

Crookwell 2 Wind Farm Section 75W Modification Application

Environmental Assessment

On behalf of
Crookwell Development Pty Ltd
September 2016



Project Director

Adam Coburn

Signed*



29 September 2016

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This document is for discussion purposes only unless signed and dated by the persons identified. This document has been reviewed by the Project Director.

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Statement of Preparation

Applicant details

Name: Crookwell Development Pty Ltd

Site and proposal details

Site Location: The site is located on Crookwell Road, approximately 14 kilometres (km) south-east of Crookwell and 30km north-west of Goulburn.

Legal Description: Lot 91 DP 750042, Lot 140 DP 750042, Lot 1 DP 1201348, Lot 2 DP 1201348, Lot 3 DP 1201348, Lot 41 DP 999621, Lot 2 DP 865814, Lot 2 DP 1091383, Lot 1 DP 79580, Lot 1 DP 1087717, Lot 2 DP 1087717, Lot 3 DP 1087717, Lot 18 DP 252214, Lot 1 DP 965855, Right of Carriageway over Lot 18 DP252214 Conveyance No. 622, Book 337.

Proposed Development: Modifications to approved the Crookwell 2 Wind Farm (DA-176-8-2004), including a reduction in the number of turbines, increased turbine size and other modifications as set out in the Environmental Assessment report.

Prepared by

Name: Adam Coburn

Qualifications: Bachelor of Environmental Planning, Master of Planning


Address: Mecone Pty Ltd, Suite 1204B, 179 Elizabeth Street, Sydney NSW 2000

Certification

I certify that I have reviewed the content of this Environmental Assessment and to the best of my knowledge:

- it is in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (The Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (The Regulation);
- all available information that is relevant to the environmental assessment of the development to which the statement relates; and
- the information contained in the statement is neither false nor misleading.

Signature:



Name: Adam Coburn

Date: 29 September 2016

Executive Summary

Introduction

This Environmental Assessment (EA) report has been prepared on behalf of Crookwell Development Pty Ltd in support of a modification application under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to modify existing development consent (DA-176-8-2004-I) for the Crookwell 2 Wind Farm (**Development Consent**).

The Development Consent was originally granted for the Crookwell 2 Wind Farm (the project) by the then Minister for Infrastructure and Planning on 10 June 2005. The Development Consent was then modified by the Minister for Planning on 29 June 2009 (**Modification-1**).

There have been significant advances in turbine technology since the determination of both the original Development Consent for the Crookwell 2 Wind Farm and Modification-1. The subject modification application has been prepared in order to further reduce the environmental impacts of the project and to take advantage of these technological advances.

Site Description

Crookwell is located in regional NSW in the Upper Lachlan Local Government Area. The Crookwell 2 Wind Farm is one of three approved/proposed wind farms in the Crookwell area, the other farms being:

- (a) Crookwell 1 Wind Farm – this project is already fully constructed and operational; and
- (b) Crookwell 3 Wind Farm – this project is the subject of a current application for State significant development consent (SSD 6695, MP 10_0034).

Background

The Development Consent as originally granted authorised, subject to conditions, the construction and operation of a wind farm consisting of 46 wind turbines and associated infrastructure, as described in the Crookwell 2 Wind Farm Environmental Impact Statement prepared by URS, dated July 2004 (**Original EIS**).

Crookwell 2 Wind Farm Modification-1 was granted under section 96(2) of the EP&A Act and involved the installation of taller and larger turbines, the relocation up to 20 turbines, obstacle lighting of up to 23 turbines, the alteration of site access points and internal roads, the revision of construction noise limits and road upgrade conditions to reflect these changes.

Specifically, the modification included:

- Increase in hub height to up to 80 metres (m);
- Increase in blade length up to 47m;
- Increase in the rotor diameter up to 96m;
- Increase in blade tip height up to 128 m;
- Increase in turbine foundation area to an approximate diameter of 17m;
- Relocation of 20 turbines;
- Change of access road location and crossing of unused rail corridor; and
- Obstacle night lighting for aviation.

Planning Context

The original Development Consent for the Crookwell 2 Wind Farm was granted as State significant development under section 80 of the EP&A Act.

In June 2009, construction commenced under the Development Consent with the start of surveying and geotechnical investigations for various sections of the site. Bulk earthworks were also undertaken involving excavation and compacting of an area 50m x 100m, constructing a hardstand area, installing steel reinforcement and pouring a concrete slab of 25m x 25m. In addition, portable buildings were installed, a bund for a generator constructed, generator installed, water tank installed, plumbing and electrical fitouts undertaken, and security fencing for the entire perimeter of the site compound erected. However, no wind turbine generators authorised under the Development Consent have been constructed to date.

The Development Consent was subsequently modified under Modification-1.

While Part 3A of the EP&A Act has been repealed, Clause 12 of Schedule 6A of the EP&A Act provides that it continues to apply to modifications of development consents referred to in Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regs). Clause 8J(8) of the EP&A Regs provides that:

- (a) a development consent relating to State significant development before 1 August 2005 is taken to be an approval under Part 3A for the purpose of modification; and
- (b) section 75W of the EP&A Act applies to any modification of such a consent.

Accordingly, as the Development Consent related to State Significant development and was approved before 1 August 2005, section 75W of the EP&A Act applies to the current modification application.

The following environmental planning instruments are relevant to the proposed modifications and were considered in the preparation of this EA:

- State Environmental Planning Policy (State and Regional Development);
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy No. 44 – Koala Habitat Protection;
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;
- State Environmental Planning Policy (Rural Lands) 2008; and
- Upper Lachlan Local Environmental Plan 2010.

Other state and commonwealth legislation was also considered, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Protection of the Environment Operations Act 1997* (POEO Act) and the *Threatened Species Conservation Act 1995* (TSC Act). In summary it was found that the proposed modifications are generally consistent with all relevant requirements.

Proposed Modifications

The proposed modification seeks to further reduce the environmental impact of the project and reflect the significant developments made in turbine technology, since 2005.

The proposed modifications include:

- Reduction of the number of approved turbines from 46 to 33 (a total reduction of 13 turbines);
- Increase in the maximum turbine envelope so as to accommodate the newer, more efficient turbine models now available. The changes proposed to the turbine envelope will:
 - Increase in the hub height from 80m to up to 95m;
 - Increase in the blade size from 47m to up to 64m;
 - Increase in the rotor diameter from 96m to up to 130m;
 - Increase in the blade tip height from 128m to up to 160m; and
 - Increase in turbine foundation area from 17m in diameter to approximately 20m;
- Inclusion of a 50m micro-siting allowance which allows for the micro-siting of turbines and project infrastructure by up to 50m from the locations approved in Modification-1;
- Modifications to the obstacle night lighting design to match the turbine layout;
- Grid cut-in reconfiguration and inclusion of a taller replacement transmission line tower for TransGrid, and associated communications infrastructure; and
- Subdivision of the proposed switchyard and any deemed subdivision arising from the grant of leases for the wind farm.

New turbine models will enable the Crookwell 2 Wind Farm to generate more energy per turbine and increase the overall energy yield of the project. This is due to the increase in turbine height providing access to stronger wind resources, the increase in the swept path area due to the longer blade length, and an increase in generator capacity in the nacelle (up to approximately 3.6 Megawatts (MW)). These changes combine to increase the amount of the wind energy harnessed by each turbine.

Current estimates show that the amended project could generate up to 385 gigawatt hours per year (GWh/y) for the 33 larger turbines in comparison to only 270 GWh/y for the 46 approved turbines.

The reduction in turbine numbers will also reduce the Project's overall environmental impacts.

In February 2015, the DP&E recommended that the Crookwell 3 Wind Farm be approved by the Planning Assessment Commission, subject to conditions.

Since that time, further changes have been proposed to the Crookwell 3 Wind Farm to further reduce its environmental impact and reflect the significant developments made in turbine technology.

An Addendum Environmental Impact Statement has been prepared for Crookwell 3 Wind Farm to assess these changes. The cumulative impact assessment contained in this EA incorporates the proposed changes to the Crookwell 3 Wind Farm as assessed in that Addendum Environmental Impact Statement.

Consultation

Consultation was carried out during preparation of this EA with both the community and all relevant authorities. Those consulted include:

- Commonwealth Agencies:

- Civil Aviation Safety Authority (CASA);
- Airservices Australia;
- Department of Defence;
- Department of Environment;
- Bureau of Meteorology (BoM);
- NSW Government Agencies:
 - NSW Department of Planning and Environment;
 - NSW Office of Environment and Heritage;
 - NSW Environmental Protection Authority;
 - NSW Department of Industry;
 - NSW Department of Industry, Crown Roads;
 - NSW Land and Property Information (NSW LPI);
 - NSW Roads and Maritime Services;
 - NSW Office of Water;
 - NSW Rural Fire Service;
 - Ambulance Service of NSW;
 - John Holland Rail on behalf of Transport for NSW;
- Local Government
 - Upper Lachlan Shire Council;
 - Goulburn Mulwaree Council;
- Other Agencies / Organisations
 - Aerial Agricultural Association of Australia;
 - Fred Fahey Aerial Services;
 - Geoscience Australia;
 - Mobile phone service providers (Optus, Telstra and Vodafone);
 - Radio Goulburn;
 - Royal Flying Doctor Service;
 - Vertical Telecoms;
 - Wireless Internet (NBN, Yless4U, ACE Internet Services);
 - Yass Aerial Service;
- Associated residents where modified turbines are located on their land;
- Non-associated neighbouring landowners / residents and local community;

Consultation activities to non-associated landowners / residents and local community included:

- Local newspaper advertisements;
- Door knocks and/or similar meetings with adjoining landowners / residents, and landowners / residents within 3km of the project site; and
- Direct mail-out to households of a project newsletter to within 3km of the project site.

Environmental and Social Impact Assessment

Visual

A Visual Impact Assessment (VIA) report has been prepared by Green Bean Design (refer to **Appendix 6**). The Visual Impact Assessment compared the approved Modification-1 against this proposed Crookwell 2 Wind Farm wind turbine layout.

The report found that the removal of up to thirteen approved wind turbines, including wind turbines within proximity to the Crookwell-Goulburn Road corridor,

would result in an overall reduction in wind turbine visibility for key non-associated residential dwellings and for motorists travelling along the Crookwell-Goulburn Road.

The removal of wind turbines would also reduce visual density and level of visual complexity created by multiple overlapping rotor blades when viewed from key surrounding view locations.

The proposed increase in wind turbine tip height would be discernible from some surrounding and proximate view locations where views toward Modification-1 turbines exist. However, the impacts of the increased tip height is not considered to be of a magnitude that would significantly increase the visual effects associated with the development as approved in Modification-1.

Shadow Flicker

A Shadow Flicker and Blade Glint Assessment has been prepared by DNV GL (refer to **Appendix 7**).

Results of the assessment indicate that there are locations within 50m of nine dwellings that are predicted to experience some shadow flicker from the Crookwell 2 Wind Farm turbines. Eight of these locations are predicted to experience theoretical shadow flicker duration in excess of the recommended limit of 30 hours per year; however, DNV GL has been informed that these are all host dwellings within either the Crookwell 2 or Crookwell 3 Wind Farms.

When considering the predicted actual shadow flicker duration, which takes into account the reduction in shadow flicker due to turbine orientation and cloud cover, the eight host dwellings are also expected to experience shadow flicker durations in excess of the recommended limit of 10 hours per year within 50m of the house location. The proponent has consulted the host landowners about the project impacts.

Blade glint involves the reflection of light from a turbine but is generally not a problem for modern turbines provided non-reflective coatings are used for the surface of the blades.

Noise

A Noise Impact Assessment has been prepared by SLR Consulting Australia Pty Ltd (refer **Appendix 8**). The report considered the noise impacts of the proposed modifications to the Crookwell 2 Wind Farm together with the modifications proposed to the Crookwell 3 Wind Farm in order to provide an assessment of cumulative noise impacts.

Modelling was conducted using the standard ISO9613 methodology and completed for three alternative turbines models (Vestas V126, GE130, Senvion M122). Initial results indicated that the wind farm would exceed the relevant noise limits at some receptors.

A mitigation investigation was undertaken utilising Noise Management Mode, and it was found that compliance at all receptors can be achieved using a mitigated layout where some wind turbines are operated in Noise Management Mode. It should be noted that when WTGs are configured in Noise Management Mode they are always operating in the reduced noise mode, which is distinctly different from Sector Management. The final configuration of Noise Management Mode WTGs will be determined from the result of noise monitoring undertaken post-construction of the wind farm.

At the request of DP&E, a more detailed predicted analysis was completed using a more realistic evaluation of the effect of the variation of meteorology on noise from the wind farm. Results show that for project involved receptors, the ISO9613 modelling approach is potentially overly conservative by 1 decibel (dBA) to

2dBA. Furthermore, when considering combined effects of meteorological propagation enhancement, turbine directivity and turbine Sound Power Level the variation in wind farm noise levels can be up to 19 dBA lower than the highest predicted wind farm noise equivalent. For non-involved receptors, it is expected that the ISO9613 modelling approach is potentially overly conservative by 2dBA to 3dBA and when considering combined effects of meteorological propagation enhancement, turbine directivity and turbine Sound Power Level the variation in wind farm noise levels can be up to 26 dBA lower than the highest predicted wind farm noise equivalent.

These results confirm that compliance at all receptors can be achieved using a mitigated layout where some wind turbines are operated in Sound Management Mode.

Heritage

Bowen Heritage Management has undertaken a Heritage Impact Assessment for the proposed modification (refer **Appendix 9**).

The report concludes that no further archaeological assessment is required for the proposed 33 wind turbine locations, as long as micro-siting is confined to within a 50m radius of the currently approved turbine locations.

Notably, the significant reduction in turbine numbers proposed as part of this modification will reduce the overall project footprint by creating 13 landscape positions within the study area that will no longer be subject to any ground disturbance.

Where vehicle access track locations are to be modified from their originally proposed route or the Modification-1 route, further archaeological investigation in the form of desktop study and field survey investigation will be required.

Aviation

An Aviation Impact Assessment (AIA) has been prepared by Aviation Project Pty Ltd. The AIA includes an Aeronautical Impact Statement (AIS) prepared by IDA Australasia (refer **Appendix 10**). The report concludes that the highest obstacle in the wind farm project will be 1,107m (3632ft) AHD and as such:

- Will not penetrate any OLS surfaces;
- Will not penetrate any PAN-OPS surfaces;
- Will not have an impact on nearby designated air routes;
- Will not have an impact on prescribed airspace;
- Is wholly contained within Class G airspace; and
- Will not have an impact on existing local aviation activities.

