Chapter 1

Introduction

CHAPTER 1 – INTRODUCTION

1.0 INTRODUCTION

This Environmental Assessment (EA) has been prepared by MasterPlan SA Pty Ltd on behalf of the proponent, Bodangora Wind Farm Pty Ltd, for the proposed development of a wind farm and ancillary infrastructure at Bodangora, in the Central Western Region of New South Wales.

This EA supports a Project Application lodged by the proponent under the Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 14 October 2010.

On 16 June 2011, the NSW Government introduced the *Environmental Planning and Assessment Act (part 3A) Bill 2011*, which will change the framework for assessment for similar projects, whereby major projects are now 'called in' for classification by the Minister and the Planning Assessment Commission as State Significant Development. The Bodangora Wind Farm project was declared a major project on 3 August 2010.

On 12 November 2010, the Director-General of the Department of Planning prescribed the specific requirements for the scope and content of the Environmental Assessment. Supplementary Director-General's Requirements for the project were prescribed on 16 August 2011. Both Director-General's Requirements for the project are contained in **Attachment A** to this document.

Correspondence from the Director-General dated 18 April 2012 outlines further requirements for the project pursuant to the Draft NSW Wind Farm Planning Guidelines (refer **Attachment B**). An assessment has been made of the key provisions of the Guidelines which need to be adopted in applications for which the Director-General's Requirements have been issued but where the project has not yet been exhibited. This is provided in **Attachment C**.

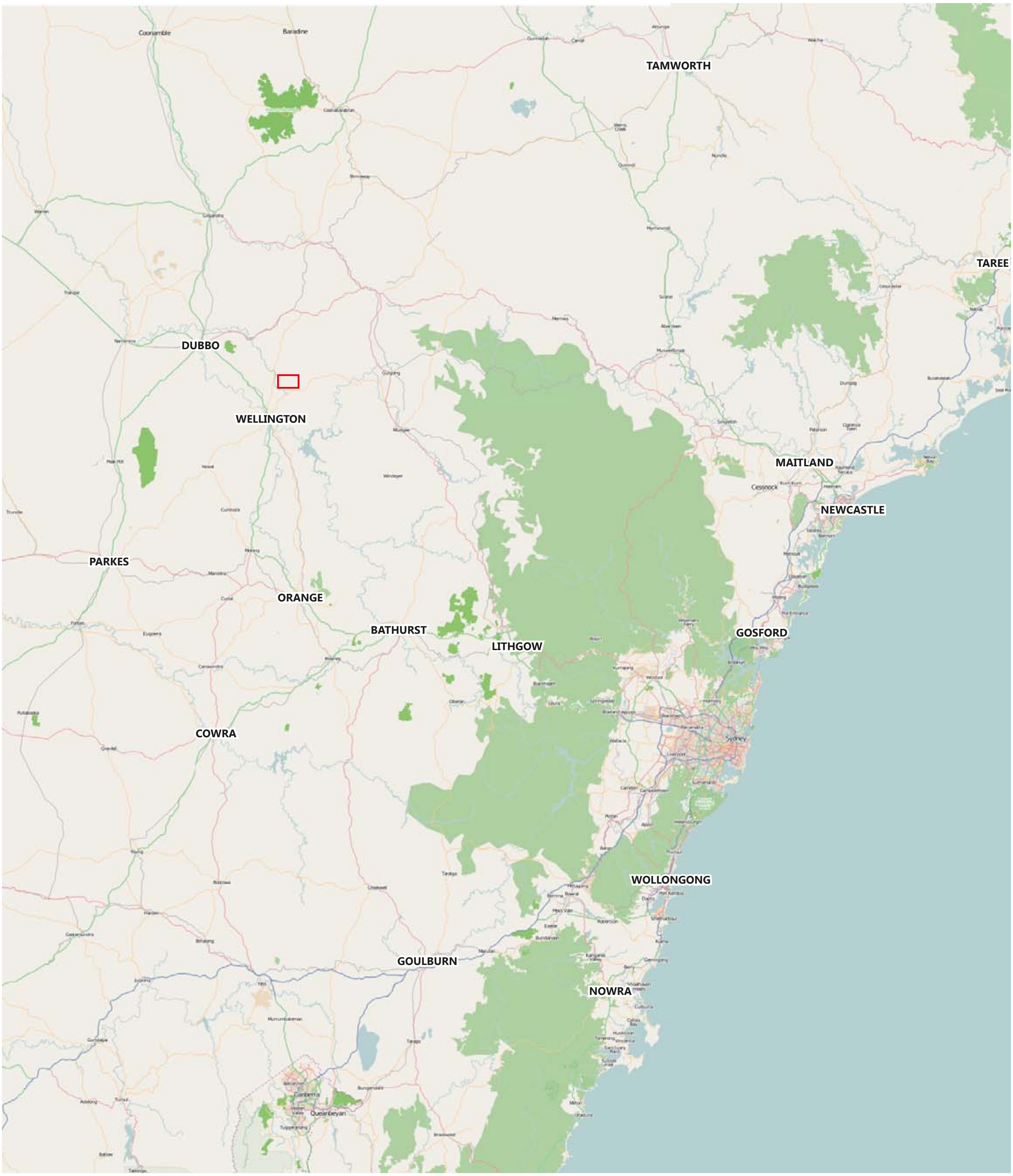
The EA has been prepared on the basis of the Director-Generals Requirements, including providing a description of the project, the existing environment and planning and environmental context for the assessment of the project, assessment of the potential impacts of the project and the measures proposed to mitigate those impacts. This document also outlines the strategic justification for the project and the consultation undertaken.

1.1 PROJECT LOCATION

The proposed development is located in Central Western NSW, between 40 and 60 kilometres south-east of Dubbo, and approximately 20 kilometres north-east of Wellington, as identified in Figures 1.1 and 1.2. The project area, including all project infrastructure elements and grid connection is situated wholly within the Wellington Council.

The project area spans over an area of approximately 18 kilometres from east to west and 12 kilometres from north to south. The project area comprises the land owned by a total of eight individual, private land owners. Currently, the primary use of the land is for sheep and cattle purposes. The surrounding locality also contains a number of rural residential dwellings. All dwellings within the project area have a lease or agreement with the proponent for the development.

Existing features within the project area include the 132kV Wellington – Beryl transmission line, and the 330kV Wellington – Wollar transmission line.



Project Area

Figure 1.1
Location

BODANGORA WIND FARM

0 40Km

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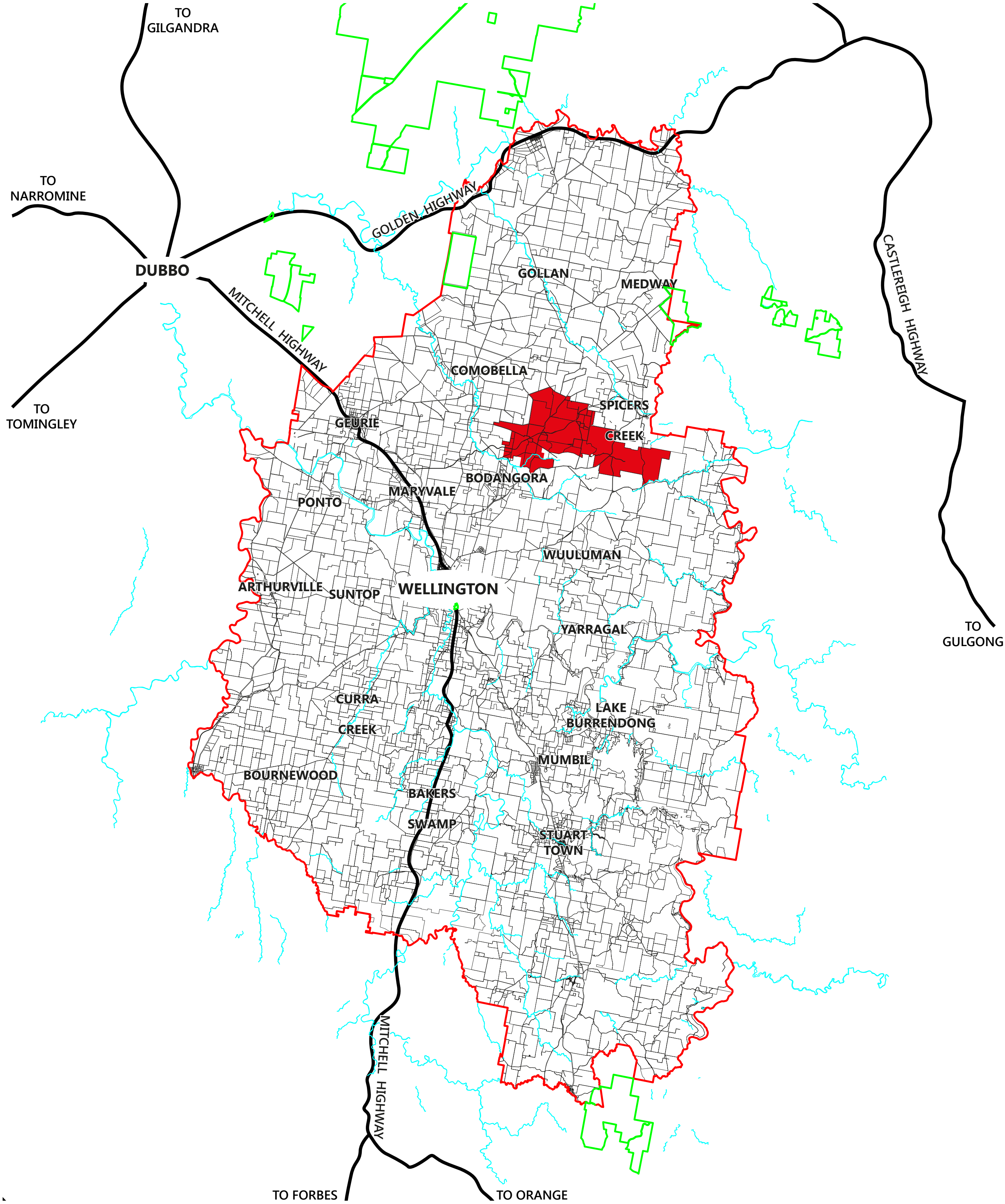

Project Area
Wellington Council
Watercourse
Highway
National Park or Conservation Area

0 10Km

Figure 1.2
Project Area

BODANGORA WIND FARM

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1.2 PROJECT OVERVIEW

The proposed wind farm will involve the construction and operation of up to a maximum of 33 wind turbines, each with a generation capacity of between 2.0 and 4.0 MW and a total installed capacity of up to 120 MW depending on the turbine model selected and the total number of turbines installed.

The maximum height of each turbine is 150 metres to blade tip. Turbine components include towers, footings, rotor, blades and nacelle, and all components are finished in a matte off-white colour. A local generator transformer may also be located at the base of each turbine.

The turbines are proposed to be located at elevations between 480 to 640 metres above sea level. The development will occupy only a small part of each property, and the existing land use will be preserved. The wind farm has been designed to provide the optimum electrical output. Specific changes to the wind farm layout have occurred as a result of the investigations and consultation.

Ancillary items to the project include the following:

- a 33/132 kV substation plus switchyards and transformers to provide connection to the existing TransGrid 132kV Wellington - Beryl transmission line, located in the south-eastern part of the project area, this will include an operation and maintenance centre;
- approximately 39 kilometres of new and upgraded access tracks;
- approximately 37 kilometres of underground (or overhead) 33kV cabling to provide connections between the wind turbines within the project area, located along access track corridors as far as possible;
- a 5.8 kilometre overhead (or underground) 33kV transmission line, providing connection between the wind farm and the proposed substation; and
- temporary and permanent wind monitoring masts.

Construction for the project is proposed for a period of 18 – 24 months, will involve approximately 70 to 80 staff working on-site at any one time, will include temporary features of a construction compound and layout area, and a site office. Following construction, all temporary facilities will be removed and all disturbed areas restored and revegetated.

Figure 1.3 provides the spatial context for the described project elements. A detailed description of the project is provided in Chapter 3 of this EA.

