818,391
Estimated emissions avoided per year (tonnes of CO ₂ -e)	146,481	219,722	203,447	303,065
Equivalent average number of households per year	18,792	28,188	26,100	38,880
NOTE: - The NSW Office of Environment and Heritage (OEH) online greenhouse gas savings tool was calculated to use a capacity factor of 0.36. - It was estimated that the wind farm would become operational in the year 2015. - Average household electricity consumption is based on OEH estimate of 7.3 MWh annually per NSW home.				

¹ <http://www.environment.nsw.gov.au/climatechange/greenhousegassavingstool.htm>



5.13.2 Conclusion

The proposed use of the more efficient turbines which have a capacity factor of up to 48% would account for an estimated annual CO₂-e saving of almost 100,000 tonnes or an estimated saving of almost 600,000 tonnes of CO₂-e from 2015 – 2020. The proposed selection of these turbines would also allow for the supply of electricity to an estimated additional 12,780 homes per year.

The amount of GHG emissions saved by NSW wind farms will also depend on whether or not the Federal Government introduces an emissions trading scheme or carbon tax. It will further depend on whether or not a carbon price is a floating or fixed carbon price in line with that of the European Union (EU).

This is because it would require generators to pay for their greenhouse gas emissions. For instance, as gas fired electricity generation has fewer emissions than coal fired generation, it will start to become more cost-effective and displace coal-fired generation. In turn, wind farms would start displacing a greater proportion of output from gas fired plants relative to coal fired plants.

Consequently, if a carbon price is not implemented through a carbon pollution reduction scheme (CPRS) or an alternative emission trading scheme or carbon tax, the greenhouse gas abatement from NSW wind farms would be even greater than current projections.

5.14 Traffic and access

A desktop assessment for the on- and off-site roads and intersections identified along the preferred transport route described in the 2009 EA was undertaken. A Swept Path Assessment was also undertaken for key intersections and roads along the preferred transport route. The Traffic Assessment report is included in Appendix G.

5.14.1 Route assessment

Figure 5.3 shows the preferred transport route to the proposed Glen Innes Wind Farm site along the Gwydir Highway and Figure 5.4 illustrates the preferred transport routes through the township of Glen Innes. These routes were in the original EA.