The report states that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine without obstacle lighting on the turbines of the project.

The report also provides recommendations for obstacle lighting (if required).

Telecommunications

DNV GL has undertaken an Electromagnetic Interference (EMI) Assessment (refer **Appendix 11**) with regards to fixed point-to-point links, radio communication assets belonging to emergency services, meteorological radars, trigonometrical stations, citizen band (CB) radio and mobile phones, wireless internet, Broadcast radio, satellite television and internet, and broadcast television.

In summary it has been found that there may be some impacts associated with the proposed modification, notably upon television reception. These can be effectively managed using a variety of measures and would be implemented following additional consultation with affected stakeholders.

Traffic and Transport

A Traffic and Transport Impact Assessment has been prepared by GTA consultants (refer **Appendix 12**). The report concludes:

- Traffic impacts associated with the proposed modifications are lower, especially during the construction phase of the development, as the number of turbines being constructed has reduced; and
- Transportation of the proposed 64m blades to the Crookwell 2 Wind Farm via the nominated transport route would be possible, subject to the temporary removal or relocation of various roadside elements at key intersections.

Notably, GTA Consultants have consulted with Upper Lachlan Shire Council in relation to the proposed use of a larger blade. The Director of Works and Operations did not raise any direct objections to the proposal but noted that the agreed road upgrades would need to be adjusted to suit the larger blades.

Biodiversity

A Supplementary Ecological Impact Assessment has been undertaken by Brett Lane and Associates Pty Ltd (refer **Appendix 13**).

In summary the report has found:

- The proposed increase in blade length increases the risk of bird collision, but overall the risk of collisions is low and affects primarily common farmland species;
- The effect of the changes to the rotor swept area (RSA) is not considered to substantially increase the risk of collisions with bats as most bat activity will remain below the lower RSA heights; and
- There are no anticipated additional impacts on flora and native vegetation compared to the approved Modification-1 layout.

Brett Lane and Associates have also prepared a Turbine Micrositing Biodiversity Management Plan (refer **Appendix 14**). This plan identifies habitats of ecological sensitivity on the site; provides a checklist to avoid potential additional impacts to biodiversity; and provides mitigation measures for the project if potential additional impacts are identified.

These measures all support the proposed inclusion of 50m micrositing allowances for turbines and associated infrastructure.

Social and Economic

The proposed modifications are not anticipated to have any adverse social or economic impacts. The detailed socio-economic analysis submitted with the application for the original Crookwell 2 Wind Farm project is considered to still be relevant and authoritative.

This analysis concluded that the project would provide a number of positive benefits to the economy and local community, including capital investment, direct and flow-on employment benefits, maintenance of existing agricultural activities and contribution to national and international efforts to reduce potential impacts of climate change. All of these benefits would be maintained or improved upon through this proposed modification, which features better, more efficient technology and fewer turbines.

Cumulative Impacts

This report assesses the cumulative impact of the proposed modifications to the Crookwell 2 Wind Farm as well as the impacts arising from the already constructed Crookwell 1 Wind Farm and the proposed Crookwell 3 Wind Farm.

In February 2015, the DP&E recommended that the Crookwell 3 Wind Farm application be approved by the Planning Assessment Commission, subject to conditions.

Since that time, further changes have been proposed to the Crookwell 3 Wind Farm to further reduce its environmental impact and reflect the significant developments made in turbine technology.

An Addendum Environmental Impact Statement has been prepared for Crookwell 3 Wind Farm to assess these changes. The cumulative impact assessment contained in this EA incorporates the proposed changes to the Crookwell 3 Wind Farm as assessed in that Addendum Environmental Impact Statement.

Results of the cumulative impact assessment contained in the shadow flicker and blade glint assessment show that no shadow flicker from either the Crookwell 1 or Crookwell 3 Wind Farm turbines is expected to affect the dwellings that receive shadow flicker from the proposed modifications to the Crookwell 2 Wind Farm. As a consequence, there is no cumulative shadow flicker impact.

The noise impact assessment prepared by SLR concludes that noise compliance at all three wind farms (Crookwell 1, Crookwell 2 and Crookwell 3) can be achieved by using a mitigated layout at both the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm, where a number of turbines are placed into noise management mode.

The EMI assessment prepared by DNV GL considered the possible cumulative impacts from this proposed modification and nearby wind farms. The possibility exists for there to be some cumulative impacts on point-to-point and point-to-multipoint links, mobile phones, wireless internet, CB radio and some television services. However, options exist to mitigate most interference issues should they occur.

This Environmental Assessment has found that the potential cumulative impacts from this proposed modification, along with the Crookwell 1 and 3 Wind Farms are both minimal and manageable.

Environmental Management

Environmental management measures and strategies for the proposed modifications would be managed with the aid of an Environmental Management Plan (EMP), including a standalone Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP).

Conclusion

This EA finds that the proposed modifications to the Crookwell 2 Wind Farm will, if approved, further reduce the environmental impact of the project and provide for the more efficient generation of clean renewable energy.

1 Introduction

This Environmental Assessment (EA) report has been prepared on behalf of Crookwell Development Pty Ltd in support of a modification application under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), modifying the existing Development Consent (DA-176-8-2004-l) granted for the Crookwell 2 Wind Farm (**Development Consent**).

The Development Consent was extended by one year on 29 April 2008, and was modified by the Minister for Planning on 29 June 2009 (**Modification-1**).

In June 2009, construction commenced under the Development Consent with the start of surveying and geotechnical investigations for various sections of the site. Bulk earthworks were also undertaken involving excavation and compacting of an area 50m x 100m, constructing a hardstand area, installing steel reinforcement and pouring a concrete slab of 25m x 25m. In addition, portable buildings were installed, a bund for a generator constructed, generator installed, water tank installed, plumbing and electrical fitouts undertaken, and security fencing for the entire perimeter of the site compound erected. However, no wind turbine generators authorised under the Development Consent have been constructed to date.

In the years since the original Development Consent and Modification-1 were determined, there have been significant advances in wind turbine technology. The subject modification application has been prepared in order to further reduce the environmental impact of the project and to take advantage of these technological advances.

1.1 Purpose and Structure of Report

The purpose of this EA report is to support an application to modify the existing Development Consent for Crookwell 2 Wind Farm under section 75W of the EP&A Act.

The structure of this EA report is as follows:

- *Site Description*, which provides a brief description of the site and its location and context;
- *Background*, which describes the previous approvals for the project;
- *Proposed Modification*, which provides a detailed description of the proposed modification to the approved project;
- *Planning Context*, which provides an overview of relevant planning legislation and policies and an assessment of the proposed modification against these;
- *Consultation*, which provides an overview of the consultation that has occurred with the community and other stakeholders in relation to the proposed modification, and identifies the key issues raised during consultation;
- *Environmental Impact Assessment*, which provides an overview of the impact of the proposed modification on the environment, including cumulative impacts, and identifies appropriate mitigation measures to safeguard the environment; and
- *Environmental Management*, which outlines the proponent's commitment to environmental management and ongoing monitoring.

This report specifically addresses the requirements specified by the DP&E in its letter dated 1 June 2015 to Union Fenosa Wind Australia. A copy of this letter is

provided in **Appendix 5**. The table below provides a summary of the required information set out in this letter and its corresponding location within this report.

Table 1. Environmental Assessment Requirements	
Requirement	Location in report
A noise impact assessment of the project (as modified) in accordance with applicable guidelines, including the <i>South Australian EPA's Wind Farms Environmental Noise Guidelines (2003)</i> .	<ul style="list-style-type: none"> • Section 7.3 • Appendix 8 (full document)
A visual assessment of the impact of the project (as modified) on all residents within 5 km of the wind farm, including any changes to direct visual impacts, shadow flicker, blade glint, and night lighting.	<p>Landscape:</p> <ul style="list-style-type: none"> • Section 7.1 • Appendix 6 (full document) <p>Shadow flicker/blade glint:</p> <ul style="list-style-type: none"> • Section 7.2 • Appendix 7 (full document)
An aviation impact assessment of the project (as modified), including an Aeronautical Impact Statement (AIS) prepared by an appropriately qualified person.	<ul style="list-style-type: none"> • Section 7.5 • Appendix 10 (full document)
An electromagnetic interference assessment of the project (as modified) that identifies the potential effects on telecommunications systems.	<ul style="list-style-type: none"> • Section 7.6 • Appendix 11 (full document)
A supplementary biodiversity assessment focusing on any additional impacts on biodiversity associated with the revised project components, particularly collision risks to birds and bats.	<ul style="list-style-type: none"> • Section 7.8 • Appendix 13 (full document)
A supplementary heritage assessment, undertaken by suitably qualified heritage consultants, of any areas outside Aboriginal Heritage Impact Permit Number 1122895, issued under the National Parks and Wildlife Act 1974.	<ul style="list-style-type: none"> • Section 7.4 • Appendix 9 (full document)

1.2 Proponent

The Crookwell 2 Wind Farm is owned by Crookwell Development Pty Ltd, a wholly owned subsidiary of Union Fenosa Wind Australia Pty Ltd. Crookwell Development Pty Ltd is the legal entity for the purpose of this project.

1.3 Proponent and Project Team

The Modification Application and Environmental Assessment Report have been prepared on behalf of the applicant, Crookwell Development Pty Ltd. The project team is outlined below.

Table 2. Project Team	
Area	Consultant
Proponent	Crookwell Development Pty Ltd
Statutory Planning	Mecone
Aeronautical and Night Obstacle Lighting	Aviation Projects
Heritage Consultant	Bowen Heritage Management
Ecology Consultant	Brett Lane and Associates
Shadow Flicker and Telecommunication	DNV GL - Energy
Landscape and Visual Consultant	Green Bean Design
Traffic and Transport Consultant	GTA Consultants
Noise Consultant	SLR Consulting Australia

The project team has also drawn upon, where appropriate, the environmental assessments undertaken as part of Original Environmental Impact Statement for the Project (Original EIS) and the Environmental Impact Statement Prepared as part of Modification 1 (Modification 1 EIS).

2 Site Description

Crookwell is located in regional southwest NSW in the Upper Lachlan Local Government Area. The Crookwell 2 Wind Farm is one of three approved/proposed wind farms in the Crookwell region, the other farms being the operational Crookwell 1 Wind Farm and the proposed Crookwell 3 Wind Farm.

The site is located on Crookwell Road, approximately 14km south-east of Crookwell and 30km north-west of Goulburn. Figure 1 and Figure 2 provide aerial views of the site, and Table 3 provides a summary description of the site.

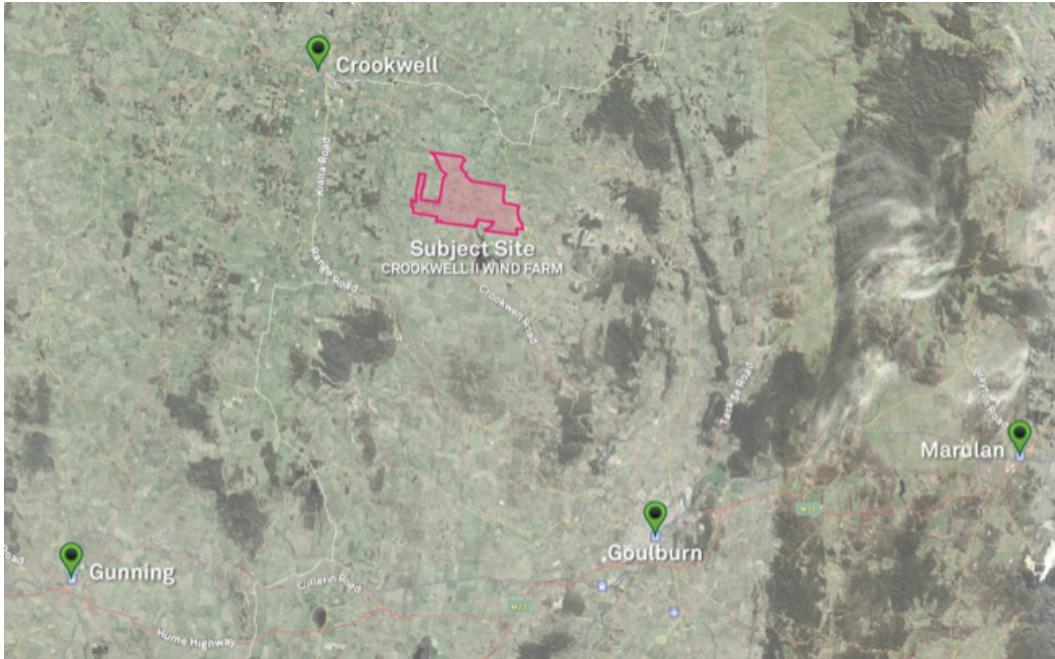


Figure 1: Regional Context
Source: Mecone 2016



Figure 2: Site Location
Source: Mecone 2016

Table 3. Site Description	
Item	Description
Legal Description	<p>Lot 91 DP 750042</p> <p>Lot 140 DP 750042</p> <p>Lot 1 DP 1201348</p> <p>Lot 2 DP 1201348</p> <p>Lot 3 DP 1201348</p> <p>Lot 41 DP 999621</p> <p>Lot 2 DP 865814</p> <p>Lot 2 DP 1091383</p> <p>Lot 1 DP 79580</p> <p>Lot 18 DP 252214</p> <p>Lot 1 DP 1087717</p> <p>Lot 2 DP 1087717</p> <p>Lot 3 DP 1087717</p> <p>Lot 1 DP 965855</p> <p>Right of Carriageway over Lot 18 DP252214 Conveyance No. 622, Book 337.</p>
Total Area	Approximately 2,088 hectares
Location	Access to the Crookwell 2 Wind Farm is via Crookwell Road and Woodhouselee Road.
Site Description	The site is located on a system of ridges and low hills that are separated by the Wollondilly River and the Goulburn-Crookwell Road corridor.
Surrounding Context	The surrounding area is rural in character and features undulating hills with some steeper slopes around valleys.

3 Background

3.1 Original Development Consent

The project was originally assessed as both 'designated development' and 'integrated development'.