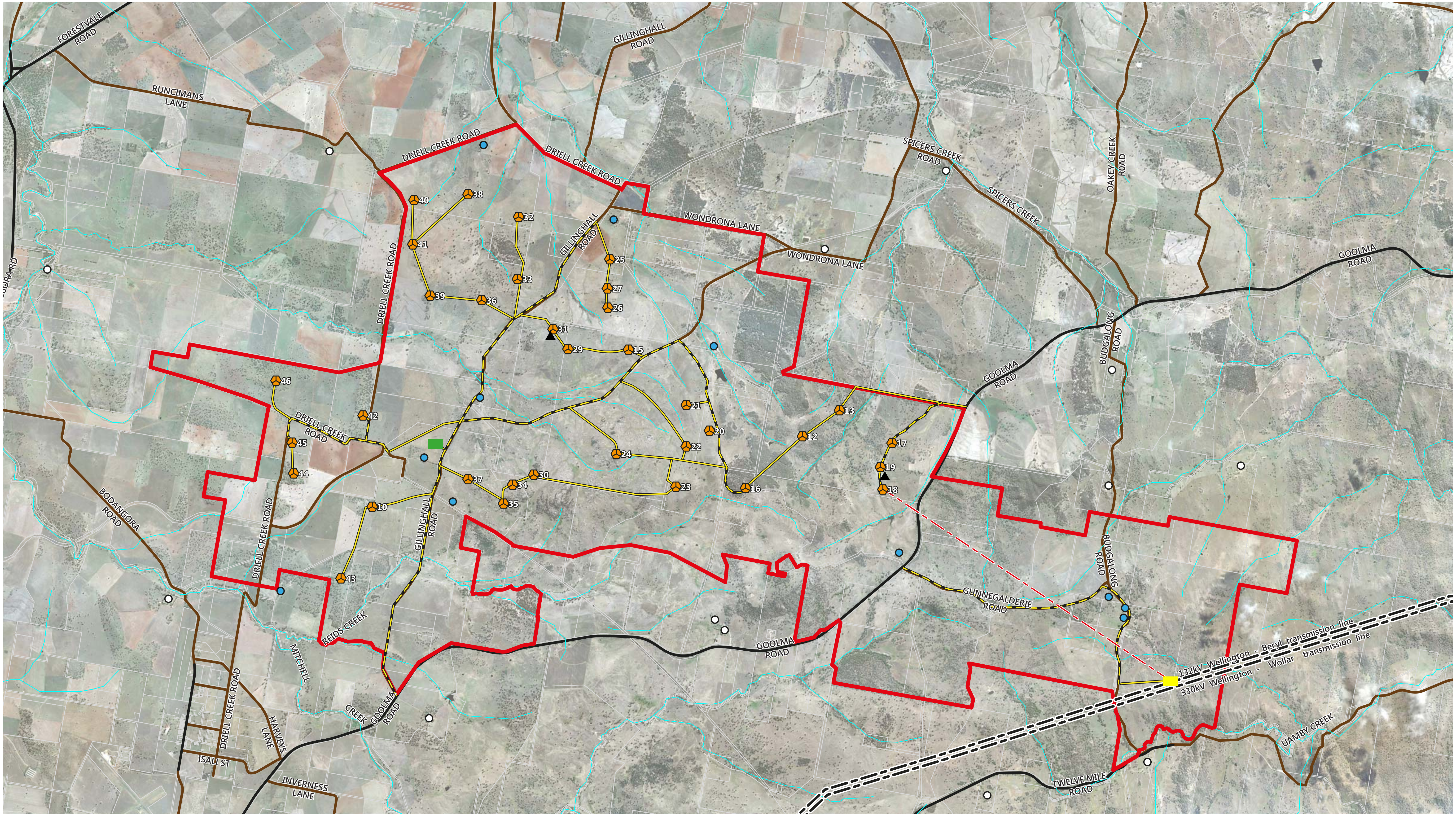
1.3 PROJECT TIMING

Subject to gaining the necessary approvals, Table 1.1 outlines the likely timetable for construction and operation of the Bodangora Wind Farm.

Table 1.1 – Project Timing

PHASE	DURATION
Pre-construction, project planning and construction certificate approval	3 months
Construction	18 months
Commissioning	3 months
Operation	25 years
Maintenance	Periodic and as required
Decommissioning or replacement	At completion of project life

Whilst the Project Application is being assessed, Bodangora Wind Farm Pty Ltd will continue to review the suitability, availability and pricing of equipment and undertake minor and detailed design. Following determination of the Project Application, Bodangora Wind Farm Pty Ltd will undertake a tender process to confirm the equipment supplier and involved contractors, pre-construction arrangements and development of the Construction Environmental Management Plan (CEMP), and the construction phase of the project.



Project Area	Existing transmission lines
Turbine locations	OHV Cabling
Dwelling (Land Owner Agreement)	Major road
Dwelling (Neighbour)	Minor or unsealed road
Substation	Proposed new access tracks
Construction site office and laydown area	Existing access roads to be upgraded
Existing wind monitoring mast	Note: 33kV cabling to run adjacent tracks / roads

1:60000 @ A3

0 1Km

Figure 1.3
Project Overview

BODANGORA WIND FARM

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1.4 PROPONENT DETAILS

Bodangora Wind Farm Pty Ltd, is the proponent of the project. This company is formed for the explicit purpose of the development. Infigen Energy Development Pty Ltd (Infigen Energy) is the parent company of Bodangora Wind Farm Pty Ltd and is managing the design, contractual and financial matters for the development.

Infigen Energy is involved with the development of new power generation capacity sourced from renewable energy sources, and develops and operates a number of commercially viable renewable energy projects. Infigen Energy is currently the largest owner of wind farms in Australia. Other projects include the following:

- Alinta (WA), 54 turbines, 89 MW generation capacity;
- Lake Bonney 1 (SA), 46 turbines, 80 MW generation capacity;
- Lake Bonney 2 (SA), 53 turbines, 159 MW generation capacity;
- Lake Bonney 3 (SA), 13 turbines, 39 MW generation capacity;
- Capital (NSW), 67 turbines, 140 MW generation capacity; and
- Woodlawn (NSW), 23 turbines, 48 MW generation capacity (currently under construction).

Together Infigen Energy's turbines generate around 1,600,000 MWh of clean, pollution free energy, enough to power 300,000 Australian homes.

Bodangora Wind Farm Pty Ltd has entered into leases and agreements with the land owners of the properties within the project area. The leases and agreements provide the consent for the lodgement of the Environmental Application, and to allow for the construction, operation and decommissioning of the wind farm. As described within this EA, Bodangora Wind Farm Pty Ltd has developed the wind farm layout in close consultation with the land owners within the project area.

1.5 PROJECT CONTACT

The contact details for the Bodangora Wind Farm are listed in Table 1.2.

Table 1.2 – Contact Details for Bodangora Wind Farm

	BODANGORA WIND FARM PTY LTD	DEPARTMENT OF PLANNING
Contact	Frank Boland	Department of Planning – Major Project Assessments Branch
Phone	(02) 8031 9914 0423 778 125	(02) 9228 6111
Facsimile	(02) 9247 6086	(02) 9228 6191
Email	frank.boland@infigenenergy.com	Website: www.planning.nsw.gov.au
Address	Level 22, 56 Pitt Street, Sydney NSW 2000	GPO Box 39, Sydney NSW 2001

1.6 CONTRIBUTORS AND PROJECT PARTICIPANTS

The organisations involved in the project scoping, technical advice, assessment of impacts and the preparation of the EA for the Bodangora Wind Farm are shown in Table 1.3.

Table 1.3 – Contributors to the Bodangora Wind Farm EA

PROJECT COMPONENT	CONTRIBUTOR
Project management and initial project engineering	Bodangora Wind Farm Pty Ltd.
Wind farm design	Bodangora Wind Farm Pty Ltd, land owners, neighbours, authors of various technical and environmental investigations as listed.
Preparation of Environmental Assessment	MasterPlan SA Pty Ltd, Infigen Energy Pty Ltd.
General Environmental and Land Assessment	Department of Environment, Climate Change and Water. Copper Strike Limited.
Visual Assessment	Moir Landscape Architecture.
Flora and Fauna	General fauna and flora: Kevin Mills and Associates, Department of Environment, Climate Change and Water. Bat fauna: Greg Richards and Associates Pty Ltd.
Heritage	Aboriginal heritage: New South Wales Archaeology Pty Ltd, and non-Aboriginal heritage: New South Wales Archaeology Pty Ltd. Department of Environment, Local Aboriginal representatives, Climate Change and Water.
Noise	Sonus Pty Ltd.
Traffic and Transport	Infigen Energy Pty Ltd, Wellington Council, the Roads and Transport Authority.
Telecommunications	Lawrence Derrick and Associates.
Trigonometry Station Review	Land and Property Information (Department of Finance and Services).
Aviation Issues	Civil Aviation Safety Authority, Wellington Council.
Transmission connection	Bodangora Wind Farm Pty Ltd, TransGrid.
Community consultation	Bodangora Wind Farm Pty Ltd, land owners within and surrounding the project area, general community.

The proponent will engage contractor(s) to supply all required infrastructure and to construct the Bodangora Wind Farm. Infigen Energy have a range of preferred contractors for wind farm construction and the contractor will be selected through a tender process. The preferred contractors are familiar with construction and environmental issues and have well developed environmental management systems, which will be considered during the tender process.

Bodangora Wind Farm Pty Ltd will ensure that the contract specification addresses the 'Statement of Commitments' as provided in Chapter 19 of this EA, as amended, according to any conditions of approval. The contractor will be required to implement and comply with a Construction Environmental Management Plan (CEMP).

TransGrid are the owner and operator of the electrical infrastructure in the region of the wind farm, including the 132kV Wellington – Beryl transmission line of which is proposed for connection. Bodangora Wind Farm Pty Ltd will work closely with TransGrid to reach a suitable grid connection design. The grid connection is described in Chapter 3.

The output of the wind farm will be sold to the National Electricity Market, and will qualify for the creation of Renewable Energy Certificates that can be sold to liable parties under the expanded Renewable Energy Target Scheme. More information about the targets is provided in Chapter 2 of this EA.

1.7 DOCUMENT STRUCTURE

Table 1.4 provides an overview of the subject headings of the Director-General's Requirements, and the relevant chapter of this EA in which they are addressed. The EA has been prepared to address the Director-General's Requirements, findings of consultation with relevant authorities, land owners and the community, and the applicable environmental guidelines and legislation.

The location of each Technical Report prepared as part of this EA is identified in Table 1.4. Each chapter has been prepared to clearly state the potential impacts of the project and any measures proposed to be implemented for the mitigation in language which can be clearly understood by the general public. The supporting studies provide technical detail for assessment by the Department of Planning.

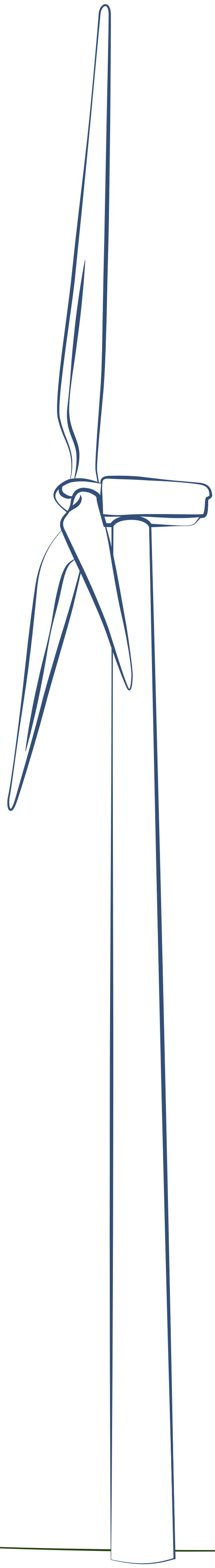
Table 1.4 – Overview of Director-General's Requirements and Relevant Chapter

CHAPTER	TITLE	DIRECTOR-GENERAL'S REQUIREMENTS	RELATED ATTACHMENTS
	Executive Summary	An Executive Summary to the EA.	
1	Introduction	An introduction to the project and this EA.	A, B and C
2	Project Justification	The strategic justification for the project.	-
3	Project Description	A detailed description of all project elements.	D and E
4	Project Area and Land Details	A detailed description of the land in which the project is located.	-
5	Approvals	Consideration of relevant statutory provisions and environmental legislation.	-
6	Consultation	An outline of the work undertaken in accordance with the consultation requirements of the project.	F
7	Planning Context	Assessment against the relevant statutory planning provisions and an assessment of the land use component of the strategic justification component for the project.	-
8	Visual Assessment	An assessment of the visual impacts of the project, and recommended mitigation.	G
9	Flora and Fauna	An assessment of the flora and fauna impacts of the project, and recommended mitigation.	H and I
10	Heritage	An assessment of the Aboriginal heritage impacts of the project, and recommended mitigation. Also an assessment of the non-Aboriginal heritage impacts of the project, and recommended mitigation.	J
11	Noise	An assessment of the noise impacts of the project, and recommended mitigation.	K
12	Traffic and Transport	An assessment of the traffic and transport impacts of the project, and recommended mitigation.	L
13	Telecommunications	An assessment of existing telecommunication services, the expected impact and mitigation measures.	M

CHAPTER	TITLE	DIRECTOR-GENERAL'S REQUIREMENTS	RELATED ATTACHMENTS
14	General Environmental Risk	An assessment of the water supply, water quality and waterways, as well as a general environmental risk analysis.	-
1	Hazards	An assessment of the hazard/risks of the project, and recommended mitigation.	-
16	Social and Economic Aspects	Consideration of the social and economic aspects of the project.	-
17	Cumulative Impact and Conclusions	A summary of the assessment of key issues and the overall impact of the project.	-
18	Statement of Commitments	Certification by the author for the information contained within this EA. A draft Statement of Commitments detailing measures of environmental mitigation, management and monitoring.	-

Chapter 2

Project Justification



CHAPTER 2 – PROJECT JUSTIFICATION

2.0 INTRODUCTION

As a significant infrastructure project, the Bodangora Wind Farm provides a worthy environmental initiative and represents an important contribution to renewable energy generation in New South Wales. The project provides additional generating capacity of approximately 333 Gigawatt hours (GWh) every year over the operating life of the wind farm. The wind farm will involve the application of renewable energy to the generation of electricity for use by electricity customers within the National Electricity Market.

Specifically, this chapter of the EA provides the following, as per the Director-General's Requirements (DGR's):

Director-General's Requirements:

> *"A strategic assessment of the need, scale, scope and location for the project in relation to predicted electricity demand, predicted transmission constraints and the strategic direction of the region and State in relation to electricity supply, demand and electricity generation technologies, and its role within the Commonwealth's Renewable Energy Target Scheme. The EA must clearly demonstrate that the existing transmission infrastructure has sufficient capacity to accommodate the project.*
>
> *A clear demonstration of quantified and substantiated greenhouse gas benefits, taking into consideration sources of electricity that could realistically be replaced and the extent of their replacement. Reference should be made to the Estimating Greenhouse Gas Emissions Abatement from Wind Farms in NSW (McLennan Magasanik Associates, July 2010, Report to the Department of Environment, Climate Change and Water (DECCW) and the associated NSW Wind Farm Greenhouse Gas Savings Tool developed by DECCW.*
>
> *Describe the alternatives considered (location and/or design (for all project components, and provide justification for the preferred project demonstrating its benefits including community benefits (for example community enhancement programmes) on a local and strategic scale and how it achieves stated objectives."*

The strategic assessment component of the DGR's also requires an assessment of the suitability of the project as a whole, with consideration of the surrounding land uses taking into account the local and strategic land use objectives. This has been undertaken within the Planning Context (Chapter 7) of the EA.