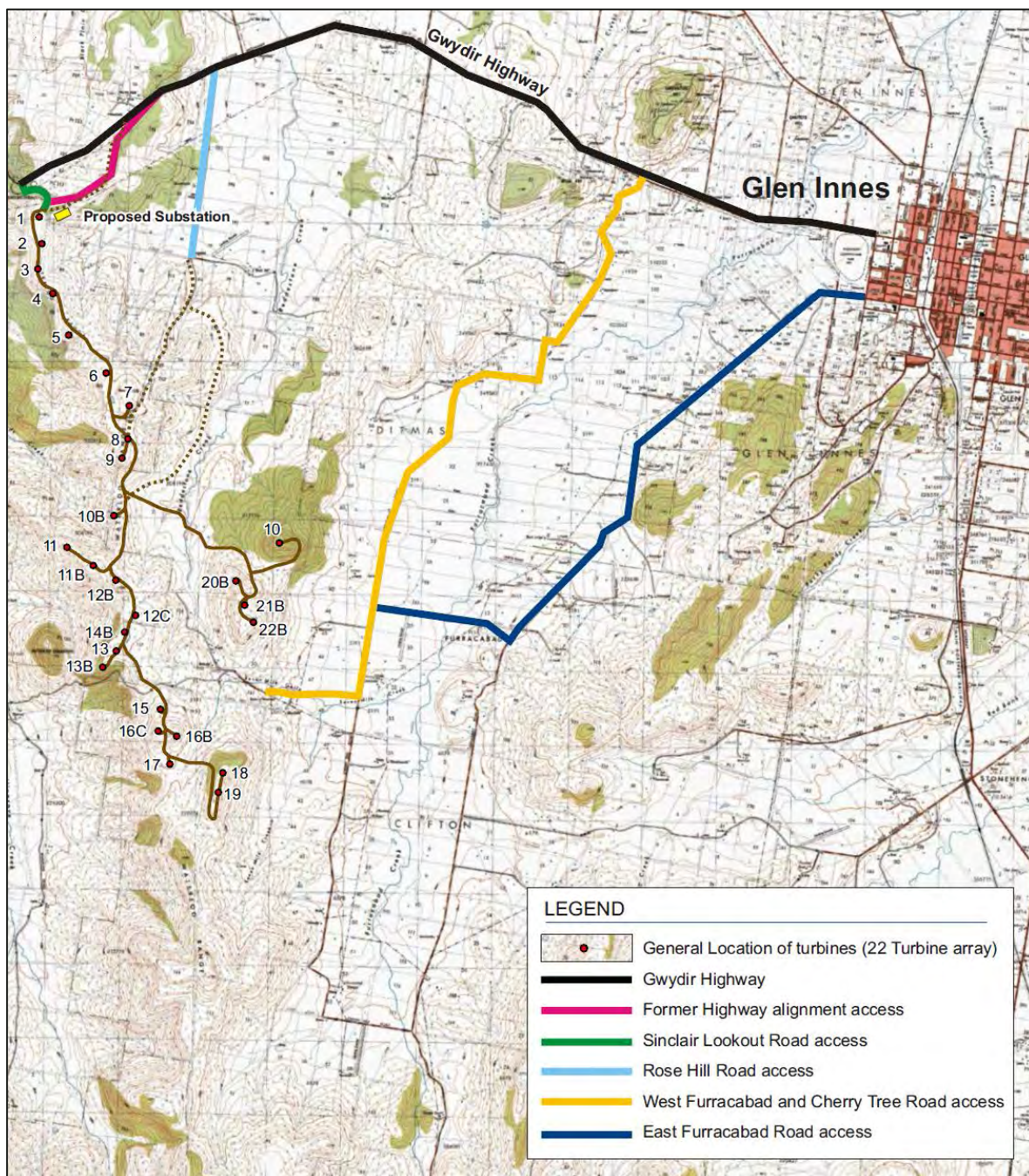


Figure 5.3: Transport option routes



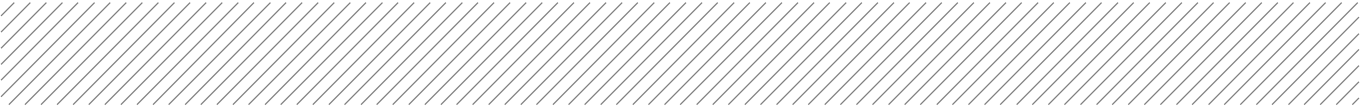
Figure 5.4: Glen Innes township transport route option

Off-site route assessment

Public roads and intersections that make up the preferred transport route are considered off-site routes and consist of, but are not limited to, the following:

- New England Highway
- Gwydir Highway
- Grafton Street
- Coronation Avenue

The assessment has identified a number of kerbsides, bridges, islands, roundabouts and road conditions that would be considered when the final routes are determined and when the Traffic Management Plan is prepared.



On-site route assessment

As the preferred transport route departs the Gwydir Highway, the proposed access road leading to all the wind turbine locations is considered on-site routes. ALSTOM WIND has provided an Installation Instructions document for the construction of on-site access tracks, which is included in Appendix G. The recommendations would be considered during detailed design and construction of the on-site access tracks.

5.14.2 Swept path assessment

To help determine the feasibility and accessibility of the wind turbine transport vehicles traversing the preferred route through the township of Glen Innes and accessing the wind farm site, Swept Path Assessments were undertaken. The swept paths were performed with the software package AutoTrack in AutoCAD using scaled aerial photography to simulate the turning manoeuvres and estimate their degree of sweep in relation to the surrounding road environment.

The swept paths help to understand the manoeuvring restrictions and requirements associated with the preferred transport routes. The report also assesses the swept paths for the transportation of the wind turbine blades which are the longest of the components to be transported.

Swept paths for the following intersections were undertaken:

- New England Highway/Grafton Street intersection
- Grafton Street/Coronation Avenue intersection
- Gwydir Highway/Coronation Avenue intersection
- New England Highway/Oliver Street intersection
- New England Highway/Meade Street intersection
- New England Highway/Gwydir Highway intersection
- Gwydir Highway/Grey Street intersection
- Former Gwydir Highway access intersection

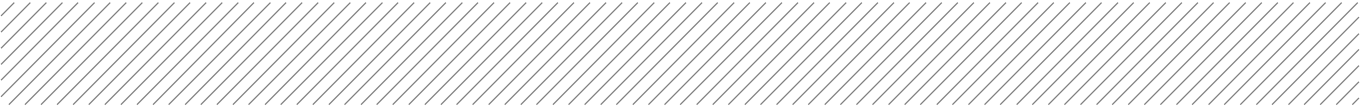
5.14.3 Conclusion

This assessment has taken into account the larger wind turbine components, the potential transport vehicle required to transport them and the constraints in their manoeuvres. The desktop assessment evaluated the subject roads and intersections via aerial photography and mapping to assist in identifying key locations that would warrant further detailed investigations.