In February 2004, the Minister for Infrastructure, Planning and Natural Resources declared the proposed Crookwell 2 Wind Farm to be State Significant Development (SSD) under Section 76A(7)(b) of the EP&A Act (see **Appendix 1**).

Development consent DA-176-8-2004-I (Development Consent) was granted, subject to conditions, on 10 June 2005, under Section 80 of EP&A Act) by the then Minister for Infrastructure and Planning for 46 x 2MW turbines and associated infrastructure, as described in the Original EIS.

The Original EIS described the project as including 55 turbines. However, five turbines were removed to protect the visual and noise amenity of neighbouring properties and four further turbines were subject to a condition requiring that a separate (Stage 2 and Stage 3) development consent be obtained before these turbines were to be constructed. No separate consent has been obtained for these turbines and these turbines do not form part of the current modification application.

Detailed conditions were imposed on the Development Consent to minimise any adverse environmental impacts, and ensure appropriate environmental management, regular monitoring and reporting on the development occurred.

Specifically, the project as originally approved included:

- 46 wind turbines (with a ground to blade tip height of approximately 107m), each consisting of:
 - A 67m steel tower;
 - A nacelle; and
 - Three 39m fiberglass blades;
- A network of unsealed site access tracks;
- Site access road entrance points;
- A network of underground electrical cables;
- A 33/330 kilovolt (kV) transformer substation and high voltage switchyard;
- A grid cut-in to connect the high voltage switchyard to the existing 330kV electricity transmission line; and
- Site control room and facilities building.

See **Appendix 2** for the conditions of consent.

3.2 Modification 1

A modification (Modification-1) to the original consent under Section 96(2) of the EP&A Act was approved with conditions on 29 June 2009. The modification permitted the installation of taller and larger turbines, the relocation up to 20 turbines, the obstacle lighting of up to 23 turbines, the alteration of site access points and internal roads, the revision of construction noise limits and road upgrade conditions to reflect these changes, and the replacement of references to the Department of Environment and Climate Change (DECC) in noise-related conditions to the Director-General, Department of Planning.

Specifically, the modification included:

- Increase in hub height to up to 80m;
- Increase in blade length up to 47m;
- Increase in the rotor diameter up to 96m;
- Increase in blade tip height up to 128m;
- Increase in turbine foundation area to an approximate diameter of 17m;
- Relocation of 20 turbines;
- Change of access road location and crossing of unused rail corridor; and
- Obstacle night lighting for aviation.

See **Appendix 3** for the modified conditions of consent.

3.3 Commencement of Construction

The Minister for Planning, as the consent authority, granted a 1-year extension to the lapsing date for the Development Consent on 29 April 2008. As a result, the revised lapsing date for the Development Consent became 10 June 2009.

In June 2009, construction commenced under the Development Consent with the start of surveying and geotechnical investigations for various sections of the site. Bulk earthworks were also undertaken involving excavation and compacting of an area 50m x 100m, constructing a hardstand area, installing steel reinforcement and pouring a concrete slab of 25m x 25m. In addition, portable buildings were installed, a bund for a generator constructed, generator installed, water tank installed, plumbing and electrical fitouts undertaken, and security fencing for the entire perimeter of the site compound erected. However, no wind turbine generators authorised under the Development Consent have been constructed to date.

3.4 Proposed Modification 2

In May 2015, the proponent notified the DP&E of its intention to apply for a modification to the Crookwell 2 Wind Farm under section 75W of the EP&A Act. The DP&E did not issue formal Secretary's Environmental Assessment Requirements for the proposed modification but rather outlined the minimum matters for inclusion in this Environmental Assessment (refer to **Appendix 5**).

4 Proposed Modifications

There have been significant advances in turbine technology since lodgment of the original project application for the Crookwell 2 Wind Farm, and the subject modification application has been prepared in order to take advantage of these advances. New turbine models will enable the Crookwell 2 Wind Farm to generate more energy per turbine and to increase the energy yield of the project whilst reducing the overall environmental impact of the project.

The proposed modifications to the project include:

- Reduction of the number of approved turbines from 46 to 33 (a total reduction of 13 turbines);
- Increasing the maximum turbine envelope so as to accommodate the newer more efficient turbine models now available. The changes proposed to the turbine envelope will:
 - Increase in the hub height from 80m to up to 95m;
 - Increase in the blade size from 47m to up to 64m;
 - Increase in the rotor diameter from 96m to up to 130m;
 - Increase in the blade tip height from 128m to up to 160m; and
 - Increase in turbine foundation area from 17m in diameter to approximately 20m;
- Inclusion of a 50m micrositing allowance which allows for the micrositing of turbines and associated project infrastructure by up to 50m from the locations approved in Modification 1;
- Modifications to the obstacle night lighting design to match the turbine layout;
- Grid cut-in reconfiguration and inclusion of a taller replacement transmission line tower for TransGrid, and associated communications infrastructure; and
- Subdivision of the approved switchyard and any deemed subdivision arising from the grant of leases for the wind farm.

The revised Capital Investment Value of the project has been estimated at up to \$200 Million.

An indicative layout plan showing the locations of the 13 turbines proposed for removal and positions of turbines relative to the closest receivers is provided in Figure 3 below and in more detail at **Appendix 16**.

The revised indicative locations reflect both the current understanding of the best location for turbines given the knowledge of wind characteristics in the area and the presence of vegetation.

As part of this application, approval is also being sought to refine the proposed layout at the detailed design stage, and once a final turbine type has been selected. It is estimated that this may result in individual turbines and associated infrastructure being moved by up to 50m from the locations indicated in Figure 3.

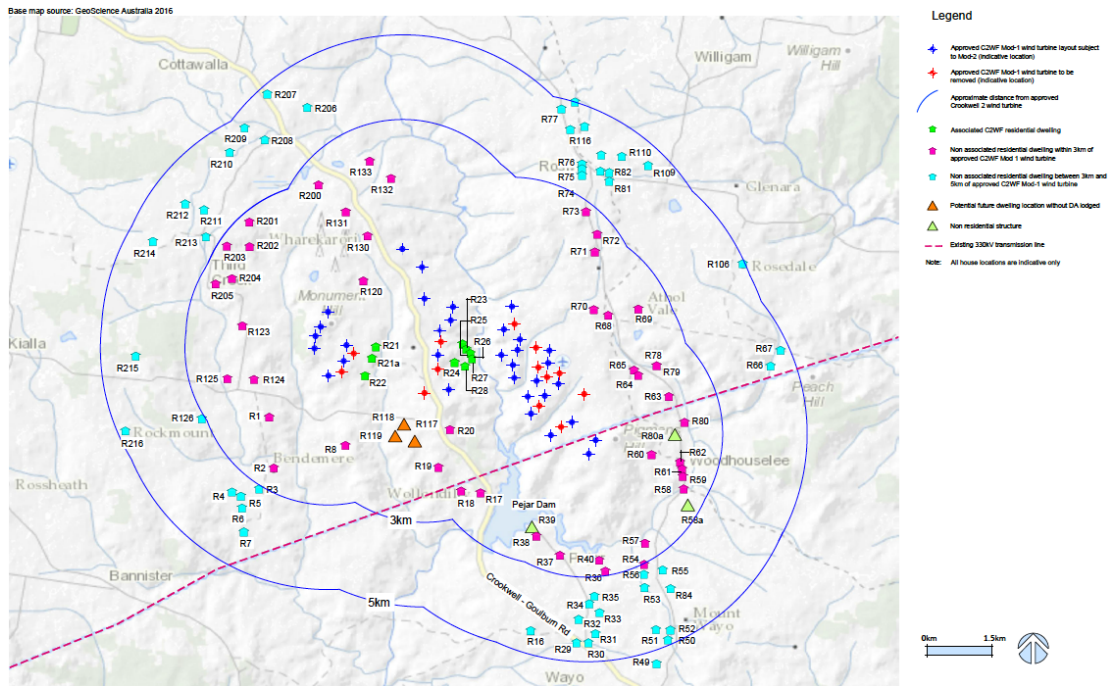


Figure 3: Indicative Layout Plan
 Source: Crookwell Development Pty Ltd and Green Bean Design

Figure 4 provides a comparison between the previously approved Modification-1 turbine envelope and that proposed under this modification.

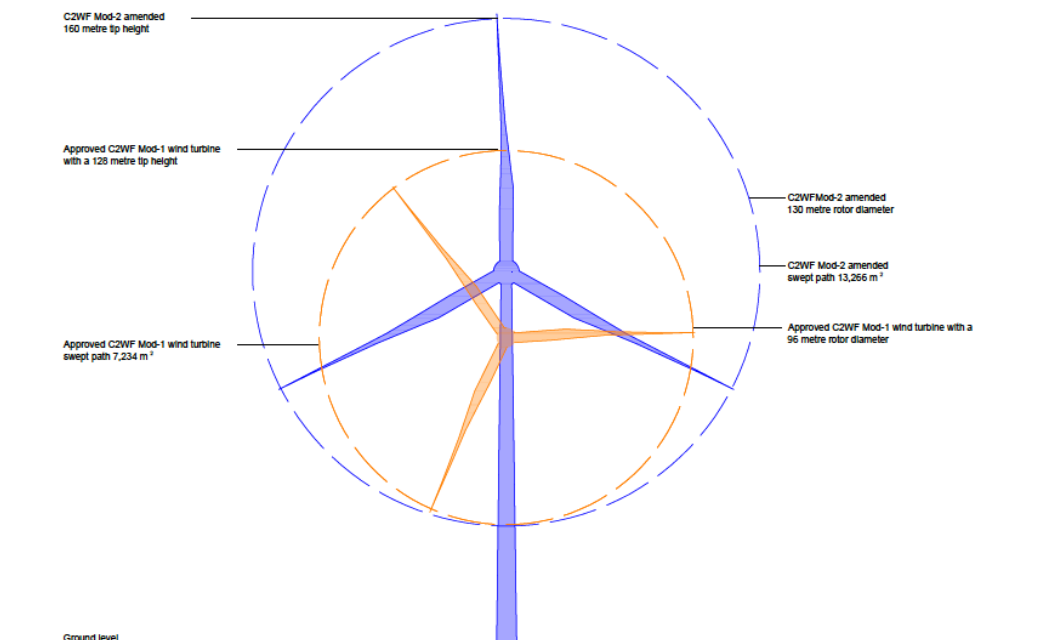


Figure 4: Comparison between approved Modification-1 turbine envelope and proposed turbine envelope
 Source: Crookwell Development Pty Ltd and Green Bean Design

Whilst the proposed wind turbines will extend the approved Modification-1 wind turbine height and rotor swept area, they will remain consistent with the visual form, design, pattern and colour of the approved Modification-1 turbines.

An indicative site infrastructure map, with revised turbine layout for Crookwell 2 Wind Farm as well as the proposed lay out for the Crookwell 3 Wind Farm, is shown in Figure 5 below.

As can be seen in Figure 5, that location and scale of ancillary infrastructure does not significantly change to that approved under the Modification-1 approval.

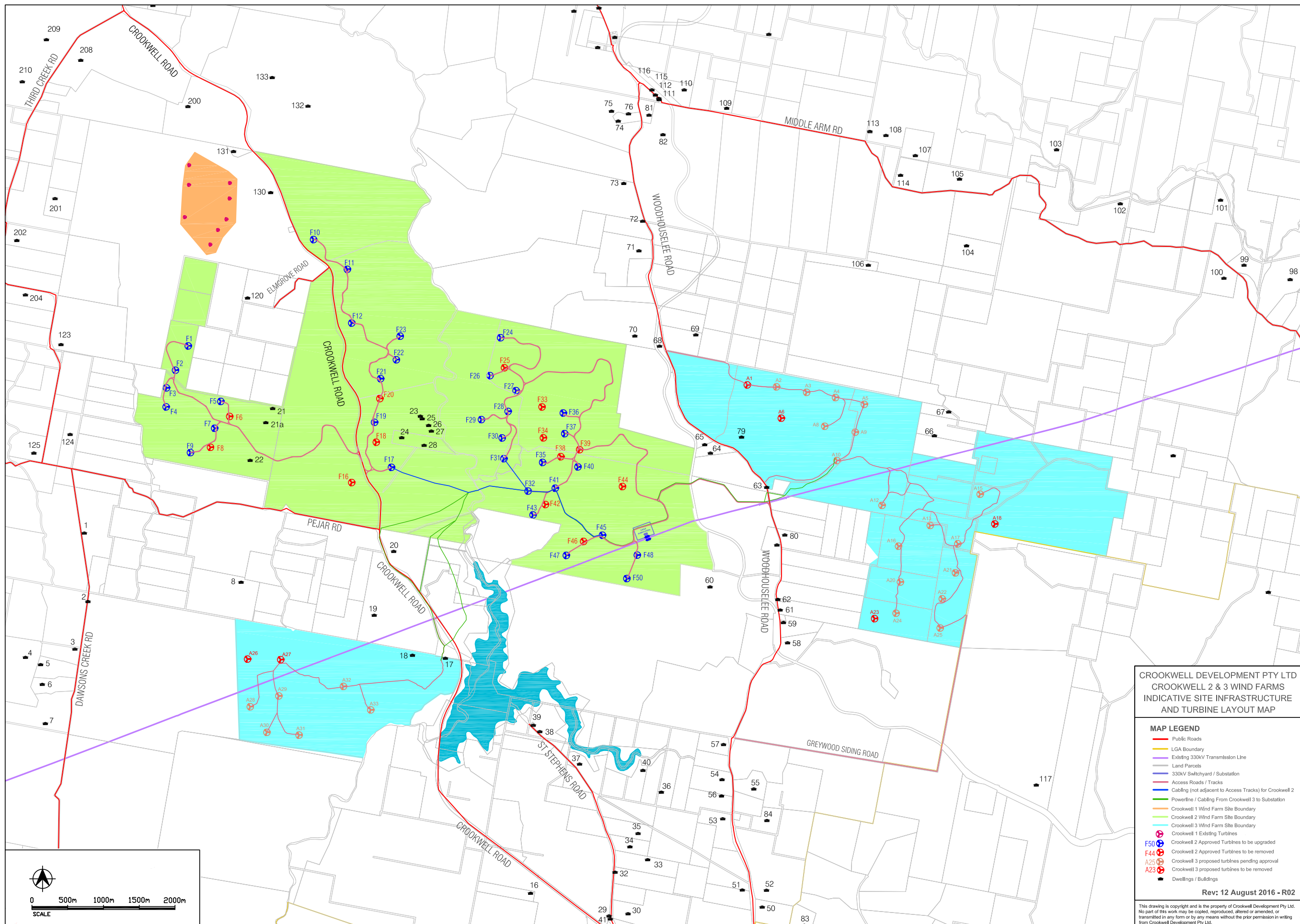


Figure 5: Site Infrastructure Map (including the layout and infrastructure for the proposed Crookwell 3 Wind Farm)
Source: Crookwell Development Pty Ltd

5 Planning Context

This chapter provides an assessment of the proposed development against the relevant environmental planning instruments and planning controls.