2.1 CONTEXT FOR WIND ENERGY DEVELOPMENT

2.1.1 Global Context

Increasing concerns about climate change globally arise from increasingly high levels of greenhouse gas emissions and the sustainable use of the world's finite resources of fossil fuels. There is a concerted global push to move to a more sustainable energy future. Part of this transition has included a substantive growth in wind energy's contribution across many parts of the world.

The Intergovernmental Panel on Climate Change (IPCC) assesses the scientific, technical and socio-economic information relevant for the understanding of risk of human-induced climate change. The Fourth Assessment Report (AR4) produced by the IPCC in 2007 reports comprehensive evidence of climate change, impacts and associated directions for mitigation of the social, environmental and economic costs. The Fifth Assessment Report (AR5) is currently under production and will be completed in 2013/2014, and will provide an update of knowledge found in the previous Assessment Reports.

The AR4 concluded that annual global greenhouse gas emissions have risen by 12.5 percent since 1990, and that the concentration of atmospheric carbon dioxide has reached the order of 390 parts per million in 2010, which has increased from the pre-industrial level of about 180 parts per million (an increase of 39 percent). The increase in atmospheric carbon is primarily due to the combustion of fossil fuels, coal, oil and gas.

Research by the World Resources Institute (WRI) has estimated two of the largest global sources of carbon dioxide are electricity and heat (32 percent) and transportation (17 percent) (*Climate Analysis Indicators Tool*, 2006).

Whilst the extent and consequences of climate change have been difficult to predict, research is shifting towards not whether climate change is or is not occurring, but the most appropriate mechanism to respond. It is generally agreed that a range of mechanisms will be required globally and locally to provide an effective response to climate change, such as a combination of the diversification of energy generation sources, improvements in electricity generation, demand management, and adaptation.

Wind power is recognised globally due to its proven technology and because it is less expensive compared to other forms of renewable energy, and accordingly has experienced strong growth globally. The Global Wind Energy Council (GWEC) have reviewed the growth in the wind power market, and despite a 38.3 GW increase in the world's wind power capacity during 2009 (a 31 percent increase from the previous year), during 2010, the overall growth decreased by 0.5 percent to a 38.3 GW growth. This decrease is generally attributed to the global financial crisis; however the outlook for 2011 is more optimistic. The largest contributors to the global wind capacity are China, the United States of America, Germany and Spain. Figure 2.1 provides the global cumulative installed wind capacity growth between 1996 and 2010.

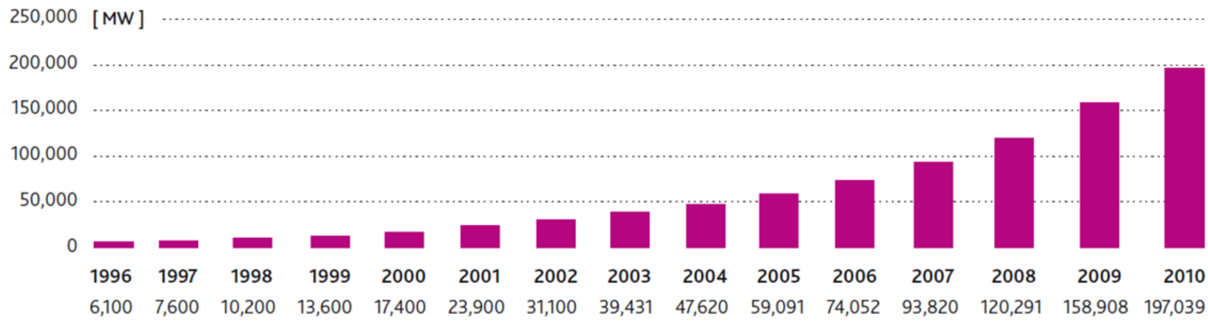


FIGURE 2.1 – GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 1996 – 2010. FIGURE SOURCED FROM GEWC, 2010 'GLOBAL WIND REPORT; ANNUAL MARKET UPDATE 2010'.

2.1.2 National Context

Australian Wind Context

Australia has a relatively small component of the global wind electricity, however is expected to play a major role in the transition to a low carbon economy. As identified by the GWEC, Australia has some of the best wind resources in the world.

At the end of 2010, the GWEC have identified that 1,880 MW of wind capacity was installed in Australia, consisting of 1,052 operating wind turbines in 52 wind farms. On average, the capacity has increased by 30 percent per year over the past decade. South Australia has the largest wind capacity in Australia, as evidenced in Table 2.1.

Table 2.1 – Installed Wind Capacity in Australia by State. Sourced from GWEC, 2010 'Global Wind Report; Annual Market Update 2010'

STATE	INSTALLED CAPACITY (MW)
South Australia	907
Western Australia	428
Victoria	202
Tasmania	187

STATE	INSTALLED CAPACITY (MW)
New South Wales	143
Queensland	12
Australian Antarctic Territory	1
Northern Territory and Australian Capital Territory	-
Total	**1,880**

The Australian Bureau of Agricultural and Resource Economics (ABARE) undertake resource and analysis in the areas of agriculture, resources and energy. The following table provides a breakdown of Australia's current and projected electricity generation, outlining that 93 percent of Australia's electricity was generated by finite resources in 2007/2008, with coal the most predominant source (72 percent). ABARE also predicts that national energy consumption is predicted to grow by 1.4 percent a year.

Table 2.2 – Primary Energy Consumption in Australia, Sourced from GWEC, 2010 'Global Wind Report; Annual Market Update 2010'

FOSSIL FUELS	2007/2008		2029/2030		AVERAGE ANNUAL GROWTH % 07/08 TO 29/30
	TWH	%	TWH	%	
Black coal	1,514	37	1,311	23	-0.8
Brown coal	610	11	452	6	-1.4
Oil	2,083	36	2,787	36	1.3
Gas	1,240	22	2,575	33	3.4
Sub-total	**5,447**	**95**	**7,125**	**92**	**1.2**

RENEWABLES	2007/2008		2029/2030		AVERAGE ANNUAL GROWTH 07/08 TO 29/30
	TWH	%	TWH	%	
Hydro	44	<1	46	<1	0.2
Wind	14	<1	160	2	11.6
Bioenergy	212	4	340	4	2.2
Solar	7	<1	24	<1	5.9
Geo thermal	<1	<1	20	<1	18.4
Sub-total	**277**	**5**	**590**	**8**	**3.5**
Total	5,724	100	7,715	100	1.4

As electricity generation contributes to a significant proportion of Australia's greenhouse gas emissions, there is considerable pressure for the electricity industry to reduce its contribution. A range of measures, including increased efficiency of generation, fuel switching, and increased renewable energy generation will need to be adopted to achieve a significant mitigation in the growth of greenhouse gas emissions from the electricity industry.

In addition, global markets for oil and gas have shown significant price volatility, drawing attention to the finite life of these resources. BP Global Energy Statistics released in June 2010 indicated that the projected life of global coal reserves has dropped from 192 years (as produced at the end of 2003) to 119 years (as produced at the end of 2009).

Australian Policy Context

Over the last decade, the Australian Government and electricity supply organisations have implemented a competitive electricity market named the National Electricity Market (NEM). The Bodangora Wind Farm will produce electricity for sale within the NEM.

The financial viability of renewable energy projects being able to participate in the NEM is supported by the Australian Government Renewable Energy Target (RET). The RET is a scheme which has been established to encourage additional generation of electricity from renewable energy sources to achieve a commitment of a 20 percent share of renewables in Australia's electricity supply by 2020. This equates to around 60,000 GWh of Australia's electricity supply to be generated by renewable sources by 2020.

The RET also places a legal liability on wholesale purchases of electricity (eg electricity retailers) to proportionally contribute to an additional 45,000 GWh of renewable energy each year.

The steep 'ramp up' profile of the requirements of RET up to 2020 and the significant lead time which is required to complete renewable energy developments and construction, requires the commencement of new projects in the immediate term.

The Australian Government is also currently working towards introducing either an Emissions Trading Scheme or a Carbon Tax which will assist in improving the competitiveness of renewable energy technologies on the market over time.

2.1.3 State Context

The NSW Government has an active programme to deliver reductions in greenhouse gas emissions. The following legislative and policy initiatives assist in reducing greenhouse gas emissions:

- *NSW 2010 – A Plan to make NSW number one* (2011) sets a target for achieving 20 percent renewable energy by 2020. Contributions to this renewable energy target will be through the promotion of energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources.
- The Greenhouse Gas Abatement Scheme which began in 1993 places a mandatory greenhouse gas reduction target on electricity retailers, with a benchmark target of a 5.0 percent reduction in the per capita greenhouse gas emissions from 1989 to 1990 levels set until 2021. This requires electricity retailers to either directly reduce emissions, to purchase emission reductions resulting in carbon sequestration, invest in renewable energy projects, or to reduce demand by promoting energy efficient measures.
- The Energy Savings Scheme, began in 2009 and requires liable entities (normally electricity retailers) to obtain Energy Savings Certificates to meet the Energy Savings Target. The Energy Savings Certificates Scheme was designed to complement the previously proposed Carbon Pollution Reduction Scheme.
- The Cabinet Office of the Government of New South Wales released the NSW Greenhouse Plan in 2005. The Plan has acknowledged the occurrence of climate change and its potential effects and provides a target for reductions to greenhouse emissions of 60 percent by 2050; and cutting greenhouse emissions to year 2000 levels by 2025. Strategies to achieve these targets include raising community awareness, introducing climate change adaption measures, and setting the state of NSW on the path of sustainable development.
- The NSW Government has also created the 'Sustainable Energy Development Authority' which has created the initiatives of 'Greenpower' and 'Energy Smart', as well as various initiatives to support wind energy development in New South Wales.

A clean energy future is identified as a key strategy in the actions in reducing greenhouse emissions. The proposed development is directly aligned with the NSW Greenhouse Plan and will provide a reliable, affordable and secure clean energy source for NSW.

2.1.4 Predicted Electricity Demand

New South Wales has a large electricity demand and a strong transmission system that has significant capacity to integrate a new renewable energy resource.

Information available from Transgrid's *Annual Planning Report* (2011) and the Australian Energy Market Operator's *Electricity Statement of Opportunities* (2011) both predict for a growth in demand for electricity beyond 2020, for electricity generated by wind farms to be an important part of the energy mix, and for new cleaner generation being required to replace older carbon intensive generation methods.

TransGrid's *Annual Planning Report* (2011) publishes energy and demand projections for the NSW region of the National Electricity Network. Figure 2.1 provides an indication of the aggregate summer peak demand of electricity and the expected growth in demand between 2011 and 2021.

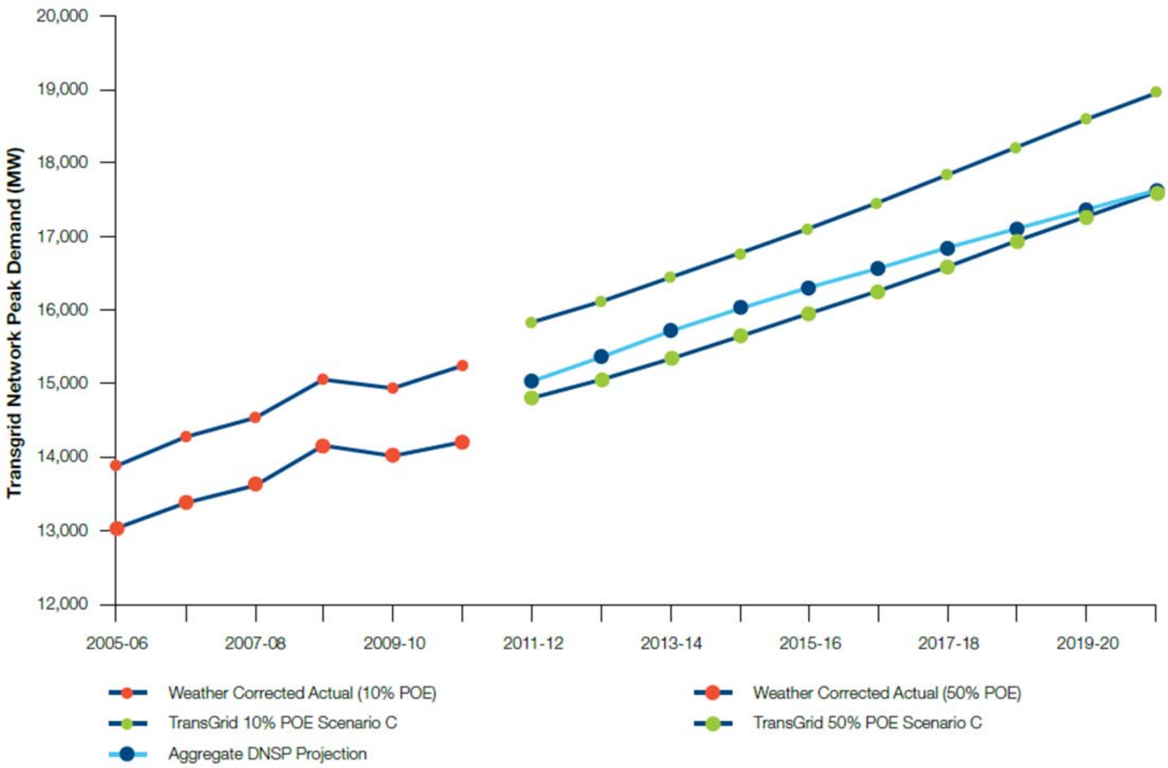


FIGURE 2.2 – TRANSGRID AND AGGREGATE DISTRIBUTION NETWORK SERVICE PROVIDER PROJECTIONS OF NSW SUMMER PEAK DEMAND (SOURCED FROM TRANSGRID'S *ANNUAL PLANNING REPORT*, 2011).