While assessing the potential impacts of transporting the larger turbine components, it was recommended that a swept path analysis be undertaken to confirm the route that was previously approved. No swept path assessment was undertaken as part of the 2009 EIS, although potential impacts along the route were identified.

Following the swept path analyses results as part of this assessment, no additional traffic and transport impacts have been identified, to those previously identified from the 2009 EIS. The Swept Path Assessment as part of this report has identified key locations along the preferred transport route where manoeuvring constraints for the transportation of the wind turbine components will be experienced, but measures to mitigate these potential impacts have been outlined below. These impacts would be considered temporary.

In light of the proposed modifications to use larger wind turbine components in comparison to the approved conditions, the preferred transport route and wind farm site access via the former Gwydir Highway, as previously established, remains unchanged.



It is also noted that the recently approved Sapphire Wind Farm is located 28 km east of Inverell and 18 km west of Glen Innes. The approval allows for up to 159 turbines with a maximum height of 157 m, turbines which are 7 m taller than those proposed for the modification for Glen Innes. The approved transport route for the larger Sapphire Wind Farm turbines includes a route through Glen Innes and along the Gwydir Highway and as such is similar to the route selected to transport the turbines to Glen Innes.

A comprehensive Traffic Management Plan will be prepared in consultation with the relevant authorities prior to the transportation of turbine components.

5.15 Telecommunications interference

The approved wind farm is within an area classed as a Low Density Geographic Location. As with other large structures, wind turbines have the capacity to interfere with radio frequency signals by scattering the signal due to both forward and backward reflections. The services that could theoretically be affected by wind turbines include aircraft navigation systems, radio signals, television signals and microwave links.

During site investigations for the 2007 Environmental Assessment, mobile phone coverage was observed to be available for elevated locations on Waterloo Range and most areas between Waterloo Range and Glen Innes. However, coverage was absent or intermittent in the valleys to the west of the wind farm site. In view of the separation distance between the base antennas and turbine structures and the wind farm location relative to areas of existing coverage, transmission of mobile phone signals were not deemed to be significantly affected by the approved wind farm.

The potential for interference to the above point to point microwave transmission services as a result of the approved wind farm appears to be low due to:

- the location of the two transmitter/receiver facilities being close to the wind farm site which means that the potential interference zone either side of the transmission path is narrow
- the direction of transmission does not pass through the turbine array, or more specifically, the area swept by any of the turbine blades

The rotating blades of a wind turbine can cause interference to the visual portion of a television signal and in some cases may mean that there is no viewable image. As part of the Conditions of Consent, GIWF is required to negotiate with impacted landowners about installing and maintaining a satellite receiving antenna if their television and radio interference is the result of the operational wind farm and mitigation measures cannot resolve the problem.

5.15.1 Conclusion

The proposed modifications are unlikely to have adverse impacts on the interference of television and radio communications compared to the approved wind farm. The primary factor affecting signal interference is this location of turbines. The proposed modifications are considered to be substantially the same development and therefore no additional impacts were identified.

GIWF has consulted with NBN and has agreed to commit to undertake monitoring of digital interference prior to construction and prior to commencing operation of the wind farm. This will enable an assessment of the potential impacts of the wind farm following construction and what mitigation measures will be required if there is an impact. NBN has confirmed with GIWF that this monitoring and assessment is appropriate and acceptable to them.

5.16 Geology, topography and soils

5.16.1 Topography

The approved wind farm is located within the New England Region of New South Wales and on the Waterloo Range approximately 12 km west of Glen Innes. This range is approximately 1200 m above sea level (ASL) and provides suitable topography for generating wind power with turbines. Overall, the topography in the region decreases in height from the elevated Ben Lomond tableland 10 km to the south of the wind farm site (approximately 1400 m ASL) to the Wellingrove Creek Valley approximately 4 km west of the site (approximately 950 m ASL).

5.16.2 Geology

The geological domain is referred to as the New England Fold Belt, which extends from the Hunter Valley in the south northward into Queensland. Major faults and fractures divide the Belt into distinct blocks, the Glen Innes area being the central block which is overlain by Tertiary volcanic rocks and in the lowland areas, Quaternary sediments.