The original EIS and the Statement of Environmental Effects (SEE) for Modification-1 assessed the compliance of the Crookwell 2 Wind Farm against the relevant planning instruments and found that the project was generally consistent with these instruments. Most of the conclusions drawn in the original EIS and Modification-1 SEE continue to apply, as the proposed modifications are relatively minor.

5.1 Commonwealth Legislation

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) aims to protect the environment, particularly on Matters of National Environmental Significance (MNES). The EPBC Act promotes ecologically sustainable development and conserves biodiversity and heritage.

Any significant impact on a MNES including national heritage values may require referral to the Commonwealth Department of the Environment. If the Minister decides that significant impacts are likely, an approval under the EPBC Act is required.

No part of the site is listed as a world heritage area, and the site does not contain or adjoin any wetlands of international significance or Commonwealth land. The project does not involve nuclear activities and does not impact on the marine environment.

This EA report includes a Supplementary Ecological Impact Assessment, prepared by BL&A, which assesses the impact of the proposed modification on relevant MNES, including listed threatened species and ecological communities or migratory species (refer to Appendix 12). Importantly, the assessment reviewed the original EIS to check for new listings of species or communities under the EPBC Act. Numerous species were added to the threatened species list (including Gang Gang Cockatoo, Swift Parrot, Green and Golden Bell Frog and Booroolong Frog). However, the assessment found that none of these species were considered likely to be impacted by the proposed modifications.

The assessment concludes that the proposed modifications are not likely to result in any significant impact on any endangered ecological community or flora species listed under the EPBC Act.

Accordingly, the proposed modification does not give rise to any requirement for the project to be a referred under the EPBC Act.

5.1.2 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act 2000* (Cth) (REE Act) aims to:

- Encourage the additional generation of electricity from renewable sources;
- Reduce emissions of greenhouse gases in the electricity sector; and
- Ensure that renewable energy sources are ecologically sustainable.

The REE Act creates demand for electricity generated from renewable sources and provides renewable energy targets. Section 17(1) of the REE Act identifies wind as an eligible renewable energy source. The proposal provides for the

generation of electricity from a renewable source and contributes to the reduction of greenhouse gases in the electricity sector. As such, it is considered that the proposal advances the objectives of the REE Act.

5.1.3 Civil Aviation Safety Regulation 1998

The Civil Aviation Safety Authority regulates aviation activities in Australia. Applicable requirements include the *Civil Aviation Regulations 1988* (Cth) (CAR), *Civil Aviation Safety Regulations 1998* (Cth) (CASR) and associated Manuals of Standards (MOS) and other guidance material.

As the height of the turbines exceeds 110m above ground level, it is necessary to notify CASA in accordance with Advisory Circular AC 139-08(0) "Reporting of Tall Structures".

Section 7.5 of this EA provides an updated aviation assessment for the proposed modifications to the project.

5.2 NSW Planning Framework

5.2.1 Environmental Planning and Assessment Act 1979

Modification of the Development Consent

The Development Consent granted for the project may be modified under section 75W of the EP&A Act. This is due to the repeal of the Part 3A of the EP&A Act, clause 12 of Schedule 6A of the EP&A Act states:

Section 75W of Part 3A [of the EP&A Act] continues to apply to modifications of the development consents referred to in clause 8J (8) of the Environmental Planning and Assessment Regulation 2000, and so applies whether an application for modification is made before or after the commencement of this clause.

Clause 8J(8) of the *Environmental Planning and Assessment Regulation NSW 2000* (EP&A Regulation) states:

For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:

(a) a development consent granted by the Minister under section 100A or 101 of the Act,

(b) a development consent granted by the Minister under State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development,

(c) a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,

(d) a development consent granted by the Land and Environment Court, if the original consent authority was the Minister and the consent was of a kind referred to in paragraph (c).

The development consent, if so modified, does not become an approval under Part 3A of the Act.

Therefore, as the development consent for the Crookwell 2 Wind Farm was granted under section 80 of the EP&A Act, the combined effect of clause 8J(8)(c) of the EP&A Regulation and clause 12 of Schedule 6A of the EP&A

Act is to require that any modification of the project to be determined under section 75W.

The relevant provisions of section 75W of the EP&A Act state:

(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

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

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

Objects of the EP&A Act

The objects of the EP&A Act are contained in section 5 and are:

- (a) to encourage:
- (i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,
 - (ii) the promotion and co-ordination of the orderly and economic use and development of land,
 - (iii) the protection, provision and co-ordination of communication and utility services,
 - (iv) the provision of land for public purposes, and
 - (v) the provision and co-ordination of community services and facilities, and
 - (vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and
 - (vii) ecologically sustainable development, and
- (b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and
- (c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The proposed modifications are consistent with the relevant objects in that they:

- continue to promote the proper management, development and conservation of natural and artificial resources as the project will develop the natural wind resource and conserve other resources such as fossil fuels and air quality. It will lead to a better environment by displacing greenhouse emissions and reducing the impacts of climate change and global warming;

- Provide for the orderly and economic use and development of land by reducing the number of turbines (and land) required to produce an equal or greater electricity output;
- Contributes to the provision of electricity utility services and provides for the protection of communication services;
- Contributes to Community Enhancement Funds to fund local projects; and
- provides for ecologically sustainable development.

Furthermore, the agency and community consultation undertaken addresses objects 5(b) and (c) of the EP&A Act.

5.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) aims to:

- Protect, restore and enhance the quality of the environment having regard to the need to maintain ecologically sustainable development;
- Encourage public participation in environmental protection;
- Provide information to the public about pollution;
- Reduce risks to human health and prevent the degradation of the environment; and
- To improve the regulatory framework for environmental protection.

Under the POEO Act operators of wind farms must hold environment protection licenses (EPL) for both construction and operation. Subject to the approval of the proposed modification, an EPL will be sought in accordance with provisions of the POEO Act.

5.2.3 National Parks and Wildlife Act 1974

The objectives of the *National Parks and Wildlife Act 1974* (NPW Act) are set out in section 2A of the Act and are to:

- Conserve nature, including habitat, ecosystems and ecosystem processes, biological diversity at the community, species and genetic levels, and landforms of significance, including geological features and processes, and landscapes and natural features of significance including wilderness and wild rivers;
- Conserve objects, places or features (including biological diversity) of cultural value within the landscape; and
- Foster public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation.

Section 7.8 of this report provides the results of the ecological investigations carried out as part of the modification application. In summary, the investigation found that the proposed modifications are not expected to have significant additional impacts on flora and fauna compared to the approved development. Notably, the reduction in the number of turbines and associated access tracks will result in decreased impacts on flora.

All stages of the archaeological investigations for the Crookwell 2 Wind Farm have been conducted in accordance with Development Consent (DA-176-8-2004-I), under the current cultural heritage protection legislation – the National Parks and Wildlife Amendment Regulation 2009 and 2010. The study area appears to have been appropriately investigated for items of cultural heritage

significance. The impact of the Crookwell 2 Wind Farm on identified European and Aboriginal archaeological sites has been adequately determined and mitigated against through a legislatively compliant investigation.

5.2.4 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to:

- Conserve biological diversity and promote ecologically sustainable development,
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities,
- Protect the critical habitat of those threatened species, populations and ecological communities that are endangered,
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities,
- Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and
- Encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

For developments likely to significantly affect threatened species, populations or ecological communities, a Species Impact Statement (SIS) must be completed as outlined in section 110 of the TSC Act.

A Supplementary Ecological Impact Assessment has been prepared by Brett Lane and Associates Pty Ltd (refer **Appendix 12**) as part of this EA. The report concludes that none of the threatened fauna recorded on site or in the vicinity of the site are likely to be affected by the project as modified. As such, no SIS is required.

5.2.5 Water Management Act 2000 and Water Act 1912

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

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

The project will require water licences and water management work approvals under the WM Act or Water Act if water from any onsite bore, dam or river (e.g. concrete batching plant) is required during construction or operation.

5.2.6 Native Vegetation Act 2003

The *Native Vegetation Act 2003* aims to:

- to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State,
- to prevent broad scale clearing unless it improves or maintains environmental outcomes,

- to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation,
- to improve the condition of existing native vegetation, particularly where it has high conservation value, and
- to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation.

As noted in the ecological impact assessment in **Appendix 12**, no areas of the native grassland and woodland communities recorded within the site would be impacted as a result of the proposed modifications. The assessment further concludes that the modifications will have no impacts on flora and native vegetation additional to those of the approved project.

5.2.7 Heritage Act 1977

The *Heritage Act 1997* aims to:

- Promote an understanding and encourage the conservation of the State's heritage,
- Provide for the identification and registration of items of State heritage significance,
- Provide for the interim protection of items of State heritage significance,
- Encourage the adaptive reuse of items of State heritage significance,
- Constitute the Heritage Council of New South Wales and confer on it functions relating to the State's heritage,
- Assist owners with the conservation of items of State heritage significance.

This report is accompanied by a heritage assessment prepared by Bowen Heritage Management (refer **Appendix 8**). The heritage assessment concludes that:

- The impact of the approved wind farm development has so far been adequately determined and mitigated against through a legislatively compliant investigation; and
- No further archaeological assessment is required for the proposed modifications, as long as micrositing is confined to within a 50m radius of the original turbine locations.

5.2.8 Roads Act 1993

The *Roads Act 1993* (Roads Act) aims to:

- Set out the rights of members of the public to pass along and have access to public roads, and
- Regulate the carrying out of various activities on public roads.

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

The original EIS stated that the proposed development would require the installation of electrical cables beneath Crookwell Road in order to connect the wind turbines to the substation located in the south-eastern portion of the site. Crookwell Road is a State-owned public road, and therefore consent is required from the NSW Roads and Maritime Services.

Modification-1 did not alter any aspect of the cables under Crookwell Road.

The proposed modifications also do not alter any aspect of the cables under Crookwell Road.

The project required upgrade works to various public roads as outlined in the Original EIS and Modification-1 EIS, enabling access to internal wind farm access roads for construction vehicles. In 2012, the proponent received approvals from the then NSW Roads and Traffic Authority and relevant Councils to carry out public road upgrades, and during late 2012 to early 2013 constructed two site access entrances from Crookwell Road, and one site access entrance from Woodhouselee Road, as well as upgrading the intersection of Crookwell and Woodhouselee Roads.

Further approvals will be sought under section 138 of the Roads Act from appropriate roads authorities for any additional upgrade works on public roads, including Crown roads.

5.2.9 Crown Lands Act 1989

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

The original EIS stated that although no Crown Land is located within the development site itself, there is a network of Crown public roads in the area. Electrical cables may be installed under these roads to connect the turbines to the substation in the south-eastern section of the site and access tracks may be installed over these roads.

In the event that the final cable network does require installation of cables under Crown public road(s), the Department of Lands would be consulted in order to determine the best means of gaining consent to install such underground cable crossings. In 2009, the proponent applied and received a Crown Road Crossing Licence, enabling access tracks and underground cabling to cross Crown roads located within the development site.

Modification-1 did not alter any aspect of the access tracks or underground cable network as it relates to Crown Land. Accordingly, there was no change in how the Crown Lands Act 1989 applied to the proposed development.

The proposed modifications also do not propose to alter any aspect of the access tracks or underground cable network as it relates to Crown Land. Accordingly, considerations under the Crown Lands Act 1989 are not relevant to the proposed modification.

5.2.10 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Wind farms are defined as 'electricity generating works' and referred to in Division 4 of Part 3 of ISEPP. Wind farm development is permitted with consent under clause 34 of the ISEPP in prescribed rural, industrial or special use zones.

It is noted that part of the development site is located on land zoned RU1 Primary Production and RU2 Rural Landscape, which are prescribed zones for the purpose of clause 34 of the ISEPP.

Part of the development site is also zoned E3 Environmental Management (E3 Land), which is not a prescribed zone under clause 34 of ISEPP. This is considered further in the 'Key Issues' section below.

State Environmental Planning Policy (State and Regional Development) 2011

Clause 8 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) declares certain development to be State significant development for the purpose of the EP&A Act, where it:

- (a) is not permissible without development consent under Part 4 of the EP&A Act; and
- (b) is specified in Schedule 1 or 2 of the SRD SEPP.

Clause 20 of Schedule 1 of the SRD SEPP provides that:

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

- (a) has a capital investment value of more than \$30 million, or
- (b) has a capital investment value of more than \$10 million and is located in an environmentally sensitive area of State significance.

The project meets these criteria and, accordingly, is declared to be State significant development under the SRD SEPP.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

The flora and fauna assessment contained in the original EIS indicates that there is no koala habitat or koalas existing in the vicinity of the site. The ecological report submitted with this EA also does not identify any koala habitat or koalas in the vicinity of the site. As such, the provisions of SEPP 44 do not apply.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The aims of this Policy are to:

- a) Provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal, and
- b) Provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality, and
- c) Support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment.

The proposed modification, which involves a reduction in the number of turbines and increase in turbine envelope, is not expected to significantly alter the approved project's hydrology impacts. As such, the proposal is considered to satisfy the aims of the *State Environmental Planning Policy (Sydney Drinking Water) 2011*.

State Environmental Planning Policy (Rural Lands) 2008

The aims of this Policy are:

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

The proposed modification to the Crookwell 2 Wind Farm promotes the continued use of the land for agricultural purposes and reduces the total footprint of the project, thus opening up more land for agricultural purposes.

This policy does not contain any provisions of specific relevance to the modifications proposed for the Crookwell 2 Wind Farm.