Whilst TransGrid and aggregated Distribution Network Service Provider (DNSP) projections differ over a 10 year period, it is expected that the network peak demand in 2021 will be between 15,500 and 17,500 megawatts (MW). This equates to an average annual growth from 2011 of between 290 and 348 MW annually (between 1.8 and 2.0 percent growth).

As previously discussed, NSW 2021 – *a Plan to make NSW number one* (2011) has made a commitment for achieving 20 percent renewable energy by 2020. The Bodangora Wind Farm will assist this target through an installed capacity of 120 MW.

The Bodangora Wind Farm will connect to the 132kV Wellington – Beryl transmission line. This transmission line works in conjunction with the 132kV Mt Piper – Beryl transmission line in supplying electricity between Mt Piper, Ilford, Mudgee, Beryl and Wellington. Regionally, TransGrid has identified in the *Annual Planning Report* (2011) upgrades to relieve limitations to times of low voltages to Beryl, with the preferred approach being the establishment of a 330kV/132kV substation near Beryl.

The following information is provided in TransGrid's *Annual Planning Report (2011)* with regard to the expected power supply sources to the west and south-western regions of NSW:

> *"The power supply sources in the south west of NSW comprise the extensive Snowy scheme, the Uranquinty gas turbine power station and distributed minor hydro power stations. There is also significant power transfer between NSW and Victoria. It is expected that gas turbine power stations, wind farms and other renewable generation will be developed in south west and western NSW in the future."*

Accordingly it is expected that the Bodangora Wind Farm will assist in meeting the predicted electricity demand and is consistent with the strategic direction of the region and State in relation to electricity supply

2.1.5 Integration of Wind Farm into the National Electricity Network

Wind farms are typically known as an intermittent form of electrical generation. The Australian Energy Market Operator (AEMO) requires that all new variable generators of >30 MW need to be registered under a new classification of 'Semi-Scheduled Generator', and submit, receive and dispatch information in a similar manner to scheduled generating units, with output limited at times to maintain secure network limits.

Issues concerning the entry of more renewable energy generation into the NEM have led to investigations and improvements in wind generation forecasting to enable improved scheduling of electricity generation. AEMO's wind energy forecasting system is very accurate, and can predict wind energy generation forecasting at accuracies of 97 percent one hour ahead of time and 99+ percent at five minutes ahead of time, which assists the AEMO in operating the NEM in a reliable and secure manner.

Technologies for control systems have been updated to manage the effect of variable generation of network flows and modelling of wind energy fluctuations, system demand changes and response mechanisms. Regulation frequency control ancillary services and a review of code connection procedures have also addressed the evolving NEM restructuring.

A preliminary assessment has indicated that the 132kV Wellington – Beryl transmission line operated by TransGrid has sufficient capacity to enable the connection of the Bodangora Wind Farm. A connection enquiry has been lodged with TransGrid and connection investigations have commenced. Further detail of the wind farm connection is provided in Chapter 3 of this EA.

2.2 BROADER SUSTAINABILTY MEASURES

The project can be both implemented with minimal environmental impacts to the project area and its locality, and is a sustainable energy development as described in this EA. In addition, the project addresses the broader dimensions of sustainability covering issues including:

- The Bodangora Wind Farm will assist in addressing global concerns about the potential enhanced climate change arising from greenhouse gas emissions. Additional energy developments utilising renewable energy sources assist to provide a 'Precautionary Principle' in addressing climate change.

- The project assists in inter-generational and social equity through reducing the growth in society's consumption of finite fossil fuel resources.

- An assessment has been undertaken in Chapter 9 of this EA which addresses the effect of the project on the local biodiversity. The project is not expected to affect the conservation values of the locality, including no significant impact to threatened species, as the wind farm layout has been designed to avoid areas of native vegetation and key habitat areas.

- The project will accurately represent the capital and operating costs of a project which generates energy from a renewable resource. Electricity generated from non-renewable resources does not cover the full cost of externalities arising from the generation (such as air pollution and greenhouse gas emissions). Whilst the cost of the electricity produced by the wind farm will be higher than the cost of electricity generated by non-renewable resources, factors including continued economic growth, greater pressure on non-renewable resources, and a carbon tax will result in increased competitiveness and investment in technologies for the renewable energy market.

2.3 GREENHOUSE GAS EMISSIONS

The electricity produced by the proposed Bodangora Wind Farm will be fed into the NEM to provide a portion of the community's power needs. Increased generation of electricity using wind energy will inevitably result in greenhouse gas emissions savings from electricity generation.

The total greenhouse gas emission saving is a combination of lifecycle greenhouse gas emissions of the project, and the net annual savings in greenhouse gas emissions.

There is significant literature available that shows that wind farms:

- are one of the most benign forms of generation technologies with one of the lowest possible greenhouse impacts;
- cause no greenhouse gas emissions as a result of operation which results in significant greenhouse gas emission reductions compared to existing electricity generating plants; and
- have little opportunity to make other than very marginal gains in the greenhouse efficiency through changes in construction methods or transportation.

A Lifecycle Analysis of the emissions arising from a development takes account of the emissions from manufacturing, through construction, operation and eventual decommissioning and disposal of infrastructure parts. The following are general characteristics for wind farm cycle emissions:

- greenhouse gas emissions for a wind farm on a life cycle basis are 10 to 15 kilograms per megawatt;
- only one third of a wind farm's lifetime emissions occur during the operation of the wind farm, these factors include auxiliary power from the grid when the wind farm is not generating, and emissions associated with vehicles and plant used for operations and maintenance;
- about two thirds of the life cycle emissions occur due to the manufacture, delivery and construction of parts. The emissions relate to steel production, chemical processes, machining, assembly and transportation;
- emissions from a wind farm are much lower than for most other electricity generating systems; and
- where the wind farm displaces other fossil fuel generation systems, there will be net savings in the greenhouse gas emissions.

An estimation of greenhouse gas emission savings as a result of the Bodangora Wind Farm has been undertaken with reference to the *NSW Wind Farm Greenhouse Gas Savings Tool* developed by DECCW.

The proposed wind farm will have a nameplate generation capacity of 120 MW depending on the electrical capacity of the turbine selected. Over a full year, annual electricity production is expected at 333 GWh, which is enough energy to power 35,000 homes annually (based on an average NSW household electricity consumption).

Emission savings are expected up to 333,000 tonnes of greenhouse gases each year, representing 2.6 million tonnes of greenhouse gas emissions by 2020.

Accordingly, it is expected that the construction and operation of the Bodangora Wind Farm will significantly assist in reducing the greenhouse gas emission intensity of NSW's electricity generation.

2.4 DETERMINATION OF PROJECT LOCATION

Infigen Energy undertakes systematic processes to identify suitable wind farm sites and to assess their relative merits. This process has included identification of potential sites with suitable wind energy resources and transmission infrastructure.

Following the identification of the Flyers Creek Wind Farm site (another project currently being assessed by the Department of Planning); Infigen Energy conducted a sophisticated wind resource modelling across the wider Central West Region. The range of hills nearby to Mount Bodangora was identified with appropriate wind speeds and electrical transmission infrastructure.

Infigen Energy approached land owners in the district, and identified those who were interested in investigating the feasibility of a wind farm in their district. The proponent performed an initial feasibility study which identified the following advantages for the Bodangora project area:

- good probability of a strong wind resource;
- availability of an appropriate voltage transmission line near the site with generation capacity; and
- preliminary consultation with Wellington Council which indicated general support for the project where the proponent appropriately consults, and enables local social and economic benefit for the community.

Sophisticated and detailed wind resource modelling was commissioned for the Bodangora site and surrounding region. Modelling of wind energy data has confirmed that the site's capable of sustaining a viable wind farm. Turbine locations can be seen relative to the energy zones but the locations of turbine sites shown differ slightly from that in the proposed array. Some high energy locations have not been selected for the final array due to environmental, social or site access constraints.

In addition, a detailed assessment of other potential wind farm sites in the wind resource modelling area was undertaken with respect to grid connection options and environmental suitability.

Once Bodangora was determined the most appropriate and suitable wind farm site, Bodangora Wind Farm Pty Ltd was established and has undertaken more detailed investigations of technical, environmental and financial viability of a wind farm at this location. Negotiations were undertaken to secure leases and agreements with relevant land owners to enable further planning studies and to seek approval for the construction and operation of a wind farm On-Site Wind Energy Resource Assessment was undertaken using two 80 metre wind monitoring masts and one SODAR for a period of 14 months.

2.5 ASSESSMENT OF PROJECT ALTERNATIVES

A variety of design options have been considered during the conceptual design of the wind farm. The overall objective of the conceptual design stage was, following identification of potential site constraints to identify the layout of the project to deliver significant savings in greenhouse gas emissions whilst being commercially viable and socially and environmentally acceptable. Constraint analysis included heritage, biodiversity, consultation, aviation, acoustic and telecommunications

The selected design is described in Chapter 3 of this EA. Whilst further refinement and micro-siting of the project elements will be undertaken as part of the final design stage, it is expected that the proposed design in Chapter 3 is accurate and will be consistent with the planning approval. The final design will be subject to review by the Approval Authority or by the Principal Certifying Authority at the Construction Certificate stage of the development.

The following variables have been considered in the wind farm design:

- **Turbines:** the spacing of turbines relates to the size of turbines, the orientation of the layout to the prevailing winds and environmental considerations. The following are the specific changes which have occurred to the layout design as a result of the investigations and project consultation:

  - the removal of WTG 8, 9, 28 and 47 following land owner consultation, primarily for the purpose of reducing the views of the project and improving the expected visual amenity;
  - the removal of WTG 40 in that it was previously proposed within 2.0 kilometres of a non-associated dwelling;
  - shifting WTG 30 approximately 300 metres to the north-west in order to avoid telecommunications interference; and
  - the removal of a number of turbines proposed in the south-east of the project area (nearby to the substation) which were removed after consultation with the land owner.

  A review of the wind characteristics of the project area and the commercial available wind turbine equipment indicate that the proposed turbine model and height is most suitable and commercially viable. Lower structures would reduce the electrical generation of the wind farm.

  Consistent with the trend in recent years, larger megawatt class wind turbines are being used increasingly in Australian and overseas. The use of larger turbines has also resulted in reduced costs of wind energy compared to other renewable technologies, as well as reducing the number of turbines required to be constructed to achieve an equivalent generation capacity.

  The turbine model selected for the planning application is the Vestas 112, with the total maximum height to blade tip 150 metres.

- **Site Access:** Existing tracks have been utilised through the project area wherever possible, and new tracks located to minimise the total length of new tracks, to ensure suitable grades, adequate curvature on bends and to avoid areas of vegetation or archaeological sensitivity.

- **Electrical Transmission:** underground transmission cables will be used for the connection of the wind turbines in the majority of the project area whilst overhead will be used where underground is not possible. Underground cables are favourable given the elevated location of the turbines and a reduced visual effect. Because of the long distance between WTG 18 and the proposed substation, an overhead cable is proposed. Overhead cables are also proposed to minimise ground disturbance to creeks.

  The location of the substation has been selected as it will not be visible from Goolma Road or any neighbouring dwellings to the wind farm, and is located along the 132kV Wellington - Beryl transmission line. The location also provides close access from Gunnegaldrie Road.

- **Construction Alternatives:** the Traffic and Transport Assessment in Chapter 12 provides an indication of the viable alternative site access routes for restricted access vehicles. The delivery of turbine parts by train was also considered but eliminated on grounds of feasibility and logistics. Issues of grade, road surface, curvature, local traffic conditions and minimal disturbance to neighbours have influenced the selection of the preferred route.

  Concrete will most likely be sourced off-site due to the proximity of concrete batching plants at Dubbo, Mudgee or Maryvale, however the viability for installing a temporary on-site concrete batching plant will be assessed by a contractor once appointed. Any temporary on-site concrete batching plant will be subject to planning approval and land owner agreement.

  Subject to material suitability, material may be sourced from the project site for the construction of access tracks. The construction phase will involve the transport of gravel to locations where it can be spread along the access tracks.

  There are limited options for variation in construction methods. The type of crane to be used may be a track based crawler crane that is able to access all the turbine sites including the sites with steep access or a conventional rubber wheel mounted crane that would require a slightly higher standard of access track for reaching all sites. Depending on the nature of the individual turbine site it may be necessary to vary the construction procedures particularly where the site is constrained by factors such as vegetation or slope.

  Minor clearing of trees may be required for the installation of turbines, which will include selective pruning, coppicing or if necessary, the removal of specifically identified trees to allow laydown and the assembly of turbine blades. Alternatively if there are large stands of vegetation, turbine components can be delivered to the turbine site as required for erection rather than the clearing of a large hardstand area. The overall objective is to avoid removal of mature native trees and particularly those with conservation significance.