The wind farm is located along the part of the New England Fold Belt known as the Waterloo Range. This range is within a geological domain comprising extensive cover of Tertiary basalt rocks. Underlying rocks include the Emmaville Volcanics a sub group of the Late Permian Wandsworth Volcanics.

Initial geotechnical field assessments revealed some variability in rock characteristics but no obvious geotechnical constraints that would preclude the proposed modification. Further geotechnical assessment will be undertaken prior to finalising the project design.

5.16.3 Soils

Alluvial sediments mainly derived from volcanic rocks are present in the valleys along water courses.

The whole of the wind farm site is represented by Tertiary basaltic rocks that have been subject to varying degrees of weathering. Weathering of the basaltic rocks has resulted in red brown and black soils. The weathering process has resulted in the formation of broad flat alluvial soil deposits in the valleys of the creeks that surround the project area.

The substation and proposed turbines will be predominantly located on Chocolate-Prairie soils on the upper slopes of basaltic knolls and ridges. The Chocolate-Prairie soil types, which cover a high proportion of the wind farm site, have a low to moderate potential for sheet erosion. Observations of slopes in these areas indicate reasonable stability and resistance to erosion. In general, the project will involve limited extent of disturbance of the slopes. Given the nature of the construction works, comprehensive controls to minimise erosion will be applied to limit any potential for erosion.

5.16.4 Conclusion

The proposed modifications are considered substantially the same development and therefore no additional impacts on soils were identified.

The current consent conditions are adequate to ensure soils are appropriately managed during all stages of the project.



5.17 Air quality

The existing air quality in the Glen Innes-Severn Shire can vary with the seasons in response to windy and dusty conditions and events eg bushfires. Visibility can be affected under severe climatic conditions such as low cloud cover on the ranges and fog and mist in the lower areas.

The construction stage involves a significant amount of earthworks and the transport of large amounts of equipment and materials to the site. Due to the small areas of earthworks required for the wind farm relative to local rural activities, dust generation is likely to be relatively minor compared to agricultural activities in the broader area. There will be low to moderate vehicle emissions during this stage as construction vehicles will be moving around the site regularly.

5.17.1 Conclusion

No additional air quality impacts were identified as a result of the proposed modifications. Any potential impacts will be managed by the control measures specified in the original EA and do not require further assessment.

5.18 Water supply and water quality

The wind farm is located on the Waterloo Range within the Border Rivers-Gwydir catchment (Severn River sub catchment). Drainage of the wind farm site is to Wellingrove Creeks, Boyd Creeks, Furracabad Creek, Reddestone Creek, Plain Black Creek Catchment and subsequently to the Severn River.

Observations in 2007 indicated that no significant groundwater resources are present in the elevated ridges of the Waterloo Range and springs are not active at the wind farm site. The surface waters of the wind farm site do not supply drinking water for humans in the immediate vicinity of the project area and the ridges on which the proposed turbines will be located have no permanent watercourses. Creek crossings will be constructed where access roads cross watercourses at the site to ensure access is available during wet weather periods.

5.18.1 Conclusion

The proposed modifications will not have adverse impacts on water supply or water quality compared to the approved wind farm. The proposed modifications are considered substantially the same development and therefore no additional impacts were identified.

5.19 Heritage

5.19.1 Indigenous heritage

The assessment of the indigenous archaeology of the Glen Innes Wind Farm site was undertaken by McCardle Cultural Heritage in conjunction with the Glen Innes Local Aboriginal Land Council (GILALC) in 2007. The assessment covered all of the area proposed for the approved project.

The 2007 survey covered the whole project area and targeted areas proposed as turbines sites, the substation site, routes for access tracks, cable routes and grid connection to the existing 132 kV transmission line. It aimed to cover all representative landforms focusing on areas of high to moderate potential archaeological sensitivity where, based on the predictive model, archaeological sites are most likely to occur, and areas of greatest ground surface visibility. Two GILALC representatives were involved throughout the survey work to ensure GILALC had an appreciation of the full project.

Despite extensive survey of the project area only a single isolated artefact was located. No areas of Potential Archaeological Deposit (PAD) have been identified.

A Section 90 Aboriginal heritage impact permit under the NP&W Act is not required prior to works due to the project being assessed under Part 3A of the EP&A Act. However, if any cultural materials are uncovered during the works, work in that area is to stop and the Department of Environment and Climate Change (DECC) and qualified archaeologist notified.