5.2.11 Upper Lachlan Local Environmental Plan 2010

The *Upper Lachlan Local Environmental Plan 2010* (ULLEP) is the primary local planning instrument applying to the site. As the Crookwell 2 Wind Farm has already been approved, further consideration of the ULLEP is not mandatory under section 75W of the EP&A Act. However, for information purposes Table 4 below provides a summary of the key development standards contained in the ULLEP as they relate to the proposed modifications to the project.

Table 4. Upper Lachlan Local Environmental Plan 2010

Clause	Provision	Assessment
<p>Clause 2.2 Zoning of land to which Plan applies</p>	<p>The site is zoned:</p> <ul style="list-style-type: none"> - E3 Environmental Management - RU2 Rural Landscape - RU1 Primary Production <p>(Refer to figure below table.)</p> <p>'Electricity generating works' are permitted with consent in the RU1 and RU2 zones but prohibited in the E3 zone.</p>	<p>Partially complies. The development is best defined as 'Electricity generating works' under ULLEP 2010.</p> <p>electricity generating works means a building or place used for the purpose of making or generating electricity.</p> <p>This use is permitted with consent in the RU1 and RU2 zones and prohibited in the E3 zone.</p> <p>Notably, the original development and Modification-1 were approved while the Crookwell LEP 1994 and Mulwaree LEP 1995 applied to the site. Under both of these LEPs the site was zoned 1(a) General Rural, and the development was permissible with consent in this zone.</p> <p>However, as the Development Consent has been granted, that part of the project which is located on land zoned E3 has the benefit of continuing use rights under section 109B of the EP&A Act.</p> <p>Refer to <u>Key Issues</u> section below table for further discussion.</p>
<p>Clause 4.1 Minimum subdivision lot size</p>	<p>The minimum subdivision lot size is 100ha (AD). The size of any lot resulting from a subdivision of land is not to be less than 100ha.</p>	<p>Approval is sought as part of this modification for the subdivision of the approved switchyard and for any deemed subdivision arising from the grant of the Leases for the Crookwell 2 Wind Farm.</p>

Table 4. Upper Lachlan Local Environmental Plan 2010

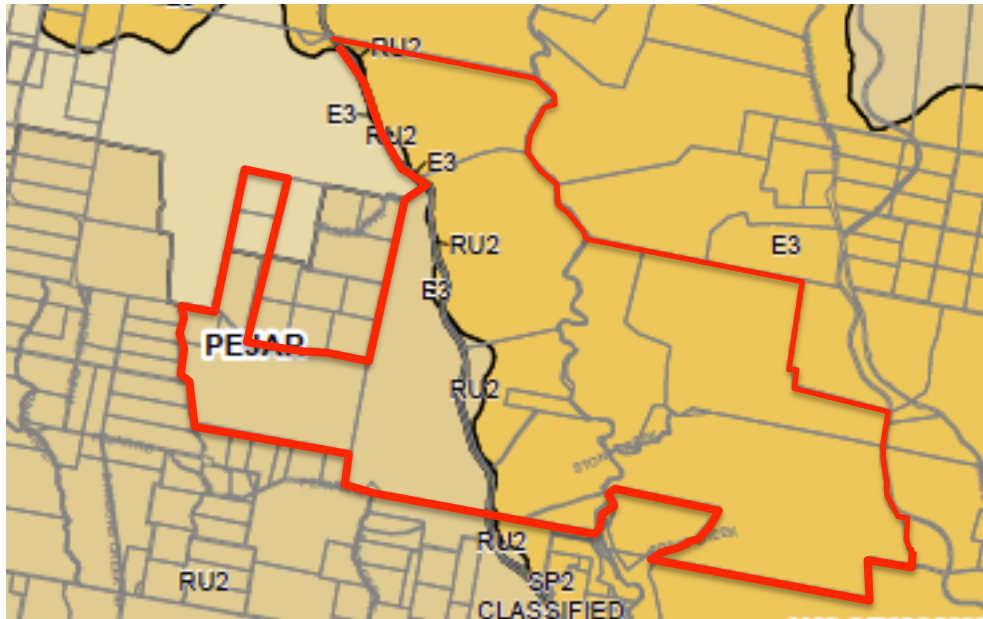
Clause	Provision	Assessment
<p>Clause 5.10 Heritage conservation</p>	<p>The consent authority may, before granting consent to any development:</p> <p>(a) on land on which a heritage item is located... require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.</p>	<p>Complies. Works are planned on land containing locally listed heritage item 142 'Gundowringa' Homestead at 2976 Goulburn Road (Part of Lot 6 DP883430).</p> <p>An Aboriginal Cultural Heritage investigation was provided as part of the original EIS, and additional sub-surface excavations performed according to the acquired S87(1) Excavation and Collection permit and S90 Consent for Salvage and/or Destroy/Deface/Damage of Aboriginal Objects under the National Parks and Wildlife Act was received as part of the acquired Aboriginal Heritage Impact Permit. In addition, a Heritage Management Sub-Plan is included in the Construction Environmental Management Plan that was approved on May 2009.</p> <p>The original investigation noted that the proposed development would not have any impact on the only item of European heritage value on the site as no construction works would be carried out in the vicinity of the item.</p> <p>Furthermore, an archaeology and heritage study was prepared as part of Modification-1. This study found that the development would have no impact on the Gundowringa Homestead.</p> <p>Given the results of the above investigations, and that the proposed modification reduces the overall footprint of the development, it is considered that the existing Heritage Management Sub-Plan, which forms part of the approved Construction Environmental Management Plan, is adequate.</p>

Table 4. Upper Lachlan Local Environmental Plan 2010

Clause	Provision	Assessment
Clause 6.2 Biodiversity	<p>The consent authority must consider any adverse impact from the development on:</p> <ul style="list-style-type: none"> (a) a native ecological community, and (b) the habitat of any threatened species, populations or ecological community, and (c) a regionally significant species of fauna and flora or habitat, and (d) a habitat element providing connectivity. <p>The consent authority must be satisfied that the development is designed, sited and will be managed to avoid any adverse environmental impact or if it cannot be avoided it can be minimised or if it cannot be minimised it will mitigate the impacts.</p>	<p>Complies. The Supplementary Ecological Impact Assessment report in Appendix 12 considers the proposal's impact on the biodiversity at the site.</p> <p>The report concludes that the proposed modifications are not anticipated to have additional impacts on flora and native vegetation compared with the approved layout. The risk of bird collisions remains low and the effect of the changes rotor swept area (RSA) is not considered to substantially increase the risk of collisions with bats.</p>
Natural Resources Sensitivity - Land Map	<p>The consent authority must consider any adverse impact from the development on:</p> <ul style="list-style-type: none"> (a) the geotechnical stability of the site, and (b) the probability of increased erosion or other land degradation processes. <p>The consent authority must be satisfied that the development is designed, sited and will be managed to avoid any adverse environmental impact or if it cannot be avoided it can be minimised or if it cannot be minimised it will mitigate the impacts.</p>	<p>Complies. A Geotechnical Investigation was prepared as part of the original EIS for Crookwell 2 Wind Farm.</p> <p>The report concluded that, provided the proposed mitigation measures and safeguards are implemented, no significant impacts are likely to occur. The proposed modifications do not seek to alter the project in a way that would affect the geotechnical stability of the land. As such, the original and Modification-1 reports are considered relevant.</p>

Table 4. Upper Lachlan Local Environmental Plan 2010		
Clause	Provision	Assessment
Natural Resources Sensitivity – Water Map	<p>There are some areas of sensitive land extending through the site relating to water. The consent authority must consider any adverse impact from the proposed development on:</p> <ul style="list-style-type: none"> (a) the water quality of receiving waters, and (b) the natural flow regime, and (c) the natural flow paths of waterways, and (d) the stability of the bed, shore and banks of waterways, and (e) the flows, capacity and quality of groundwater systems. <p>The consent authority must be satisfied that the development is designed, sited and will be managed to avoid any adverse environmental impact or if it cannot be avoided it can be minimised or if it cannot be minimised it will mitigate the impacts.</p>	<p>Complies. The original EIS contained a detailed analysis of hydrology and surface water at the site.</p> <p>The analysis concluded that the project would result in a negligible change to the amount and quality of water leaving the site. The potential risks to water quality can be managed effectively by established best management practice measures and the selection of proven technologies. The proposed modifications do not seek to alter the project in a way that would affect the water quality and stability at the site. As such, the original report is considered relevant.</p>

Figure 4 below indicates the land use zone as per the Land Zoning map in the ULLEP.



- E3 Environmental Management
- IN2 Light Industrial
- R2 Low Density Residential
- R5 Large Lot Residential
- RE1 Public Recreation
- RU1 Primary Production
- RU2 Rural Landscape

Figure 6: Land use map
Source: Department of Planning and Environment

Key issues

Permissibility and compliance with zone objectives - Background

The original project was subject to the provisions of and approved under the *Crookwell Local Environmental Plan 1994* and *Mulwree Local Environmental Plan 1995*. Under these LEPs the site was zoned General Rural 1(a), and 'Generating works' (which included wind farms) were permitted with consent in this zone.

Currently the site is subject to the *Upper Lachlan Local Environmental Plan (ULLEP) 2010* and is zoned RU1 Primary Production, RU2 Rural Landscape and E3 Environmental Management, as shown on the land use map extract above.

Permissibility and compliance with zone objectives – Rationale

The proposed 'Electricity generating works' are permitted with development consent in the RU1 Primary Production and RU2 Rural Landscape zones but prohibited on the E3 Land.

That part of the project located within the E3 Environmental Management zone, is currently prohibited under the ULLEP. However, as the project is already approved, section 109B of the EP&A Act grants it continuing use rights over that part of the site, including for further modifications of the Development Consent.

Nevertheless, this EA has considered the relevant zone objectives below in the context of the proposed modifications and concludes that the modifications are generally consistent with those objectives.

The objectives of the RU1 Primary Production zone are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To promote the use of agricultural land for efficient and effective agricultural production.*
- *To allow for the development of non-agricultural land uses that are compatible with the character of the zone.*
- *To allow the development of processing, service and value adding industries related to agriculture and primary industry production.*
- *To minimise the visual impact of development on the existing agricultural landscape character.*
- *To protect and enhance the water quality of watercourses and groundwater systems and to reduce land degradation.*
- *To maintain areas of high conservation value vegetation.*

The proposed modifications are consistent with RU1 zone objectives in that they:

- Provide for a non-agricultural use that is compatible with the character of the zone.
- Reduce the approved project's footprint and thus reduce impact on agricultural lands.
- Protect the water quality of watercourse and groundwater systems; and
- Maintain areas of high conservation value.

The objectives of the RU2 Rural Landscape zone are:

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

The proposed modifications are consistent with these objectives in that they:

- Reduce the approved project's footprint and thus reduce the project's impacts on agricultural practices;
- Provide for a compatible use in the area (being an electricity generating use that is consistent with an agricultural use);
- Do not impact on environmentally sensitive areas;
- Maintain areas of high ecological value; and
- Do not greatly detract from the rural character of the land.

The objectives of the E3 Environmental Management zone are:

- *To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.*
- *To provide for a limited range of development that does not have an adverse effect on those values.*
- *To facilitate the management of environmentally sensitive land and areas of high environmental value to the local government area.*

The proposed modifications are generally consistent with these objectives in that they:

- Have no unreasonable impacts on the site's ecological value (as described in the ecological report in **Appendix 12**); and
- Have no unreasonable impacts on the site's aesthetic value (as described in the landscape/visual report in **Appendix 13**).

5.2.12 Upper Lachlan Development Control Plan 2010

The Upper Lachlan Development Control Plan (ULDCP) 2010 is the primary development control plan that applies to the site.

However, under clause 11 of State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP), development control plans do not apply to State significant development. The project, as modified, falls within the definition of State significant development under clause 8 of the SRD SEPP and, accordingly, the ULDCP does not apply.

Nonetheless, the following DCP compliance table is provided for information purposes.

Table 5. Upper Lachlan Development Control Plan 2010		
Control	Provision	Assessment
9.5 Wind Farms	a. The development should be sited and carried out to minimise impacts on, or restrictions to grazing, farming and forestry practices;	<p>Complies.</p> <p>As noted in the Original EIS, the Crookwell 2 Wind Farm development will have a negligible impact on current agricultural practices.</p> <p>The proposed modification involves removal of several turbines and associated access tracks, resulting in decreased impacts on grazing and farming.</p>

Table 5. Upper Lachlan Development Control Plan 2010

Control	Provision	Assessment
	<p>b. The development should be carried out in a way that minimises any physical adverse effects on adjoining land and the development site, including, but not limited to:</p> <ul style="list-style-type: none"> (i) land degradation (ii) alteration to drainage patterns (iii) pollution of ground water (iv) spread of noxious plants and animals, and (v) bushfire hazard 	<p>Complies.</p> <p>The Original EIS addressed these matters in detail and concluded that the development would not have any unreasonable impacts in terms of land degradation, alteration to drainage patterns, pollution of ground water, spread of noxious plants and animals, and bushfire hazard.</p> <p>The proposed modifications do not alter the development's consistency with these controls.</p>
	<p>c. The developer must assess the visual impact of the project including an assessment of scenic value. The developer must consult with the Council and the community on appropriate visual impact measures;</p>	<p>Complies.</p> <p>A landscape report assessing the visual impact of the proposed modifications is provided in Appendix 6.</p>
	<p>d. The developer must assess the cumulative impact of the development having regard to wind farms in existence and those approved but yet to be constructed. Council does not favour large expanses of ridgelines being covered with wind farms and turbines;</p>	<p>Complies.</p> <p>The proposal has been designed with regards to the approved Crookwell 1 Wind Farm and proposed Crookwell 3 Wind Farm.</p> <p>The reports included as part of this modification application consider the cumulative impacts of the developments.</p> <p>A summary of cumulative impacts is provided in Section 7.10 of this report.</p>
	<p>e. Proposed wind turbines shall comply with the South Australian Environment Protection Authority Wind farms environmental noise guidelines (July 2009) or any replacement guidelines. Note that where noise levels are found to exceed those guidelines, Council may require remediation work such as the cessation or decommissioning of the turbines to reduce the noise impacts on</p>	<p>Complies.</p> <p>A noise impact report, assessing the impact of the proposed modifications to Crookwell 2 Wind Farm, including the impact of the existing Crookwell 1 Wind Farm and proposed Crookwell 3 Wind Farm, is</p>