As far as possible the construction period will be limited to minimise any impact on the local community and to enable completion of the wind farm and commencement of the electricity generation as soon as practicable.

2.6 COMMUNITY ENHANCEMENT PROGRAMMES

Bodangora Wind Farm Pty Ltd will commit to a voluntary community enhancement programme as a goodwill measure, to offset residual impacts in the local area in which the wind farm is proposed, and to benefit the community of Wellington Council.

Infigen Energy has committed to various community enhancement programmes at their operating wind farms, and the Bodangora Wind Farm will seek to combine the most practical aspects of these.

Bodangora Wind Farm has consulted and will continue to liaise with key stakeholders in the Bodangora region to optimise the community enhancement programme. Some of these stakeholders include:

- Wellington Council;
- various sporting organisations;
- Agricultural Society; and
- Community groups and rotary.

Bodangora Wind Farm has already sought to engage local groups wherever possible to maximise local content, including the Comobella Ladies Auxiliary Group for the catering of both open days.

The final structure and amount of community engagement programmes will be finalised prior to construction and will seek to have input from a diverse range of community members.

The nature of the community enhancement programme, selection of projects and distribution of funding will be managed through the establishment of a community enhancement programme comprising a cross section of the community including representatives of Bodangora Wind Farm Pty Ltd and the Wellington Council (should they choose to participate).

Agreed community enhancement programmes to previously approved wind farm developments have included (NSW Government, 2011):

- the establishment of a community enhancement fund (Cullerin Wind Farm, near Goulburn) administered in consultation with the local Council and local community representatives. Allocations from the fund have been used for equipment for local community use, historical projects and other community revitalisation projects; and
- funding for upgrades to a local road and purchase of a new fire truck (Capital Wind Farm, Bungendore).

In addition to an agreed community enhancement programme, Bodangora Wind Farm Pty Ltd will provide local economic benefit, the employment of local contractors through the establishment of a contractors' register list, and increased business opportunities as flow-on effects in nearby townships. Further information relating to the social and economic aspects of the project is provided in Chapter 16.

Pursuant to Section 94 of the EP&A Act, planning authorities can also levy developers requiring a monetary contribution at the development application stage to help pay for additional community facilities and/or infrastructure. Further information on Section 94 of the EP&A Act is provided in Section 7.1.1.

2.7 SUMMARY OF PROJECT BENEFITS

The key benefits of the construction and operation of the Bodangora Wind Farm are summarised below:

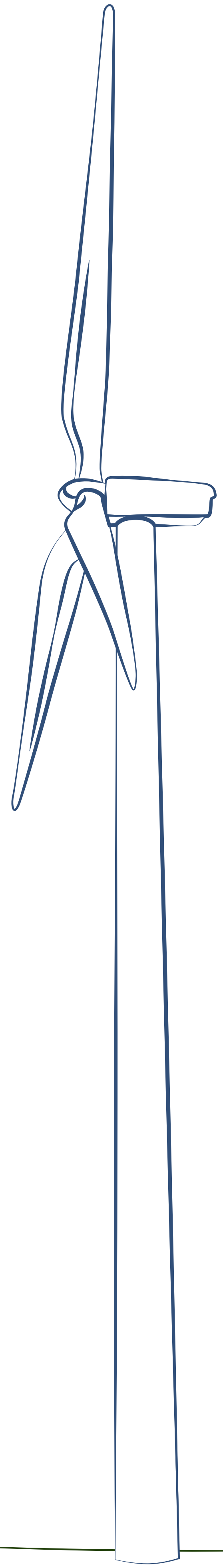
- the provision of a new source of electricity generated from renewable energy sources;
- additional electricity generation in the order of 333 GWh/year to assist the National Electricity Market to be able to satisfy forecast increased electricity demands, being enough clean energy to provide for around 35,000 standard NSW households;
- the provision of an additional energy source for retailers to meet the obligations of the Federal Government's RET Scheme which mandates that over 45,000 GWh/year of renewable energy be generated by renewable energy plants by 2020;
- the provision of an additional, sustainable energy source to provide for an alternate energy source to black coal which is currently the largest energy source in NSW;
- the displacement of energy from fossil fuels, reducing greenhouse gas emissions by up to 333,000 tonnes of CO2 per year;
- the provision of management and mitigation measures to ensure the project does not compromise environmental values either during construction or operation, and does not place stress on the existing environmental values at the locality including ecological, heritage, soils or water quality;
- local economic benefit, particularly to the land owners within the project area and also to the wider Wellington community. The construction phases of the project in particular will involve the employment of local contractors and increased business opportunities as flow-on effects in nearby townships;
- the Bodangora Wind Farm is consistent with the National and State objectives for the sustainable production of energy and the abatement of greenhouse gas emissions;
- suitability of the proposal to co-exist with the grazing and cropping land use activities on the subject land which can continue during the operation of the project;
- as identified through the findings of the community consultation as detailed in Chapter 6 of this EA, the project enjoys the support from the majority of the local community; and
- contribution to inter-generational equity by reducing greenhouse gas emissions and reducing the consumption of finite fossil fuel resources.

The benefits of the project as outlined above should be considered in the context of the potential impacts of the project, which have been identified throughout this EA. The potential impacts of the project include changes to the landscape of the locality in which the wind farm is located; and increased levels of noise and traffic during the construction periods of the project.

The project is considered a worthy environmental initiative and represents an important contribution to the future renewable energy generation capability in New South Wales. This EA provides assessments of all relevant issues and Chapter 18 a summary of the effects and justification for the project. The conclusion of the assessment is that the proposal is environmentally acceptable and is therefore justified.

Chapter 3

Project Description



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CHAPTER 3 - PROJECT DESCRIPTION

3.0 PROJECT DESCRIPTION

This chapter provides a detailed description of the proposed Bodangora Wind Farm, through both construction and operation periods. Specifically, this chapter of the EA provides the following, as per the Director-General's Requirements (DGR's):

Director-General's Requirements:

"A detailed description of the project for both the wind farm and transmission line including:

- *construction, operation and decommissioning details;*
- *the location and dimensions of all project components including the wind turbines (including map coordinates and AHD heights), underground and above ground cabling between turbines, electrical substation and transmission line linking the wind farm to the grid (including easement width and height), on-site control room and equipment storage, temporary concrete batching plant(s), construction compounds, access roads/road upgrades (including access tracks), any obstacle lighting, relation to Crown roads, and any subdivision proposals;*
- *a timeline identifying the proposed construction and operation of the project components, their envisaged lifespan and arrangements for decommissioning and staging;*
- *supporting maps/plans clearly identifying existing environmental features (e.g. watercourses, vegetation, infrastructure and land use (including nearby residences and approved residential developments or subdivisions) and the location/siting of the project (including associated infrastructure) in the context of the existing environment;*
- *resourcing requirements (including, but not limited to, water supply and gravel); and*

- *a description of alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits including community benefits (for example community enhancement programmes) on a local and strategic scale and how it achieves stated objectives.*

The project involves the construction and operation of up to a maximum of 33 wind turbines, each with a generation capacity of between 2.0 and 4.0 MW and a total installed capacity of up to 120 MW depending on the turbine model selected and the total number of turbines installed.

Ancillary items to the project include:

- a 33/132 kV substation plus switchyards, transformers and microwave towers to provide connection to the existing 132 kV Wellington - Beryl transmission line;
- 39 kilometres of new and upgraded access tracks;
- approximately 37 kilometres of underground cabling;
- 5.8 kilometres of overhead cabling;
- temporary and permanent wind monitoring masts;
- a construction compound;
- gravel quarries; and
- an operation and maintenance centre.

The description of the processes for the construction of the project is provided in this project description, with details for temporary construction elements (for example the construction site office and laydown area) in Chapter 3.7.

3.1 LAYOUT DESIGN

The project site for the wind farm spans an area of approximately 18 kilometres from east to west and 12 kilometres from north to south. This area accommodates all infrastructure and construction works, and comprises the total land holdings of property owners upon which wind farm infrastructure is to be located. The properties on which it is proposed to construct the wind farm are privately owned and are used predominantly for sheep and cattle grazing. The development, although covering a wide area, will occupy only a small part of each property and the existing land use will be preserved. Further details on the land within the project area is provided in Chapter 4 of this EA.

The turbine layout has been designed to provide for the optimum arrangement with the following objectives:

- maximisation of the wind farm electrical output;
- maintain spacing of turbines to minimise turbulence and airflow interactions between turbines;
- avoidance of locations which would affect the existing flora and fauna, and heritage values of the site;
- maintenance of acceptable noise levels and construction of large turbine components;
- enable accessibility in relation to delivery and construction of large turbine components; and
- achieving a wind farm scale required for project economic viability.

The wind farm layout has been informed through:

- extensive wind monitoring data and feasibility studies;
- environmental investigations;
- land suitability assessment;
- land owner requests; and
- community and stakeholder engagement processes.

The following are specific changes which have occurred to the layout design as a result of these investigations and consultation:

- the removal of Turbines 8, 9, 28 and 47 following land owner consultation, primarily due to minimising visual amenity;
- shifting turbine 30 approximately 300 metres to the north-west in order to avoid telecommunication interference; and
- there were also a number of turbines proposed in the south-east of the project area, however they were removed after significant consultation with the land owner.

This EA proposes the most likely and accurate representation of the final wind farm layout.

Variations to this layout may result from:

- further public and agency consultations and submissions;
- as directed by the Minister for Planning;
- refinements and minor variations following additional investigations during the detailed design phase, including geotechnical investigations;
- to address the conditions of any approval granted; or
- by the appointed contractors for the project.

Such variations will be addressed at the appropriate time, with the final development in accordance with any planning approval. The proponent would seek the ability to micro site turbines up to 200 metres from the present location.

3.2 WIND TURBINE GENERATORS

A maximum of 33 wind turbine generators (turbines) will be constructed as part of the proposal. The location of the wind turbine generators is shown on Figure 1.3 (Project Overview) and the locations of which detailed in Table 3.1.

Table 3.1 – Wind Turbine Generator Locations

WIND TURBINE GENERATOR NUMBER	EASTING	NORTHING	GROUND SURFACE LEVEL (METRES AHD)	MAXIMUM HEIGHT OF TURBINE (METRES AHD)
10	690990	6411498	500	650
12	698211	6412679	600	750
13	698831	6413115	580	730
15	695291	6414133	540	690
16	697255	6411811	600	750
17	699713	6412565	608	758
18	699560	6411787	640	790
19	699518	6412163	638.2	788.2
20	696649	6412773	595.9	745.9
21	696262	6413204	580	730
22	696260	6412508	595	745
23	696086	6411834	600	750
24	695086	6412384	575	725
25	694977	6415650	520	670
26	694944	6414839	535.3	685.3
27	694935	6415159	528.9	678.9
29	694275	6414144	540	690
30	694016	6412010	553.3	703.3
31	694025	6414477	538.4	688.4
32	693448	6416362	500	650
33	693423	6415324	520	670
34	693346	6411867	557.3	707.3
35	693193	6411552	548.8	698.8
36	692829	6414961	520	670
37	692599	6411960	540	690
38	692599	6416740	500	650
39	691963	6415040	500	650
41	691672	6415899	500	650
42	690833	6413029	500	650
43	690466	6410294	500	650

WIND TURBINE GENERATOR NUMBER	EASTING	NORTHING	GROUND SURFACE LEVEL (METRES AHD)	MAXIMUM HEIGHT OF TURBINE (METRES AHD)
44	689673	6412056	500	650
45	689646	6412574	500	650
46	689376	6413614	480	630

The indicative turbine model selected for this planning application is the Vesta 112.

A schematic illustration of the proposed wind turbine is shown Figure 3.1. The total height of each turbine to blade tip is a maximum of 150 metres. Each turbine will have a control system to each rotation to face the rotor into oncoming wind, and to adjust the pitch of the turbine blades. The turbines and supporting structures will be finished in a matte off-white colour.