The assessment by McCardle Cultural Heritage concluded that no potential archaeological deposits were identified and given the extent and content of sites based on visible artefacts, it is unlikely that subsurface materials will exist in areas of least disturbance across the study area.

Desktop Review 2013

An updated desktop search for Indigenous heritage items was conducted to ensure there were no sites of Aboriginal Heritage registered at or around the wind farm since the project was approved. The search was conducted on 24 June 2013 at four lot and DPs within the project area with a buffer of 1 km using the Aboriginal Heritage Information Management System (AHIMS) database². This revealed that zero Aboriginal sites are recorded in or near the area where the works will take place (Appendix H).

Table 5.8: AHIMS 2013 search results

AHIMS Database Search	Specifications	Results
Lot 1332 DP1004132	1 km radius	0 Aboriginal sites or places have been declared in or near the above location.
Lot 2 DP596311	1 km radius	0 Aboriginal sites or places have been declared in or near the above location.
Lot 90 DP753319	1 km radius	0 Aboriginal sites or places have been declared in or near the above location.
Lot 2 DP562615	1 km radius	0 Aboriginal sites or places have been declared in or near the above location.

Native Title NC98/17

A search of the Native Title Tribunal Claims Register in 2007 identified a single claim by the Nucoorilma Clan of the Gamilaaroy Aboriginal People that was filed on 07/07/1998 and accepted 13/12/2001. (Federal Court file no. NSD6106/98/Tribunal file no. NC98/17). The Native Title Claim covers a large area (14,490 km²) described as Bendemeer to Wallangra and spans the area from Glen Innes in the east to Warialda in the west. It covers Seven Local Government Areas including the western part of the Glen Innes Severn Shire. The area of the claim includes the wind farm site.

Under the *Native Title Act 1993* developers are required to negotiate with native title holders and others with a potential interest in the land before commencing any development. Native title holders do not have the power to veto developments; instead they have a right to negotiate. The outcome of successful negotiations may take the form of Indigenous land use agreements (ILUAs). If the parties can't reach a negotiated agreement within certain time limits the issue can be subject to compulsory mediation and determination by the National Native Title Tribunal.

² <http://www.environment.nsw.gov.au/awssapp/>

Conclusion

The proposed modifications are considered substantially the same development and therefore no additional impacts were identified. The proposed modifications may require consultation with the Nucoorilma Clan of the Gamilaroi Aboriginal People prior to making a determination at the wind farm site.

5.19.2 Non-Indigenous heritage

There are no buildings within the vicinity of the project site that have been identified as having any heritage significance. Non-Indigenous heritage was assessed in the approved wind farm application. This noted the presence of the former Gwydir Highway alignment, the Ross Hill trigonometrical station and a rock cairn on rocky hillock south of (then) Turbine 12B. These are not identified as heritage items at present.

A search for Non-Indigenous heritage items was conducted on 24 June 2013 to ensure that all known heritage items are considered (Appendix H). Table 5.9 below demonstrates databases searched and the specifications used for each search as well as any results found.

Table 5.9 Databases and extents searched for Non-Indigenous heritage items

Database	Specifications	Results
EPBC Protected Matters http://www.environment.gov.au/epbc/pmst/	Beyond proposal extent	No Commonwealth heritage items. North East NSW RFA applies RNE – 1 indicative place
Australian Heritage Database http://www.environment.gov.au/cgi-bin/ahdb/search.pl	Searched by Glen Innes suburb	No heritage items located within close proximity to the proposal
State Heritage Register http://www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx	Searched by Glen Innes LGA	No State heritage items are located within close proximity to the proposal
Glen Innes Severn LEP 2012 http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+467+2012+cd+0+N	Searched using LEP 2012 maps	No heritage items or heritage conservation areas located within close proximity to the proposal.

Conclusion

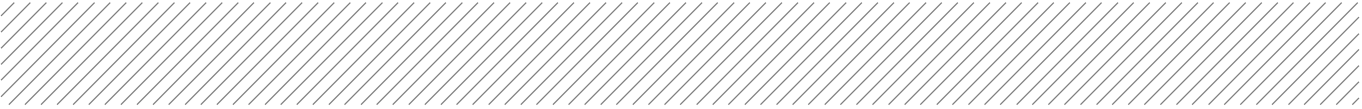
The proposed modifications are unlikely to have adverse impacts on any heritage items. The proposed turbines would be micro-sited within approved locations and these areas were previously assessed in the original EA.