Table 5. Upper Lachlan Development Control Plan 2010

Control	Provision	Assessment
	sensitive receptors such as non-related dwellings. The developer shall also furnish all data that has been collected on Infrasound levels that would occur at a representative sample of neighbouring non-host residences;	provided in Appendix 8 . In summary the report finds that compliance at all receptors can be achieved using a mitigated layout where some turbines are operated in Sound Management Mode, a reduced noise mode.
	f. Turbines shall not be located within 2.0 kilometres of any dwelling not associated with the development or from any lot upon which a dwelling may be constructed. The 2.0 kilometre setback proposes utilising a precautionary principle in addressing perceived visual and health concerns;	N/A The proposed modifications involve no changes to the approved turbine locations.
	g. Turbines shall not be located within a distance two times the height of the turbine (including the tip of the blade) from a formed public road. A greater distance may be required by the road authority;	N/A The proposed modifications involve no changes to the approved turbine locations.
	h. Turbines shall not be located within a distance two times the height of the turbine (including the tip of the blade) from a non-related property boundary;	N/A The proposed modifications involve no changes to the approved turbine locations.
	i. Existing and proposed screenings may be used to minimise visual impacts to non-related properties. However, due to the height of turbines, screening is not the preferred method of minimising visual impact. Turbines shall be located in positions so as to have minimal visual impact on nearby properties, especially existing dwellings and lots on which dwellings may be constructed;	Complies. A rigorous assessment of the locations of the turbines was carried out as part of the EIS for the original application and Modification-1. No new turbine locations are proposed.
	j. Turbine locations are to be sensitive to existing related dwellings on the subject site. Noise and shadow flicker should be minimised and turbines should not be located in close proximity to existing dwellings;	Complies. No new turbine locations are proposed. The proposed modifications involve removal of a number of turbines near dwellings in order to minimise impacts on these

Table 5. Upper Lachlan Development Control Plan 2010

Control	Provision	Assessment
		dwellings.
	k. Turbine locations shall not surround a non-related property. Turbines shall be located with the specified setbacks from property boundaries to minimise the visual impact of the development on adjacent and nearby non-related property. Cumulative impacts, having regard to existing turbines and turbines approved but yet to be constructed, should be assessed;	<p>Complies.</p> <p>No new turbine locations are proposed. The proposed modifications involve removal of a number of turbines near dwellings in order to minimise impacts on these dwellings.</p>
	l. A Communications Study should identify the existing status of communications and detail the proposed method of dealing with potential communication interference. Developers are advised that many parts of the Upper Lachlan Shire have very poor radio, TV, mobile phone, two way reception and the like. The development should not detract from the reception of any of these or other communication methods. Where necessary, it may be required to install additional services (boosters/communication towers/ re-transmission towers etc) to maintain such services in the vicinity of the development. Where this is determined to be necessary, the work and equipment shall be at the developers cost;	<p>Complies.</p> <p>An Electromagnetic Interference (EMI) report, assessing the potential impact of EMI from the proposed modifications on various telecommunication services is provided in Appendix 11.</p> <p>In summary the report finds that any potential EMI resulting from the proposed modifications can be mitigated effectively.</p>
	m. Construction vehicles, including concrete trucks, carriers of turbine components, and related heavy vehicles (including relevant contractors) shall only travel on an approved route. This route shall be identified and approved in accordance with this Plan;	<p>Complies.</p> <p>The Traffic and Transport report in Appendix 12 identifies the proposed travel route for construction vehicles.</p>
	n. A report detailing investigations into the impact of construction vehicles on the proposed route shall accompany the development application. Detailed road condition reports will be required as part of any consent. Council requires the use of the ARRB 'laser car' and 'gypsy camera' for this purpose;	<p>Complies.</p> <p>The Traffic and Transport report in Appendix 12 details the roads proposed to be utilised to access the site for construction purposes, which are the same as in the approved development consent.</p>

Table 5. Upper Lachlan Development Control Plan 2010

Control	Provision	Assessment
		<p>The report was prepared following a detailed investigation into the road condition.</p> <p>Condition 56 on the development consent details a requirement for a further road dilapidation report including use of the AARB 'laser car'. The proposed modifications do not seek to alter this condition.</p>
	<p>o. Council will require road works to cope with the over size and overweight traffic movements related to the construction of a wind farm. Bonds will also be required for any potential damage to roads during the construction phase. The road works and bond amounts will be determined by Council professional staff, but will be determined generally by the length of road and condition of road surface/base bridge, drainage etc relevant to the selected route.</p> <p>Where road works are determined necessary for the development, costs associated with the road works shall be the developer's responsibility;</p>	<p>Complies.</p> <p>The proposed modifications involve no changes to conditions of consent relating to road upgrades.</p>
	<p>p. The construction and maintenance of internal roads (roads within the property subject to the development) shall be the responsibility of the developer. Council will require proof that they have been adequately designed and constructed for their purpose. Council and relevant State Government Agencies shall be provided with adequate information about the environmental aspects of the internal road construction;</p>	<p>Complies.</p> <p>The proposed modifications involve no changes to conditions of consent involving construction and maintenance of internal roads.</p>
	<p>q. All infrastructure related to the wind farm should be included in the development application. Management of temporary facilities, waste, numbers of contractors/employees, etc, should be part of the Development Application information. All infrastructure should be located in low visual impact locations</p>	<p>Complies.</p> <p>The original development application included details for all necessary infrastructure. No changes are proposed to these original arrangements.</p>

Table 5. Upper Lachlan Development Control Plan 2010

Control	Provision	Assessment
	and interconnection cables/wiring and the like should be underground;	
	r. Developers shall consider and refer to the Department of Planning's NSW Wind Energy Environmental Impact Assessment Guidelines, the NSW Wind Energy Handbook, Best Practice Guidelines for implementation of Wind Energy projects in Australia (AusWEA), South Australian Environment Protection Authority Wind farms environmental noise guidelines (July 2009) and all other relevant polices and legislation applicable to the proposed development. Reference to relevant Council policies and documents shall also be made;	<p>Complies.</p> <p>The Original EIS included a detailed investigation and review of all relevant guidelines and policies.</p> <p>The relevant sections of this report detail how the proposed modification addresses all relevant planning and environmental controls, instruments and guidelines.</p>
	s. If appropriate, the development application should include details of a viewing area where safe vehicle and pedestrian movements can view the wind farm. The developer should liaise with relevant officers of Council's Works and Operation Department and the RTA regarding any proposed viewing area;	<p>N/A.</p> <p>No viewing area is proposed.</p>
	t. Within six months of the wind turbine generators ceasing to operate, any rights of carriageways that were created to enable maintenance to be conducted on the wind turbine generators are to be extinguished by the developer and the land made good, unless otherwise agreed with the landowner.	<p>Complies.</p> <p>It is not proposed to alter conditions of consent related to decommissioning.</p>
	u. Within twelve months of the wind turbine generators ceasing to operate, they are to be fully dismantled and removed from the site. A security guarantee/bond is to be lodged with the consent authority (prior to any work commencing on-site) in an amount determined by the consent authority to cover the cost of dismantling and removal of the turbines; and	<p>Complies.</p> <p>It is not proposed to alter conditions of consent related to decommissioning.</p>
	v. Details of the proposed connection to the electricity reticulation network shall be included as part of the Development Application Environmental Assessment.	<p>Complies.</p> <p>Details of the proposed electricity connection were</p>

Table 5. Upper Lachlan Development Control Plan 2010		
Control	Provision	Assessment
		provided in the Original EIS.
	<p>Community enhancement program</p> <p>Prior to the commencement of construction, the proponent is to prepare a Community Enhancement Program prepared in consultation with the local community and Council to be funded by the proponent at a minimum rate of \$2,500 per constructed turbine per annum (indexed to the consumer price index for Sydney (Housing) commencing at the September 2010 quarter).</p>	<p>The proponent commits to contribute funds to the Upper Lachlan Shire Council's Community Enhancement Fund.</p> <p>The Enhancement Fund provides funding for a range of community projects that will benefit the community in proximity of the project.</p>
	<p>Infrastructure</p> <p>Much of Council's road network is generally not capable of sustaining the overweight loads involved with wind farms and will require substantial upgrading to accommodate the wind farm construction vehicles. Appropriate bonds will be required to ensure any road damage is repaired to Council's satisfaction. Such bonds are payable prior to commencement of any works on the site.</p> <p>Road sealing shall be required where appropriate on unsealed public roads utilised by the proponent.</p>	<p>Complies.</p> <p>No changes are sought to conditions of consent relating to infrastructure bonds.</p>

5.3 Guidelines

5.3.1 Draft NSW Planning Guidelines: Wind Farms

The *Draft NSW Planning Guidelines: Wind Farms* (the Draft Guidelines) were prepared in December 2011 by the Department of Planning and Infrastructure. The purpose of the Draft Guidelines is to:

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

The Draft Guidelines were exhibited from 23 December 2011 to 14 March 2012 and public comments on the Draft Guidelines were sought. The Draft Guidelines

remain in draft form and, as at the date of this report, have not been finalised or adopted by the DP&E.

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

5.3.2 South Australian EPA's Wind Farms Environmental Noise Guidelines

In its letter dated 1 June 2015, the DP&E requested that the South Australian EPA's Wind Farm Environmental Noise Guidelines be specifically addressed in this EA. The 2003 SA EPA Wind Farms Environmental Noise Guidelines recommend the following noise criteria for new wind farms:

The predicted equivalent noise level (LAeq, 10min), adjusted for tonality in accordance with these guidelines, should not exceed:

- 35 dBA, or
- the background noise level by more than 5 dBA,

whichever is the greater, at all relevant receivers for each integer wind speed from cut-in to rated power of the WTG.

The guidelines also provide information on measuring background noise levels, locations and requirements on the number of valid data points to be obtained, and the methodology for excluding invalid data points. It also outlines the process for determining lines of best fit for background data, and determination of the noise limit.

The guidelines do not provide an assessment for the potential of low frequency noise or infrasound, but they do state that recent turbine designs do not appear to generate significant levels of infrasound, as the earlier turbine models did.

A noise impact assessment has been undertaken in accordance with these guidelines.

6 Consultation

6.1 Consultation for the Original Project Application

A community and stakeholder engagement process was conducted for the original Project. Consultation was conducted with:

- NSW Department of Infrastructure, Planning and Natural Resources (now the Department of Planning and Environment);
- NSW Environment Protection Authority;
- Crookwell Shire Council;
- Mulwaree Shire Council;
- Goulburn City Council;
- Sydney Catchment Authority (SCA);
- Sustainable Energy Development Authority (SEDA);
- NSW Roads and Transport Authority (now Roads and Maritime Services);
- NSW National Parks and Wildlife Service (NPWS);
- NSW Agriculture;
- Pejar Local Aboriginal Land Council;
- Local Catchment Management Committee/Trust;
- Country Energy;
- Department of Lands;
- Department of Utilities, Energy and Sustainability; and
- NSW Health.

Consultation activities included:

- Planning Focus Meeting - with the majority of authorities listed above, in December 2003 identifying issues to be considered in the original Environmental Impact Statement for the Project.
- Newsletter – for landowners, residents and the broader Crookwell Community;
- Focus Group Meeting – key members of the local community invited to discuss views and issues; and
- One-on-one discussions - with landowners and residents in the vicinity of the site.

The public exhibition of the EIS provided an opportunity for submissions from the community relating to the Crookwell 2 Wind Farm.

6.2 Consultation for Modification-1

Community and stakeholder engagement was conducted for Modification-1. Consultation was conducted with:

- Federal Government agencies, including the Commonwealth Civil Aviation Safety Authority, Air Services Australia and the Department of Defence;

- State Government agencies, including the Department of Planning (now DP&E), the former DECC, the former Department of Water and Energy, TransGrid, Roads and Traffic Authority (now Roads and Maritime Services);
- Upper Lachlan Shire Council and Goulburn Mulwaree Council;
- Pejar Local Aboriginal Land Council; and
- Landowners immediately surrounding the boundaries of the Crookwell 2 Wind Farm.

Consultation activities included:

- Newsletter—aimed at informing the broader community about the proposed modifications;
- Public Information Day—conducted on 6 November 2008 where input from the community was incorporated and addressed in the Modification-1 application.

The public exhibition of Modification-1 provided an opportunity for submissions from the community relating to the Crookwell 2 Wind Farm.