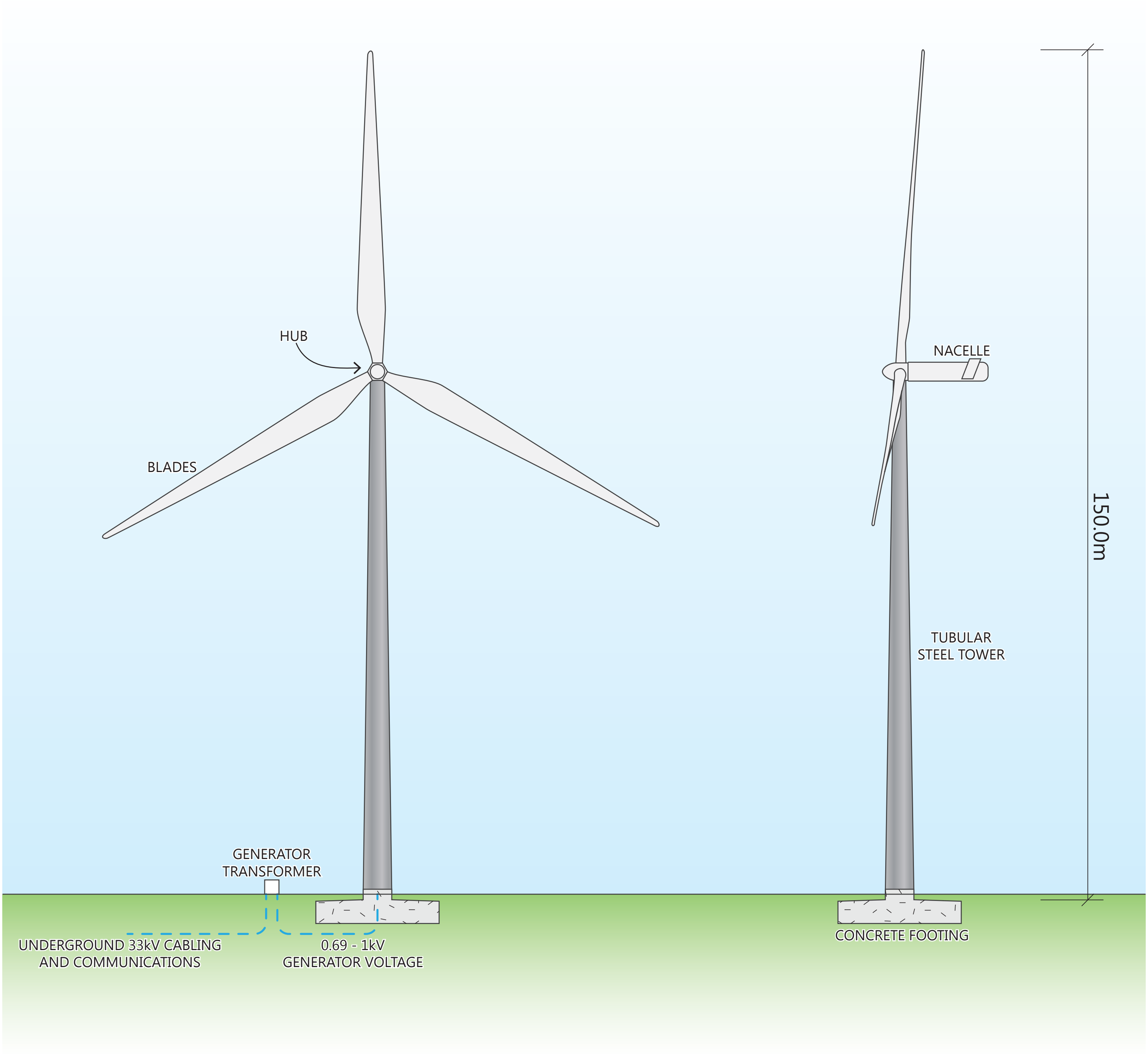
The 33 turbines are numbered 10, 12 – 13, 15 – 27, 29 – 37, and 41 – 46 and are referred to as such within this EA. The missing turbine numbers reflect the previously considered turbine locations which have not been adopted in the final layout. Each of the 33 turbines will comprise several main component parts:

- Towers: each supporting structure will be a tapered steel structure to a maximum total height of 100 metres, with an approximate diameter of 5.0 metres at the base and 2.5 metres at the top.

- Footings: each tower will be located on a reinforced concrete footing with a diameter of up to 12 metres, to a depth of 2.0 to 3.0 metres, incorporating around 110 cubic metres of concrete. The concrete footings are likely to be steel reinforced, tensioned and have rock anchors to bolt the footing into the underlying rock. Conduits for power and control cables will be incorporated into the concrete footings.

- Rotor and blades: each turbine will have three blades with a diameter of between 88 and 114 metres. Each blade will be constructed of fibreglass, and attached to a steel rotor and shaft. The rotor will incorporate metallic conductors to conduct lightning strikes to earth.

- Nacelle: each turbine will incorporate the 'nacelle', housing mounted at the top of each tower which encloses a gear box, generator, motors, brakes, electronic components, wiring and hydraulic and lubricating oil systems. The nacelle will be constructed of steel and fibreglass and will be approximately 10 metres long, 3.0 metres wide and 3.0 metres in height. The nacelle will also incorporate weather monitoring equipment.



OVERALL HEIGHT: 150.0m (max.)
ROTOR DIAMETER: 112.0m
BLADE LENGTH: 54.6m
HUB DIAMETER: 3.2m (max.)
NACELLE: 14.0m(L) × 3.9m (H) × 3.9m (W)
TOWER DIAMETER: 5.0m (max.)
TOWER HEIGHT: 100.0m (max.)
GENERATOR TRANSFORMER: 3.5m(L) × 2.5m (H) × 2.5m (W)

Figure 3.1

Turbine schematic diagram

NOT TO SCALE

3.2.1 Construction of Wind Turbine Generators

- The installation of wind turbine generators, materials and equipment will be delivered to the site by restricted access vehicles where necessary, as described in Chapter 3.4. The layout of the turbine hardstand area adjacent to each turbine which will be utilised for construction is provided in Figure 3.2. A hardstand area will remain as a cleared, functional area adjacent to the turbine for maintenance purposes during operation.

- As each turbine will be manufactured in sections, assembly will occur on-site as per the following:

  - in most cases, turbines will be constructed from a hardstand area located at the base of each turbine location (as per Option A, Figure 3.2);
  - where turbines are located on sloping ground or in proximity to sensitive vegetation areas, special erection procedures may be required including the lifting directly from the transport vehicle (as per Option B, Figure 3.2);
  - each turbine will take between one and several weeks for erection depending on weather conditions;
  - turbines will be installed in a sequential process following footing and hardstand areas formation, minimising the need for the transfer of the crane between sites;
  - standard turbine erection method include the tower erected first, with the initial tower component bolted to a stub section embedded within the concrete footings. Each subsequent section is raised by a crane and bolted to the section below. The nacelle is then lifted to the top of the tower and secured, with rotor and blade assembly following; and
  - once the turbine is constructed, it will be checked prior to energising and commissioning.

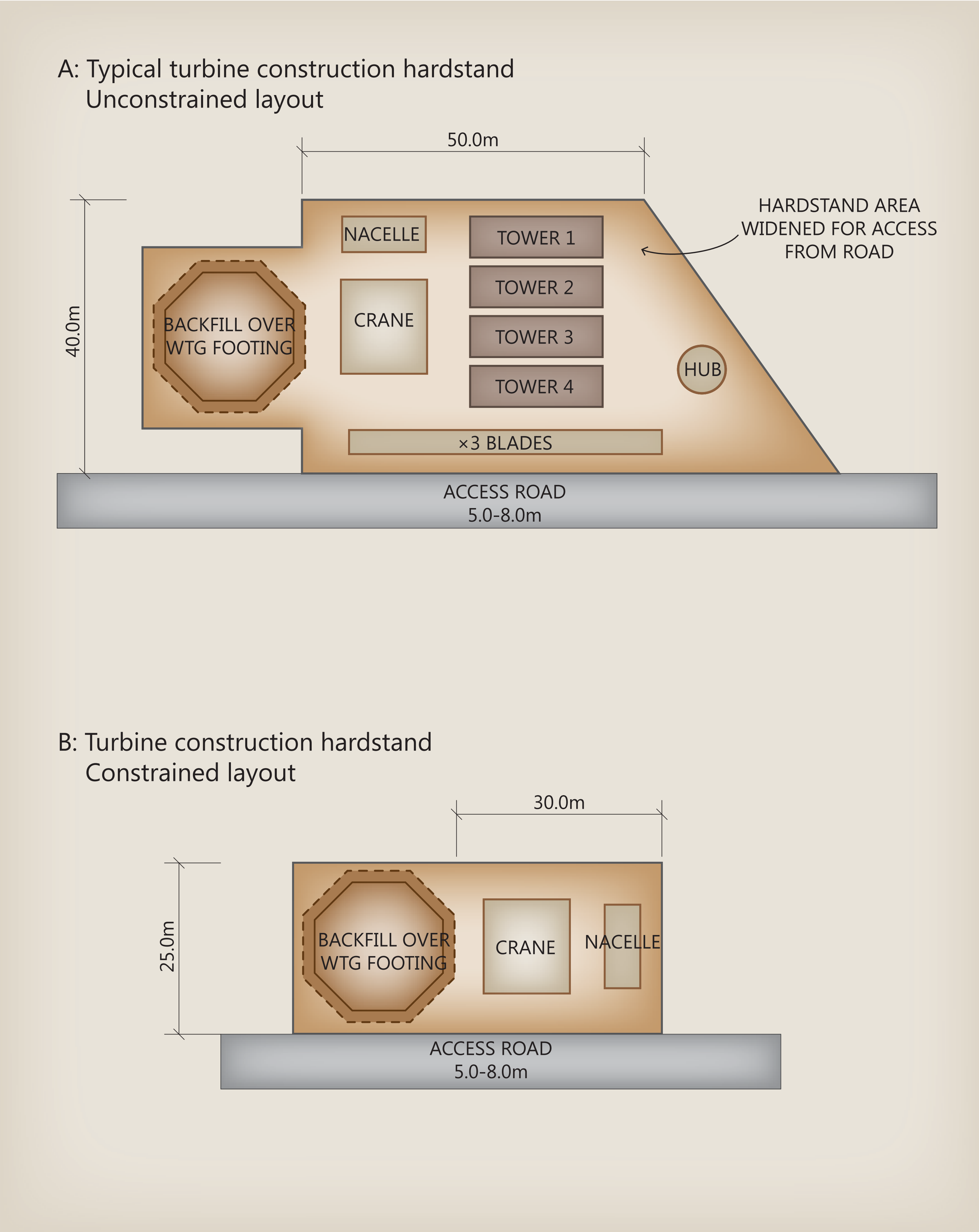
- The construction of footings for the wind turbines will include the following:

  - The excavation of between 220 and 340 cubic metres of soil at each turbine location, carried out by mechanical equipment, and by some low level blasting at rocky locations (blasting to be undertaken by qualified professionals subject to relevant statutory requirements and approvals, and in accordance with ANZECC guidelines for blasting in proximity to neighbouring dwellings). Alternatively, the installation of rock bolts may be used. A detailed assessment is to be undertaken once a project contractor is appointed.
  - Excavated topsoil will be stockpiled, and used for backfilling over the constructed footing, or used for restoration. A level hardstand area will be located adjacent to each footing and used primarily for the erection of each turbine by cranes. The level hardstand area will be maintained during operational periods for maintenance purposes.
  - Each footing will be a reinforced concrete block poured against natural ground, a 'blinding' layer and formwork. The footing will be tensioned and rock anchors will be installed.
  - The footings will also include conduits for power and control cables that provide for auxiliary power to the wind turbine generator, to export the power when it is operating and for various controls and monitoring functions.

  - The completed footings will be either covered by soil and grass, or raised slightly above ground level.

- The sourcing of approximately 110 cubic metres of concrete required per turbine footing:

  - Concrete will most likely be sourced from the local Boral concrete batching plant at Maryvale. Traffic for delivery will occur on approximately 50 days during turbine and substation footings construction.
  - Alternatively, a mobile concrete batching plant may be utilised to produce the concrete required for the project. This would accommodate an area measuring approximately 50 by 60 metres, and would consist of a trailer mounted concrete mixer, cement bins, and sand and aggregate stockpiles, and would be powered by a diesel generator. Sufficient area would be required to enable the use of front end loaders, delivery of materials and entry and exit of concrete agitator trucks. A mobile concrete batching plant would operate for up to 50 days, over a period of four to six months during construction.
  - The contractor for the project will need to review the practicality and commercial aspects to determine if any on-site batching plant is warranted, and if so, suitable sites would need to be identified, assessed and approvals obtained.



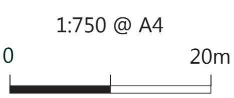


Figure 3.2
Turbine site construction layout

3.3 ELECTRICAL INFRASTRUCTURE

A series of underground and overground cables, switchgear and a substation are proposed to connect the Bodangora Wind Farm with the national electricity grid. Infigen Energy have identified the connection to the existing 132kV Wellington - Beryl transmission line as the most feasible and efficient option for grid connection. Considerable consultation with TransGrid has been undertaken and the site proposed minimises connection distance and is well suited to the TransGrid network. Alternatives were considered including the Wellington substation and the Wellington - Wollar 330kV line. A schematic drawing of the electrical connections and substation for the project is shown in Figure 3.3.

The following outlines the main components of the electrical infrastructure proposed as located on the Project Overview, Figure 1.3:

- The output from each turbine will be directed to 33kV underground or aboveground cables, which link each turbine to a new proposed substation located in the south-eastern portion of the project area. The 33kV cables will generally follow upgraded and proposed access tracks within the project area where possible.

- A new substation will provide a connection for the generated power to the existing 132kV Wellington - Beryl transmission line which traverses the project area, and which will enable the provision of the energy created by the wind farm to the national electricity network.

- Meetings have been held with TransGrid to determine the requirements for connection to the existing 132kV transmission line. Preliminary grid connection studies have indicated the existing 132kV transmission line has sufficient capacity to accept the output of the wind farm. A connection enquiry has been submitted to TransGrid in accordance with the National Electricity Code requirements for connection and a number of associated technical studies are being undertaken.

- Works for connection of the Bodangora Wind Farm are an integral part of the development activities, and should be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. Country Energy may choose to undertake a separate assessment of any necessary transmission line works undertaken by TransGrid under Part 5 of the *Environmental Planning and Assessment Act 1979*.

The following is proposed:

- Local generator transformers, providing the connection between turbine and underground or overhead 33 kV cables:

  - Each turbine will incorporate a generator transformer within a 'padmount kiosk' adjacent to the hardstand area, painted in a low visibility green. Depending on the turbine selected, the generator transformer may be located internal to the nacelle and painted in a matte off-white.
  - Depending on the supplier, each generator transformer is likely to be approximately 3.5 metres long, by 2.5 metres wide and 2.5 metres high.
  - The transformers may be either oil-filled or dry, depending on the turbine equipment supplier. If oil-filled transformers are used, the volume of oil used for generator transformers is likely to be in the order of 2,000 litres, with appropriate metres for containment and spill protection utilised.