5.20 Cumulative projects

Other wind farms currently in planning or development stages within the region include:

Modification to White Rock Wind Farm

The White Rock Wind Farm development was approved by the Department of Planning on 10 July 2012 to construct up to 119 turbines and associated infrastructure in the Northern Tablelands region of



NSW, 20 km west of Glen Innes and around 500 km north of Sydney. The proponent for the project is White Rock Wind Farm Pty Ltd, a wholly owned subsidiary of Epuron.

The proposed modification is an alternative 132 kV powerline route from the wind farm site and an alternative substation location adjacent to TransGrid's 330 kV transmission line which is approximately 13 km west of the White Rock Wind Farm site. The proponent is currently reviewing submissions for the modification application.

Sapphire Wind Farm

A recommendation by the Department of Planning was made for Sapphire Wind Farm and the Director-General's Environmental Assessment Report was released in June 2013 and the project approved on 26 June 2013. Sapphire Wind Farm Pty Ltd proposes to construct and operate the Sapphire Wind Farm, consisting of up to 159 wind turbines with a maximum installed capacity of 319 MW. The approval allows for turbines with a maximum height of 157 m, which are 7 m taller than those proposed for the modification for Glen Innes. The site is located in the Kings Plains, Wellingrove and Sapphire areas, approximately 28 km east of Inverell and 18 km west of Glen Innes. The project is estimated to produce approximately 999,363 MWh per annum, which would provide power for an estimated 136,899 homes in NSW.

The project is also a 'controlled action' under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and has been assessed under an accredited assessment process between NSW and the Commonwealth. However, the Commonwealth Minister for the Environment maintains a separate approval role for the project. The Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) determined that the proposed modification is a "controlled action" under the Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act).

The project will be assessed by way of accredited assessment process under section 87 of the EPBC Act. The accredited assessment process for the proposed modification is Part 3A of the New South Wales Environmental Planning and Assessment Act 1979. The construction phase of this project is estimated to begin in late 2013 and take approximately 12-18 months to be completed mid-2015.

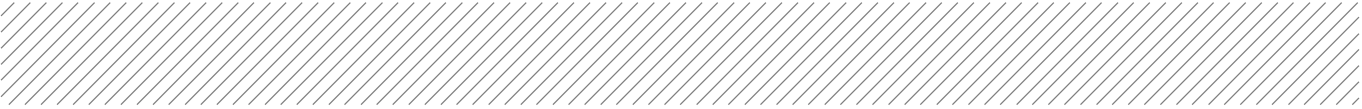
Deepwater Wind Farm

Director-General requirements were issued on 19 February 2013 for Deepwater Wind Farm within the Glen Innes Severn Council LGA. The Project is approximately 35 km north of Glen Innes and approximately 6 km south east of the township of Deepwater. The Project would involve the construction, operation and maintenance of up to ten wind turbines, together with the ancillary structures, access tracks and electrical infrastructure required to connect the project into the existing electricity network.

The wind turbines would be connected by a series of underground power cables and via a 2.5km overhead power line to a substation which will be located at the connection point to the existing 132kV TransGrid transmission line. Pending the preparation of an Environmental Assessment and lodgement of a Major Project application, this project could potentially be approved and begin construction in 24 months' time.

Glen Innes Aerodrome

A Development Application for Glen Innes Aerodrome was approved by the Joint Regional Planning Panel on 12 December 2012. The Project is to build an aviation training college complete with accommodation, teaching facilities, dining and recreation facilities and subdivide the land into three lots.



The Glen Innes aerodrome is approximately 10 km north east of the proposed wind farm site and is operated by the Glen Innes Severn Council.

Ben Lomond Wind Farm

The Ben Lomond Wind Farm Part 3A Major Project development has been revoked and is no longer a potential cumulative impact to the project



6 Conclusion

The proposed modifications involve provision for the installation of more efficient turbines at the wind farm. The proposed additional turbines will have an increased hub height from 80 m to 89 m and increased blade tip height from 130 m to 150 m. The blade swept area will increase by 52%.

The revised layout will include micro-siting of two of the approved turbine location. This is permissible within the guidelines of the *Draft NSW Planning Guidelines for Wind Farms*. The areas that will be impacted by the revised layout were previously assessed in the field for the original environmental assessment submitted in 2008 for the approved project. There are no additional impacts predicted as a result of the micro-siting of these two turbines.

The proposal to increase the envelope of approved turbines to include the more efficient turbines, which are now available, is within the approved capacity range. This environmental assessment has shown that there is no significant change to the environmental impacts predicted for the approved wind farm.

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