6.3 Consultation for Proposed Modification 2

Community and stakeholder engagement was conducted for the proposed Modification 2. Consultation was initiated / conducted with:

- Commonwealth Agencies:
 - Civil Aviation Safety Authority (CASA) [for Aviation impact, Telecommunication impact];
 - Airservices Australia [for Aviation Impact, Telecommunication impact];
 - Department of Defence [for Aviation Impact, Telecommunication impact];
 - Department of Environment, online Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters Search Tool [for Ecology impact];
 - Bureau of Meteorology (BoM) [for Telecommunication impact];
- NSW Government Agencies:
 - NSW Department of Planning and Environment [for Planning and Assessment provisions, Noise impact, Visual impact, Socio-Economic benefits (including Voluntary Planning Agreement, Neighbour Benefit Sharing Scheme)];
 - NSW Office of Environment and Heritage, including Schedule 1 to the NSW Threatened Species Conservation (TSC) Act 1995 [for Ecology impact, Heritage impact];
 - NSW Environmental Protection Authority [for Noise impact];
 - NSW Department of Industry [for Regional investment, Socio-Economic benefits (including Voluntary Planning Agreement, Neighbour Benefit Sharing Scheme)];
 - NSW Department of Industry, Crown Roads [for Traffic impact, Crown Road Crossing Licencing];
 - NSW Land and Property Information (NSW LPI) [for Telecommunication impact];
 - NSW Roads and Maritime Services [for Traffic impact];
 - NSW Office of Water, Sydney Catchment Authority / Southern Rivers Catchment Management Authority [for Watercourse Crossing Licencing];

- NSW Rural Fire Service [for Telecommunication impact, Aviation impact];
- Ambulance Service of NSW [for Telecommunication impact];
- John Holland Rail on behalf of Transport for NSW [for Traffic impact, Unused Rail Corridor Access Licencing];
- Local Government
 - Upper Lachlan Shire Council [for Planning provisions, Aviation impact, Traffic impact, Telecommunication impact, Socio-Economic benefits (including Voluntary Planning Agreement, Neighbour Benefit Sharing Scheme)];
 - Goulburn Mulwaree Council [for traffic impact, Aviation impact];
- Other Agencies / Organisations
 - Aerial Agricultural Association of Australia [for Aviation impact];
 - Fred Fahey Aerial Services [for Aviation impact];
 - Geoscience Australia [for Telecommunication impact];
 - Mobile phone service providers (Optus, Telstra and Vodafone) [for Telecommunication impact];
 - Radio Goulburn (for Telecommunication impact);
 - Royal Flying Doctor Service [for Aviation impact];
 - Vertical Telecoms [for Telecommunication impact];
 - Wireless Internet (NBN, Yless4U, ACE Internet Services) [for Telecommunication impact];
 - Yass Aerial Service [for Aviation impact];
- Associated residents where modified turbines are located on their land;
 - Host Landowners [for proposed changes to the project, Planning provisions and amendment process, Socio-Economic benefits (including Voluntary Planning Agreement, Neighbour Benefit Sharing Scheme)]; and
- Non-associated landowners / residents and the local community
 - Neighbouring landowners, residents, local community groups and individuals [for proposed changes to the project, Planning provisions and amendment process, Socio-Economic benefits (including Voluntary Planning Agreement, Neighbour Benefit Sharing Scheme)];

Consultation activities included:

- Letter to the Department of Planning and Environment:
 - The Department of Planning and Environment were advised of the intention to modify the existing project and subsequently provided the proponent with matters to be considered as part of the Environmental Assessment (refer to Appendix 5);
- Correspondence with government agencies, other agencies and organisations by the proponent and its authorised consultants team commissioned for work on this project:
 - The relevant stakeholders were advised on the amendment application proposal and were requested feedback on any impact that may arise as a result of the amendment to the project;
- Non-associated landowners / residents, and the local community:
 - Local newspaper advertisements in 2015 and 2016;

- Door knocks and/or similar meetings with adjoining landowners / residents, and landowners / residents within 3km of the project site in December 2015. A copy of the newspaper advertisement for the household door-to-door knocks is provided at Appendix 15. This advertisement was featured in the Goulburn Post and Crookwell Gazette during 7-11 December 2015; and
- Direct mail-out to households of a project newsletter to within 3km of the project site in August 2016, and project newsletters were also made available at the Upper Lachlan Shire Council offices in Crookwell. A copy of the newspaper advert for the summary of the amendment proposal is provided in Appendix 15. This advertisement was featured in Goulburn Post and Crookwell Gazette during 22-26 August 2016;
- The proponent also carried out additional consultation in 2012 with adjoining landowners of both the approved Crookwell 2 Wind Farm and the proposed Crookwell 3 Wind Farm. This consultation identified those landowners interested in participating in a voluntary Neighbour Benefit Sharing Agreement (Neighbour Deed). Further consultation on the voluntary Neighbour Deed was carried out in late 2015 and in 2016.

7 Environmental and Social Impact Assessment

7.1 Landscape

7.1.1 Introduction

Green Bean Design (GBD) was commissioned by UFWA on behalf of Crookwell Development Pty Ltd to prepare a Visual Impact Assessment (VIA) to assess and determine the potential visual effect of the proposed modifications against the approved Modification-1. See **Appendix 6** for the full report.

7.1.2 Methodology

A desktop study was carried out to review the original Crookwell 2 Wind Farm approval as well as the viewsheds approved in Modification-1. This study also referenced topographic maps and aerial photographs of the surrounding landscape.

Zone of Theoretical Visibility (ZTV) diagrams for the proposed wind turbine layout were prepared to illustrate the theoretical visibility of the Modification-1 wind turbines (tip height 128m) and the wind turbines (tip height 160m) that are proposed in this modification.

These ZTV diagrams were also used to inform the likely extent and nature of residual visual effects within a 5km view shed of the approved wind turbines. Topographic maps and aerial photographs were used to identify the locations and categories of potential view locations that could be verified during the fieldwork component of the assessment.

GBD undertook fieldwork for the proposed modifications to the Crookwell 2 Wind Farm project, including:

- a site inspection to determine and confirm the extent of residual effects between the approved Modification-1 wind turbines and those proposed as part of this modification application and ancillary project structures, and to identify landscape characteristics surrounding the wind farm site, and around the proposed electrical works; and
- photography for the photomontages from residential and public view locations.

An understanding of the residual visual effects on surrounding receiver locations resulted from the combination of the proposed wind turbine visibility and the characteristics of the landscape between, and surrounding, the receiver locations and the Crookwell 2 Wind Farm. The potential degree of visibility and resultant visual effect were determined by a combination of factors such as:

- category and type of situation from which people could view the Crookwell 2 Wind Farm (examples of view location categories include residents or motorists);
- visual sensitivity of view locations surrounding the Crookwell 2 Wind Farm;
- distance of visual effect (between view locations and the Crookwell 2 Wind Farm) and
- duration of time people could view the Crookwell 2 Wind Farm from any particular static or dynamic view location.

A series of eight photomontages were then prepared for views from residential dwellings and public road corridors. The photomontages illustrate and contrast the Modification-1 wind turbines and layout and the wind turbines and layout

proposed in this modification.

7.1.3 Results

The result of the preparation and assessment of the ZTV diagrams for Modification-1 and the proposed wind turbine layouts illustrate that the area of land within which the Crookwell 2 Wind Farm would be theoretically visible (as well as number of wind turbines being visible), would be very similar.

The installation of ancillary wind farm infrastructure, including the proposed TransGrid tower at the substation grid connection, would not result in additional or unacceptable levels of visual impact from surrounding key receiver locations.

The report also includes an assessment of visual impact at the ninety-four residential dwellings within 5 km of the Crookwell 2 Wind Farm.

The overall assessment of visual effects associated with the proposed modifications is summarised as Low to Negligible. The proposed modifications are not considered to be of a magnitude that would significantly increase visual effects above those associated with the approved Modification-1 development.

The proposed wind turbines are consistent with the approved Modification-1 wind turbines with regard to their visual form, design, pattern and colour. This consistency, along with the proposed deletion of 13 approved wind turbines reduces the extent of the magnitude of visual effects.

Eight photomontages were prepared to illustrate the location and extent of wind turbines within the Modification-1 and proposed wind turbine layouts. Photomontages were not prepared to reflect the original Crookwell 2 Wind Farm original applications as they now differ from best practice or advice within contemporary guidelines as to the preparation and presentation of photomontages.

As proposed, amendments to Modification-1 are considered to result in low-level visual effects, and introduce elements which are neither prominent or out of character with those approved. The potential for the proposed wind turbines to result in any additional significant cumulative visual effects is considered to be low.

The overall area from which the proposed obstacle lighting may be visible is not expected to extend extensively beyond the influence of obstacle lighting associated with the approved Modification-1.

7.1.4 Mitigation Measures

Given that proposed modifications reduce the number of turbines, removing a number of turbines close to non-associated residences, the amendments proposed are considered to be of low impact and therefore no additional mitigation measures are recommended.

7.2 Shadow Flicker and Blade Glint

7.2.1 Introduction

DNV GL has been commissioned by UFWA on behalf of Crookwell Development Pty Ltd to independently assess the shadow flicker and blade glint impact of the

proposed changes to the approved Crookwell 2 Wind Farm. See **Appendix 7** for the full report.

Shadow flicker involves the modulation of light levels resulting from the periodic passage of a rotating wind turbine blade between the sun and an observer.

Blade glint involves the reflection of light from a turbine blade and can be seen by an observer as a periodic flash of light coming from the wind turbine.

7.2.2 Methodology

The duration of shadow flicker experienced at a specific location can be determined using a purely geometric analysis which takes into account the relative position of the sun throughout the year, the wind turbines at the site, local topography and the viewer. This method has been used to determine the shadow flicker duration at sensitive locations neighboring the proposed Crookwell 2 Wind Farm.

However, this analysis method tends to be conservative and typically results in over-estimation of the number of hours of shadow flicker experienced at a dwelling. Therefore, an attempt has been made to quantify the likely reduction in shadow flicker duration due to turbine orientation and cloud cover, and hence produce a prediction of the actual shadow flicker duration.

The *Draft NSW Planning Guidelines: Wind Farms* recommend a shadow flicker limit of 30 hours per year. However, these guidelines do not contain or recommend a methodology for assessing shadow flicker durations. The assessment for the modification, therefore, was based on the methodology recommended in the Environment Protection and Heritage Council's *Draft National Wind Farm Development Guidelines* (draft National Guidelines). The relevant shadow flicker duration at a dwelling was taken as the maximum calculated duration occurring within 50m of the dwelling.

It should be noted that the results are based a hypothetical turbine configuration with a 95m hub height and 130m rotor blade diameter. If the turbine selected for the site has smaller dimensions than that is, the shadow flicker durations are likely to be lower than those predicted in the subject assessment.

7.2.3 Results

Results of the assessment indicate that there are locations within 50m of nine dwellings that are predicted to experience some shadow flicker from the modified Crookwell 2 Wind Farm turbines. Eight of these locations are predicted to experience *theoretical* shadow flicker duration in excess of the recommended limit of 30 hours per year; however, it should be noted that these are all host dwellings.

The predicted *actual* shadow flicker duration shows that the same eight host dwellings are expected to experience actual shadow flicker durations in excess of the recommended limit of 10 hours per year within 50m of the house location, as set out in the draft National Guidelines. The shadow flicker durations predicted at some of the host dwellings are significantly higher than the recommended limits.

However, this prediction of the actual shadow flicker duration does not take into account any reduction due to low wind speed, vegetation or other shielding effects around each house in calculating the number of shadow flicker hours. Therefore, the values presented may still be regarded as conservative.

Blade glint is not likely to cause a problem for observers in the vicinity of the Crookwell 2 Wind Farm provided non-reflective coatings are used on the blades of the turbines.

7.2.4 Mitigation Measures

Given that the shadow flicker durations predicted at some of the host dwellings are significantly higher than the recommended limits, DNV GL recommends that the proponent approach the host dwellings to discuss the matter.

The effects of shadow flicker can be reduced through a number of mitigation measures, such as:

- Installation of screening structures or planting of trees to block shadows cast by the turbines, or
- Use of turbine control strategies, which shut down turbines when shadow flicker is likely to occur.

Blade glint is not likely to cause a problem for observers in the vicinity of the Crookwell 2 Wind Farm provided non-reflective coatings are used on the blades of the turbines.

7.3 Noise

7.3.1 Introduction

SLR Consulting Australia Pty Ltd (SLR) was commissioned by Crookwell Development Pty Ltd to assess the potential noise impacts from proposed modifications to the Crookwell 2 Wind Farm together with an amended layout for the proposed Crookwell 3 Wind Farm. See **Appendix 8** for the full report.

SLR (previously Heggies Pty Ltd) has been involved with the project since 2004 and has previously conducted noise assessments for both the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm.

7.3.2 Methodology

As some receptors are potentially affected by noise from both the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm, the DP&E requested that the noise impacts resulting from the proposed modifications be assessed cumulatively with the proposed impacts of the Crookwell 3 Wind Farm and the Crookwell 1 Wind Farm. SLR Consulting was accordingly commissioned to conduct a cumulative noise assessment for the three windfarms. For the purpose of this assessment each of the Crookwell 1, 2 and 3 Wind Farms were assumed to be operating simultaneously and both Crookwell 2 and 3 Wind Farms were assumed to be operating with the same wind turbine generator (WTG) model.

As part of this assessment, additional monitoring was undertaken at four locations in the vicinity of the Elmgrove property. The purpose of this monitoring was to confirm that the noise level produced by Crookwell 1 Wind Farm is accurately portrayed in the noise model as well as to provide an estimate as to the background noise level at the Elmgrove property where no previous monitoring has been completed due to access constraints.

Modelling using the standard ISO9613 methodology was completed for three potential alternative turbines models (Vestas V126, GE130, Senvion M122).

A potential limitation of the ISO9613 methodology is that it assumes downwind propagation from each source to each receptor. This is an unrealistic oversimplification of what will occur at some receptors as all receptors will not be

downwind of each operating wind turbine. This oversimplification can therefore lead to very conservative results.

A mitigation investigation was then undertaken for the Vestas V126 model utilising a mitigated layout where some turbines are operated in Noise Management Mode (NMM). This mode is a firmware-locked operation mode of the turbine whereby the speed of the rotor is reduced to lessen the sound power generated by the blades. This mode is set by the turbine manufacturer and is fixed for each turbine. Notably, information regarding NMM for the GE130 and Senvion M122 models was not available at the time of compiling the report, as these models are relatively new.

To address the limitations of the ISO9613 methodology, and at the request of DP&E, a detailed predictive analysis was also completed using a more realistic evaluation of the effect of meteorological variation on noise. For this analysis the noise modeling algorithm changed from the ISO 9613 Standard to the CONCAWE calculation method. In contrast to the ISO9613 methodology, the CONCAWE algorithm has inputs for meteorology allowing for a more detailed analysis of the influence of wind speed, wind direction and atmospheric stability on the final predicted noise level.

7.3.3 Results

Results of standard modelling indicated that the revised wind farm layout may exceed the relevant noise limits at some receptors without the use of NMM.

However, the mitigation investigation found that compliance at all receptors can be achieved using the mitigated layout where some turbines operate in NMM. It is anticipated that subsequent testing for the models not included in the mitigation investigation (GE130 and Senvion M122) would also demonstrate compliance when some turbines are operated in NMM.

The results of the CONCAWE analysis show that for project involved receptors, the ISO9613 modelling approach is potentially overly conservative by 1dBA to 2dBA. For non-involved receptors, it is expected that the ISO9613 modelling approach is potentially overly conservative by 2dBA to 3dBA.

7.3.4 Mitigation Measures

Modern wind farms are generally able to apply two types of noise mitigation to their operations—Sector Management (SM) and Noise Management Mode (NMM). DP&E have expressed their preference to avoid the use of SM as a basis for establishing compliance during the planning and approval processes. However, NMM differs from SM as using a wind turbine generator in NMM is akin to selecting a model with a lower sound power level.

The conservative noise modeling conducted for the project has shown some predicted exceedance of the noise criteria. However, the mitigation layout investigation has shown that NMM can be successfully employed to meet all relevant noise criteria. For the purpose of the NMM noise modelling a total of 9 turbines were placed into Noise Management Mode operation, which reduces the sound power output compared to the standard Mode 0 operation. Three of these nine turbines are located within the approved Crookwell 2 Wind Farm layout, and the other six located within the proposed Crookwell 3 Wind Farm layout.