- Approximately 37 kilometres of underground 33kV cables, providing connections between each turbine and the substation:

  - The turbines are grouped according to location to generally provide the most direct and economical route between the turbines and the substation, and have been developed to minimise route length, according to slope and vegetation features.
  - Generally cabling will be located alongside access tracks to minimise site disturbance.
  - The underground trenches will also incorporate control cables for the monitoring and management of the turbines.

- A minimum of 5.8 kilometres of 33kV overhead transmission lines:

  - Overhead 33kV transmission lines are proposed in selected locations rather than underground cables, particularly where creek crossings are involved, where there are areas of sensitive vegetation, or where trenching is not otherwise appropriate.
  - Overhead transmission lines are also proposed between the wind turbines (WTG 18) and the substation.

Plate 3.1 provides an indication of the appearance of a typical generator transformer alongside the base section of a turbine tower.

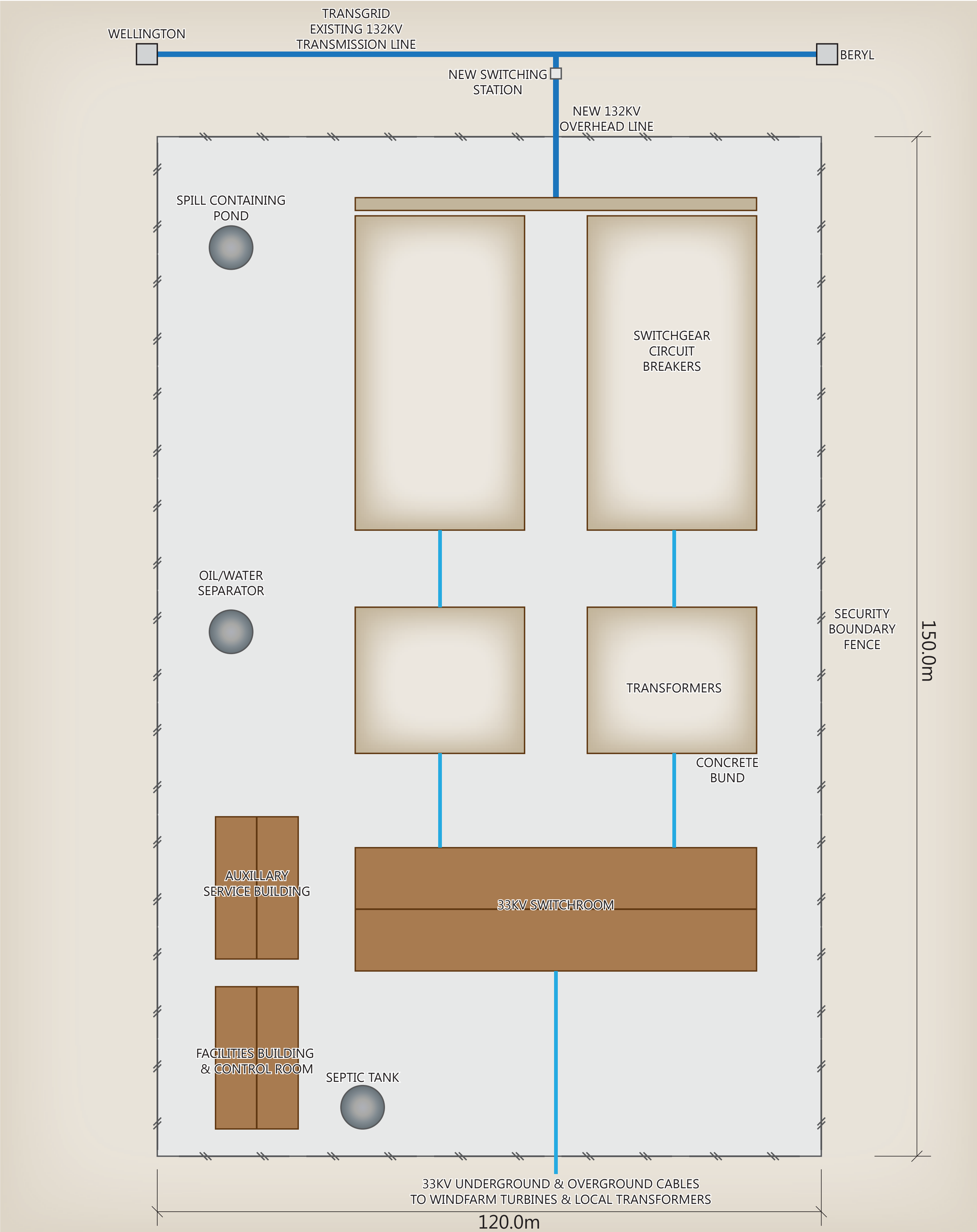


Figure 3.3

Conceptual substation layout

NOT TO SCALE

Plate 3.1 – Example of typical generator transformer at base of turbine.

PLATE 3.2 – EXAMPLE DOUBLE CIRCUIT 33KV OVERHEAD TRANSMISSION LINE.

PLATE 3.3 – PHOTOGRAPH FROM BUDGALONG ROAD, NEARBY TO PROPOSED BODANGORA SUBSTATION LOCATION AT 132KV WELLINGTON TO BERYL TRANSMISSION LINE (THE 330KV WELLINGTON TO WOLLAR LINE IS ALSO VISIBLE).

- A 33kV/132kV substation including two transformers:
  - Located at a south-western corner of the project area, to facilitate connection to the existing 132kV transmission line between Wellington and Beryl. The location has been selected with consideration to energy collection arrangements, proximity to existing electricity infrastructure, land ownership, environmental issues and low visibility.
  - The substation will occupy a land component of approximately 120 metres by 80 metres.
  - Equipment will include two 33kV/132kV transformers, transformer separation wall, busbars, circuit breakers, underground fibre optic communications cable, microwave communications towers, and isolators.
  - A buried earth grid will also be installed within the substation area.
  - The substation will also likely include two or three small buildings including a switchroom, wind farm control room, and an auxiliary services building.
  - Up to 50,000 litres of oil will be stored at the site for use in the transformers and associated components. Oil will be stored in concrete bunds, with an oil spill retention basin and an oil/water separator external to the concrete transformer bunds.
  - An earthen bund embankment will surround the substation area as a secondary containment measure.
  - A fire deluge system will reduce the risk of the effect of fire and will incorporate suitable containment.

- 2.4 metre high chain mesh or palisade security fencing will be provided surrounding the perimeter of the substation site.
- Low level security lighting will be installed, with additional flood lighting triggered by security sensors.

An image of the Lake Bonney 33kV/132kV substation, of which the proposed Bodangora substation will be similar, is provided in Plate 3.4.

PLATE 3.4 – VIEW OF LAKE BONNEY 33KV/132KV SUBSTATION.

- Three buildings will be located at the substation site:
  - The substation will include two small buildings to house equipment and facilities for the operation of the wind farm, and one switchroom building.
  - Buildings will either be slab on ground constructions with steel frames, metal or brick walls and a sheet steel roof, or demountable buildings.
  - Roof water will be captured in rainwater tanks for domestic purposes.
  - A septic system or composting toilet system will be installed to treat wastewater produced from substation buildings, subject to Council environmental health standards.
  - A facilities building of a nominal 10 by 25 metres will house wind farm control instrumentation, electrical and communications equipment, routine maintenance equipment and stores, a small work area, roof mounted solar photovoltaic panels and staff amenities.
  - A control building of a nominal 15 metres by 5.0 metres will contain 132kV switchyard control equipment and batteries and be used by TransGrid for operation of the 132kV switchyard and transmission line.
  - The facilities building will be used by the operators of the wind farm and include an office area for monitoring and reporting.

- A carpark for all site staff, site vehicles and visitors.
- A switchroom building will contain 33kV wind farm switchgear and overhead busbars.
- All buildings will comply with relevant electrical standards.

- Depending on alternatives available with existing communication links, Transgrid may decide that a communications mast is required. If this is required, we will install this at or near the substation site. The tower will be 40 – 60 metres in height, and a four legged steel lattice tower with approximately two microwave receivers attached. The location of the substation communications tower will be in close proximity to the substation on a rise which can clearly reach the next point to point receiver.

3.3.1 Construction of Electrical Infrastructure

- The installation of the substation will include the following:

  - the clearing and site works of an area of approximately 120 by 80 metres;
  - the construction of footings, including a surface layer of crushed rock and a buried 'earth grid', oil/water separation unit, cable ducting, lightening protection masts;
  - the installation of the structures and component parts;
  - the installation of the facilities and control buildings;
  - the installation of rain water collection tanks and a septic system to treat wastewater produced within the buildings;
  - fencing;
  - carpark;
  - communications tower and associated optical fibre cabling;
  - the location of a small temporary site office and amenities facilities at the substation site during the construction period; and
  - a separate construction site office and laydown area will be installed at the substation site (as outlined in Section 3.7).

- The trenching for the installation of approximately 37 kilometres of underground cables will involve the following:

  - Underground cables, comprising power and control cables will be buried in trenches of approximately 1.0 metre in depth and 0.5 to 0.75 metres in width. In some locations wider trenches may be required where two cables are located side by side.
  - Excavation will be depending upon ground conditions, most likely undertaken by either a mobile trenching machine, a hydraulic rock breaker, and an excavator.
  - Wherever practical, trenches will be backfilled immediately upon cable installation in accordance with the Construction and Environmental Management Plan, with measures adopted to slow stormwater flows and to prevent the scouring of open trench or disturbed ground prior to revegetation.
  - A temporary access track will be located alongside the trenches for access during construction for trenching and cable installation vehicles.
  - Marker tape and posts will be placed above buried cables in accordance with the relevant standards to indicate the presence of underground cables.
  - Surplus excavated material will be distributed over the surrounding area and will be revegetated. Alternatively, it may be used in track construction.

A photograph of trench excavation is provided in Plate 3.5.

PLATE 3.5 – EXAMPLE OF UNDERGROUND CABLE TRENCH FOR 33KV BEING EXCAVATED

3.4 ACCESS WORKS

The following provides an outline of the proposed works to enable access during construction and operational phases of the project. Access works comprise local road upgrades to enable transport of wind farm components, and new and upgraded on-site access tracks for both construction and operation.

A diagram of the proposed regional/local roads is provided in Figure 1 to **Attachment L** of this EA. A diagram of proposed on-site access tracks, including new and upgraded on-site access tracks is provided in Figure 1.3 of this EA. Further detail on the access works components of the project is also provided in Chapter 12.

3.4.1 Regional Road Access for Construction Purposes

The following describes the sourcing of various components of the wind turbines and other infrastructure:

- The nacelle, blades and hubs for the turbines will be imported from overseas, with the most likely delivery to the Port of Newcastle in New South Wales, otherwise Port Kembla. Tower sections may be manufactured in Australia in Queensland, Victoria or South Australia, or may otherwise be imported and arrive via the Port of Newcastle or Port Kembla.

- Depending on the selection of the suitable suppliers, electrical equipment may be sourced from various locations around Australia, however it is expected that the main transformers will arrive at the Port of Newcastle.

- Local quarries will be utilised for stone and concrete, for example from Dubbo, Maryvale, Mudgee or Molong.

- The transport of equipment for each turbine and the transformer is according to the details provided in Table 3.2.

Table 3.2 – Typical turbine components, dimensions and mass

ITEM	NUMBER OF PARTS	TOTAL NUMBER OF PARTS (33 TURBINES)	APPROXIMATE WEIGHT OF EACH PART (TONNES)	APPROXIMATE LENGTH OF EACH PART (METRES)
Tower	4 sections per turbine	132	70	26
Nacelle	1 part per turbine	33	120	19
Turbine blades	3 blades per turbine	99	20	55
Rotor	1part per turbine	33	20	3.9
Main transformer	2	2	120	8
Transmission line poles	TBA[1]	TBA	TBA	20

The following describes the proposed access route for restricted access vehicles for wind farm delivery purposes from the Port of Newcastle, which will be finalised in consultation with Wellington Council and the Road Transport Authority:

- Bourke Street / Cowper Street / Hannell Street / Industrial Drive / Pacific Highway / New England Highway / Golden Highway / Wheelers Lane / Mitchell Highway / Goolma Road / Gillinghall Road.

In addition, deliveries from South Australia to the wind farm site could be via the Sturt Highway / National Highway / Newell Highway / Mitchell Highway / Goolma Road / Gillinghall Road.

If towers sections are delivered from Queensland, they may be transported via the Warrego Highway / Leichhardt Highway / Newell Highway / Mitchell Highway / Goolma Road / Gillinghall Road.

Investigations for the requirement for upgrading of the horizontal geometry or pavement for safe access will be investigated by the haulage company. The following are identified as areas that will require particular investigation to determine if upgrades are required:

- Denman Road / Golden Highway, Denman;
- Palace Street / Golden Highway, Denman; and
- Goolma Road / Gillinghall Road, Bodangora.

[1] To be confirmed once overhead transmission line distances are finalised, subject to detailed ecologist review of final proposed turbine, and access track and transmission line layout.

3.4.2 Local Road Upgrades

Preliminary discussions have been held with the Wellington Shire Council and further consultation will be undertaken prior to construction to confirm the final design and any measures required to address safety issues as required. Further consultation will be held with the NSW Roads and Traffic Authority.

Existing local roads will be used by construction vehicles for delivery of wind farm parts. All roads will be constructed to relevant engineering standards. Local roads for access have been selected to enable safe access and minimise disruption to local traffic.

Investigations for the requirement for upgrading of the horizontal geometry or pavement for safe access will be investigated by the haulage company. The following in particular are identified as areas that will require investigation to determine if upgrades are required:

- crossing of Mitchell Creek on Goolma Road, Bodangora; and
- Gillinghall Road, Bodangora (within project area).

Watercourses within the project area will be negotiated by the construction of new culverts with inlet and outlet protection. Existing fords may need to be upgraded for construction due to vertical geometry suitability for delivery vehicles. Watercourse crossings will be subject to the requirements of the Soil and Erosion Control Plan.

3.4.3 On-site Access Tracks

Access tracks will be constructed to enable access to the wind turbines for the purposes of turbine construction and maintenance.

The width of access tracks will be approximately 9.0 metres to allow for the delivery of parts and materials to each of the turbine locations. Access tracks will be reduced to a width of 5.0 metres following construction. Those areas of land no longer required for access will be appropriately remediated to the state they existed prior to construction commencing.

The location of on-site access tracks is indicated on the Project Overview, Figure 1.3. The layout and design of the access tracks have considered the following:

- upgrades to existing tracks are proposed wherever possible;
- minimising total track length;
- landowner preferences;
- to enable the movement of oversize and heavy vehicles of up to 60 meters in length;

- low to moderate grades and curvatures suitable for the required vehicles (the maximum slope for roadways is typically 14 percent);
- general location along the ridge lines within the project area to enable access to groups of turbines; and
- reducing the need for vegetation clearance.

Construction will involve clearing and the construction of paths in accordance with the proposed traffic and site conditions. The final location of tracks will be subject to the Construction and Environmental Management Plan, and developed in conjunction with an ecologist and project contractors to ensure minimal impact on remnant scattered trees.

Where steeper access track grades are proposed, there may be a need for the access track to be benched into the sides of the slope, and track construction would include suitable batters with stabilisation to prevent erosion. The use of 'cut and fill' may be required to produce an even grade for the oversize vehicles. Where steeper tracks are proposed, assistance can be provided by towing/pushing the heavy equipment with bulldozers.

3.4.4 Construction of On-Site Access Tracks

The forming of approximately 39 kilometres of upgrade and new access tracks to a width of up to 9.0 metres:

- this will include clearing, grading and removal of topsoil as required, and the compaction of gravel road base;
- the provision of drainage works in accordance with the Construction Environmental Management Plan;
- excavated topsoil will be stockpiled during construction, and later used in the rehabilitation of the site. Stockpiles to be managed in accordance with the Construction Environmental Management Plan;
- access tracks to be reduced to 5.0 metres in width and surrounding land restored, revegetated and/or returned to former grazing uses.

The sourcing of gravel and sand for access road construction:

- Local materials including gravel, sand and concrete for the construction of roadways and turbine footings will be sourced wherever possible.
- The use of local materials will assist in minimising the transport distance and local investment.

- Examples of supply sources include local quarries located in Dubbo, Mudgee, Molong and Maryvale.
- Potentially up to 30,000 cubic metres of gravel may be required.
- Road base material may also be extracted from the removal of material from turbine footing locations.
- The contractor will review options for sourcing gravel for track construction and if any extraction of gravel is proposed then appropriate approvals will be south, both from legislative approvals and approval from the landowner.
- Any material brought to the site will be assessed against the provisions of the Construction Environmental Management Plan to reduce the risk of weed introduction.

3.5 WATER PROVISION

Water will be required for construction, including for wetting exposed soils during stockpiling to reduce the risk of erosion and dust movement. Water will be acquired from the Wellington Shire Council during construction, trucked into the site as and when required for these purposes. It is estimated that 10 megalitres of water will be required over the 18 to 24 month construction period. If a concrete batching plant is used on-site, then an additional 2.0 megalitres of water would be required, however it is most likely that concrete would be sourced off-site.

To a lesser extent, water will also be used for domestic purposes within building facilities. Once operational, water will be provided to buildings with amenity facilities from a rainwater storage tank that will collect roof drainage.

An approved septic system will be installed to treat small quantities of wastewater produced from staff amenities. Wastewater will be collected and disposed by a licensed contractor.

Once operational, the project will require a relatively small water supply which will be primarily sourced from roof drainage at facility buildings, and imported from domestic supplies as necessary.

3.6 WIND MONITORING MASTS

There are currently two 80m wind monitoring mast installed within the project for investigations purposes. After construction the two original masts will be removed and Three to four new wind monitoring masts will be required and installed within the project area to provide for ongoing meteorological investigations and power curve verification.

The locations of the existing wind monitoring masts are identified on the Project Overview, Figure 1.3. The locations of the new wind monitoring masts will confirmed in conjunction with the successful turbine supplier.

The construction of the wind monitoring masts will involve the construction of concrete footings, erection of the mast with supporting guy wires, and the installation of monitoring equipment. The total height of each wind monitoring mast is likely to be the same height as the eventually hub-height of the turbine.

Additional temporary wind monitoring masts may need to be established for turbine calibration purposes, which would be erected at least three months prior to the construction of the turbines at the exact location of the proposed turbine. Temporary wind monitoring masts will be removed prior to turbine construction.

3.7 TEMPORARY CONSTRUCTION PROJECT ELEMENTS

The construction of the wind farm will take approximately 18 months, and may involve up to 70 to 100 staff working on-site at any one time.

Construction works will occur subject to final approval, contractor engagement, and once a Construction Environmental Management Plan has been prepared and approved. All works will be undertaken in accordance with approval conditions and statutory requirements.

It is expected that construction staff will be accommodated within neighbouring towns, including Wellington and Dubbo.

Specific elements of the project which will be evident during the construction phase of the project include the following:

- Site office and laydown area comprising:
  - Several demountable buildings used for office, workshop and storage purposes, an amenities block, and portable toilet facilities will be located at the project area during construction.
  - Arrangements will be made for power and communications at the site office during the construction period.
  - Sufficient car parking will be provided.
  - A cleared flat area to provide for the storage of various items during construction.
  - The most likely location for the site office and laydown area is indicated on the Project Overview, Figure 1.3.
  - A schematic diagram of the construction site office and laydown area is provided in Figure 3.4.

All temporary construction facilities will be removed and the land restored and rehabilitated once construction has been completed. This will include the following:

- the removal of temporary facilities, wastes and surplus materials from the site;
- removal and restoration of any temporary construction tracks and ongoing maintenance of any land stabilisation required;
- revegetation of disturbed areas in consultation with the land owners to return the land to the condition prior to construction (in most cases this will include re-seeding and restoration for agricultural production) to prevent site erosion and sedimentation;

- the rehabilitation of areas where underground cables have been installed to enable grazing activities to continue; and
- management of weeds in the disturbed areas.

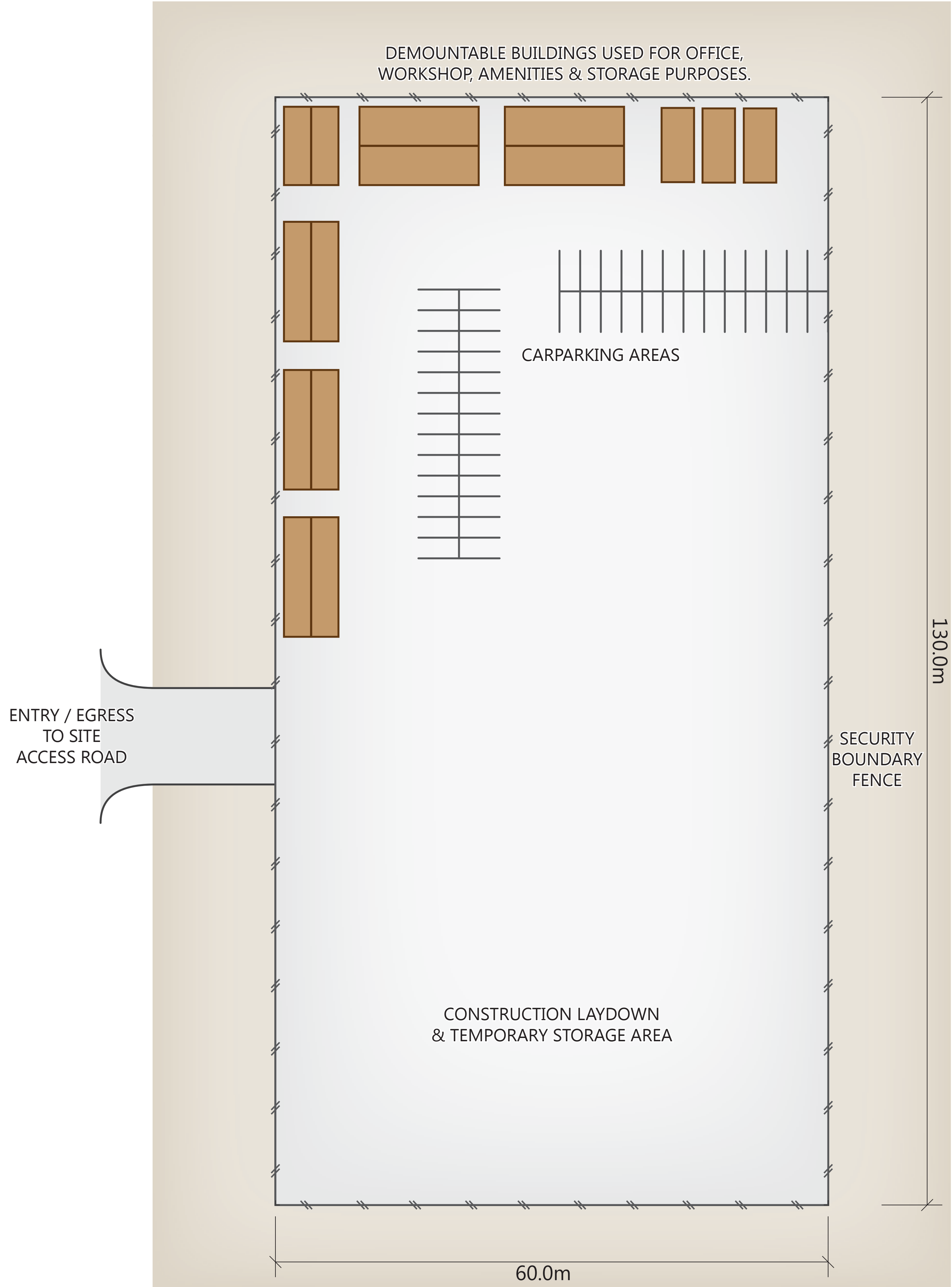


Figure 3.4

Construction site office & laydown area

NOT TO SCALE

3.8 OPERATIONAL DETAILS

The wind turbines convert wind energy into electrical energy on an automatic basis. The rotation of the blades by wind, causes the rotation of the turbine rotor which is connected via a gearbox to a generator. Each gearbox generates around 0.69 to 1.0kV, which is converted to 33kV by the generator transformer at each turbine.

Wind turbine operation will commence at a wind speed of approximately 4.0 metres per second (14.4 kilometres per hour) and de-rate or stop at 25 metres per second (90 kilometres per hour). The turbines will have a maximum rotation speed to 14 to 18 revolutions per minute, causing a rotation of 360 degrees approximately every 4.2 seconds.

Once commissioned, the wind farm will operate with a moderate on-site work force at the substation office of approximately six to ten staff, employed for inspection and maintenance purposes. Additional visits by other technical staff will be made where assistance is required. Once commissioned, the wind farm will be able to operate whenever wind speeds allow for generation. Ongoing staff are likely to be accommodated in nearby towns to the project area, such as at Wellington or Dubbo.

3.9 DECOMMISSIONING OR REPLACEMENT

At the end of its economic life, all equipment will either be replaced with comparable new equipment, or the wind farm will be decommissioned. Replacement would be subject to new approvals.

Decommissioning would involve dismantling or removal of all equipment, and rehabilitation to restore the land to its previous condition. Turbine footings would be retained at a level below the ground surface, as acceptable to the land owner. Access tracks may be retained depending on the landowners' wishes. Any overhead wires no long required will be removed.

A Decommissioning and Rehabilitation Plan is provided in **Attachment C**.

The proponent is responsible for the decommissioning of the wind farm. Every associated land owner of the Bodangora Wind Farm has this clause in their lease. This is a legally binding obligation that will be tied to the land regardless if the parties of the lease ever change.

3.10 PROJECT TIMING

Subject to gaining the necessary approvals, Table 3.3 outlines the likely timetable for construction and operation of the Bodangora Wind Farm.

Table 3.3 – Project Timing

PHASE	DURATION
Pre-construction, project planning and construction certificate approval	5 months
Construction	18 months
Commissioning	3 months
Operation	25 years
Maintenance	Periodic and as required
Decommissioning or replacement	At completion of project life

3.11 CONSTRUCTION AND OPERATIONAL ENVIRONMENTAL MANAGEMENT PLANS

A Construction and Operational Environmental Management Plans (CEMP and OEMP) will incorporate the necessary environmental controls during both construction and operation to address any potential identified risks throughout this EA. This CEMP will be prepared prior to the construction of the wind farm, based upon the Department of Planning's Guideline for the Preparation of Environmental Management Plans (2004).

The CEMP will cover (and will not be limited to) the following aspects, in accordance with the findings of the investigative studies undertaken in the preparation of this Environmental Assessment:

- construction traffic management;
- location and extent of site earthworks;
- soil and water management;
- emissions including dust and noise control;
- fuel storage and handling;
- waste storage, handling and disposal;
- bush fire prevention;
- coordination with property owners and effects on stock;
- weed control and site restoration;
- management of any quarrying activities (if relevant); and
- management of any mobile concrete batching plant (if relevant).

Specific aspects are outlined in the Statement of Commitments included within this EA.

The CEMP will routinely monitor activities of construction, operations and maintenance of the wind farm.