NMM is a firmware-locked operation mode of each turbine whereby the speed of the rotor is reduced to lessen the sound power generated by the blades. This is set by the turbine manufacturer and is fixed for each model. If post-construction measurements demonstrate that the wind farm already complies and that

additional mitigation is not required then the firmware is not installed and the reduced noise mode is not used. Alternatively, if additional mitigation is required, the manufacture can change firmware settings within each turbine to activate the reduced noise mode. The turbines will then each operate according to the relevant sound power curve settings.

7.4 Heritage

7.4.1 Introduction

Bowen Heritage Management Pty Ltd (BHM) was commissioned by Crookwell Development Pty Ltd to prepare a supplementary report to assess the implications for Aboriginal cultural heritage associated with modifications to the approved Crookwell 2 Wind Farm development. Refer to **Appendix 9** for the full report.

The aim of the report is to ascertain whether there are any heritage values that could be affected by the development modifications and, if so, to provide mitigation measures for the management of those impacts.

7.4.2 Methodology

The report reviews the heritage work undertaken to date for the Crookwell 2 Wind Farm project and compares the impacts of the proposed layout to the approved layout.

7.4.3 Results

The report finds that the impact of the Crookwell 2 Wind Farm development has so far been adequately determined and mitigated against through a legislatively compliant investigation.

The report concludes that no further archaeological assessment is required for the 33 turbine layout—as long as micrositing is confined to within a 50m radius of the existing approved turbine locations. This will ensure that the locations are limited to those that have already been tested for archeological sites and have mitigation measures in place where necessary.

7.4.4 Mitigation Measures

The report identifies the following mitigation measures:

- Micrositing should be confined to within a 50m radius of the approved turbine locations. If micrositing is greater than 50m, additional archaeological testing of that location will be required.
- Any alterations to vehicle access roads will initially require further archaeological desktop assessment and field survey investigations (if required), including appropriate Aboriginal consultation and participation.
- A meeting should take place between the Proponent, Jackie Taylor from the Queanbeyan branch of the OEH and the DP&E to formally endorse the proposed work.
- Any further archeological investigations must be conducted in accordance with the OEH 2010 *Code of Practice for Archeological Investigations of Aboriginal Objects in New South Wales* and will require Aboriginal consultation and participation in line with OEH 2010 *Aboriginal Heritage Consultation Requirements for proponents*.

7.5 Aviation

7.5.1 Introduction

Crookwell Development Pty Ltd engaged Aviation Projects to conduct an aviation impact assessment with respect to the proposed modifications of the Crookwell 2 Wind Farm. See **Appendix 10** for the full report.

7.5.2 Methodology

The following activities were conducted as part of the assessment:

- The scope and deliverables were discussed with and agreed by the Proponent's Project Manager;
- A desktop review of the supplied materials was conducted;
- Relevant regulatory requirements and sources of information were reviewed;
- An Aviation Impact Statement was prepared;
- A qualitative risk assessment was prepared;
- A lighting design was prepared;
- Stakeholders were consulted in writing and/or by telephone interview as applicable;
- A draft report was prepared, finalised and forward to Airservices Australia, Civil Aviation Authority and Commonwealth Department of Defence for consultation; and
- A final report was prepared.

7.5.3 Results

The following conclusions were made as a result of the assessment.

Consultation

An appropriate and justified level of consultation was undertaken with the following parties:

- Aerial Agricultural Association of Australia;
- Airservices Australia;
- Civil Aviation Safety Authority;
- Department of Defence;
- Fred Fahey Aerial Services;
- Goulburn Mulwaree Council;
- NSW Rural Fire Service;
- Royal Flying Doctor Service;
- Upper Lachlan Shire Council; and
- Yass Aerial Service.

Aviation Impact

In summary it was determined that:

- The blade tips of the highest obstacle in the wind farm project will be 1107m (3236ft) Australian Height Datum (AHD) and as such:
 - Will not penetrate any OLS surfaces;
 - Will not penetrate any Procedures for Air Navigation Services-Aircraft Operations surfaces;
 - Will not have an impact on prescribed airspace;
 - Are wholly contained within Class G airspace; and
 - Will not have an impact on existing local aviation activities.
- The wind farm obstacles are located outside the clearance zones associated with aviation navigation aids and communication facilities.
- A preliminary assessment on the impact of the wind farm on ATC radar surveillance facilities has been made. There will be an impact on the Route Surveillance Radar at Mt Bobbara. The Primary Surveillance Radar and Secondary Surveillance Radar facility at Mt Majura may be affected. Further liaison with Airservices Australia will be required to refine the impact analysis and, if required, coordinate impact mitigation measures.
- The wind farm is sufficiently distant from airfields to not have an impact on contingency procedures and engine inoperative flight paths.
- Subject to resolution of surveillance radar impact issues, the wind farm obstacles have been assessed as not having an impact on prescribed airspace. The development is therefore considered approvable in accordance the relevant civil aviation regulations. This AIS can be used as supporting documentation for an application to CASA.

Aircraft Operator Characteristics

- Based on input during consultation activities, the proposed modifications will result in a reduced net impact on aerial agricultural operations. Moreover, the impacts may be further alleviated by an effective and functional working relationship between the Proponent and aerial agricultural operators that are likely to operate in the vicinity of the Crookwell 2 Wind Farm
- There is no significance in the impact of the proposed modifications on NSW Rural Fire Service (RFS) aerial firefighting operations. It would be beneficial to develop procedures to stop turbines blades from rotating before RFS begins aerial firefighting operations within the area.
- No significant impact is anticipated on Royal Flying Doctors Service operations as long as the obstacles are properly referenced on navigation charts.

Hazard Lighting and Marking

- The wind turbines in the Project are proposed to be up to 160m Above Ground Level (AGL). With respect to the CASA Manual of Standards (MOS) 139 7.1.5.1, the proposed towers must be reported to CASA if they will be higher than 110m AGL. With respect to MOS 139 7.1.5.2, the wind turbines must be regarded as obstacles if they are higher than 150m AGL, unless CASA assesses otherwise.
- With respect to MOS 139 9.4.1.2 (b), the wind turbines will need to be lit if they are higher than 110m AGL, unless an aeronautical study assesses they are of no operational significance.

- Aviation Projects has assessed that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines.
- If lighting is required, the lighting design proposed by Aviation Projects is subject to confirmation of the final turbine layout as any changes could potentially affect which turbines should be lit in accordance with the 900m interval consideration.
- CASA recommends that the Crookwell 2 Wind Farm be lit with steady red low intensity lighting at night as per Section 9.4 of the CASA MOS Part 139. Characteristics for low intensity area stated in Part 139 Subsection 9.4.6. CASA agrees that the turbines that should be lit are identified in the drawing '100405 Crookwell 2 Wind Farm Obstacle Lighting Design v0.1, (10 August 2015)'.
 - A summary of design characteristics for obstacle lighting acceptable by CASA, if required, is provided below:
 - Two steady red low intensity obstacle lights should be provided;
 - The light fixtures should be mounted sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction; and
 - The characteristics of the obstacle lights should be in accordance with the applicable standards in MOS 139.
- To ensure the ongoing availability of obstacle lights (if required), a monitoring, reporting and maintenance program will need to be established in accordance with the guidance in MOS 139 Section 9.4.10.
- With respect to marking of turbines, it is generally accepted that, as an alternative to white, an off-white or light grey colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.
- With respect to marking wind-monitoring towers, they will be lower than, and are likely to be within 400m of, a turbine and are therefore not likely to require obstacle marking or lighting.
- The Department of Defence was consulted with respect to the potential impacts of the proposed modifications on its aviation operations. In a letter dated 24 November 2015, the Department advised it has no concerns with the proposed modifications subject to the following requests being met:
 - Provide Airservices Australia with "as constructed" details, by emailing the details to vod@airservicesaustralia.com;
 - Wind turbines should be lit in accordance with the requirements of MOS 139; and
 - If LED obstruction lighting is to be provided, ensure the frequency range of the LED light emitted falls within the range of wavelengths 655 to 930 nanometres (nm), ensuring they are visible to persons using night vision devices.

Risk Assessment

A summary of the risks associated with the project is provided in the table below.

<i>Risk Element</i>	<i>Consequence</i>	<i>Likelihood</i>	<i>Risk</i>	<i>Actions Required</i>
Aircraft collision with a wind turbine	Catastrophic	Rare	6	Acceptable without obstacle lighting. Communicate details of wind farm to local and regional operators and make arrangements to publish details in ERSA for surrounding airports, before, during and following construction.
Aircraft collision with a monitoring tower	Catastrophic	Rare	6	Acceptable without obstacle lighting. Although there is no obligation to do so, consider marking the wind monitoring towers according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings, specifically 8.10.2.6 and 8.10.2.8. Communicate details of wind farm wind monitoring towers to local and regional operators and make arrangements to publish details in ERSA for surrounding airports, following construction.
Harsh manoeuvring leads to CFIT	Catastrophic	Rare	6	Acceptable without obstacle lighting. Communicate details of wind farm to local and regional operators and make arrangements to publish details in ERSA for surrounding airports before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting. Communicate details of wind farm to local and regional operators and make arrangements to publish details in ERSA for surrounding airports before, during and following construction.
Visual impact from obstacle lights	Moderate	Possible	6	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise environmental impacts.

Figure 7: Summary of aviation risk assessment
Source: Aviation Projects

7.5.4 Mitigation Measures

In addition to the mitigation measures mentioned in the results section above, the following is recommended:

Notification and reporting

- 'As constructed' details of wind turbine and wind monitoring tower coordinates and elevations should be provided to the Royal Australian Air Force (RAAF) AIS, by emailing the details to vod@airservicesaustralia.com.
- Any obstacles above 110m AGL (including temporary construction equipment) should be reported to Airservices Australia Notice to Airmen (NOTAM) office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
 - The planned operational timeframe and maximum height of the crane; and
 - Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.

Operating procedures

- The Proponent should engage with local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Crookwell 2 Wind Farm. Procedures may include stopping the rotation of the wind turbine rotor blades prior to the commencement of the aircraft operations within relevant areas.
- The Proponent should consult with the NSW Rural Fire Service when developing fire management procedures, ensuring due consideration of the use of aerial firefighting techniques within the wind farm area.

Making of turbines

- The rotor blades, nacelle and the supporting mast of the wind turbines should be painted white, off-white or a light grey colour.

Lighting of turbines

- If obstacle lighting is required, obstacle lighting should be installed on the following 24 turbines (without the 'F' as the identification prefix): 1, 4, 5, 9, 10, 11, 12, 17, 19, 21, 23, 24, 26, 27, 29, 31, 36, 37, 40, 43, 45, 47, 48 and 50.
- If obstacle lighting is required, the turbines should be lit with steady red low intensity lighting at night as per MOS 139 Section 9.4, while minimising visual impact. To ensure the ongoing availability of obstacle lights, a monitoring, reporting and maintenance program should be established in accordance with MOS 139 Section 9.4.10.
- Department of Defence requested that if LED lighting is used for obstacle lighting, then emitted light should fall within the wavelength range of 655 to 930nm for night vision device compatibility.
- The Proponent may consider other factors in its decision as to whether obstacle lights should be installed.

Marking of wind monitoring towers

- Consideration should be given to marking wind-monitoring towers according to the requirements set out in MOS 139 Section 8.10 (as modified by the guidance in NASF Guideline D).

Triggers for review

- Triggers for review of this risk assessment are provided for consideration:
 - Prior to construction to ensure the regulatory framework has not changed;
 - Following any significant changes to the context in which the assessment was prepared, including the regulatory framework; and
 - Following any near miss, incident or accident associated with operations considered in this risk assessment.

7.6 Telecommunications

7.6.1 Introduction

Garrad Hassan Pacific Pty Ltd, now trading as DNV GL, has been commissioned by Crookwell Development Pty Ltd to assess the potential electromagnetic interference (EMI) issues associated with the development and operation of the proposed Crookwell 2 Wind Farm. See **Appendix 11** for the full report.

The report summarises the results of an EMI assessment conducted for the site. Information relating to nearby telecommunication licenses has been obtained from the Australian Communications and Media Authority (ACMA). In accordance with the planning guidelines relevant to the project, the report assesses the potential risks regarding interference with radio communication services operating in the vicinity of the project, including:

- Fixed point-to-point links,
- Fixed point-to-multi point links,
- Radio communication assets belonging to emergency services,
- Meteorological radars,
- Trigonometrical stations,
- Citizen Band (CB) radio and mobile phones,
- Wireless internet,
- Broadcast radio,
- Satellite television and internet, and
- Broadcast television.

7.6.2 Methodology

If not properly designed, wind farms have the potential to interfere with radio communication services. The two services that are most likely to be affected include television broadcast signals and fixed point-to-point microwave signals. The Draft National Guidelines recommend that a radial distance of 50-60km from the centre of a wind farm would normally capture all of the potentially affected services in the area.

However, the methodology for assessing the potential radio communication interference used in the subject assessment is to locate all of the telecommunication towers within approximately 75km of the proposed wind farm site, and then assess the telecommunication licenses attached to these towers. This is to reduce the likelihood that telecommunications links crossing the site are inadvertently excluded from the assessment.

DNV GL considered a conservative turbine geometry, with dimensions satisfying all of the following criteria:

- a rotor diameter of 130m or less; and
- an upper tip height of 160m or less.

7.6.3 Results

Fixed Point-to-Point Links

Several point-to-point microwave links were identified with a path over or near the proposed project boundary. Of these, five links were identified passing the site boundary. The potential interference zones around these point-to-point links have been identified and it has been found that six proposed six turbines have the potential to cause interference to three of these links. DNV GL has contacted the operators of these links (Ambulance Service of NSW, NSW Rural Fire Service, Radio Goulburn, Vertical Telecoms and Optus Mobile) to seek feedback.

The NSW Rural Fire Service has confirmed that two turbines located within the exclusion zone calculated by DNV GL are likely to cause interference to their link,

which already experiences poor performance, and have recommended an exclusion zone of 150m in the vicinity of the wind farm.

To mitigate the potential impact to their services, the NSW Rural Fire Service has indicated that they are willing to consider re-routing their link provided that they are not expected to cover the cost. It is recommended that further discussions with the NSW Rural Fire Service be held prior to the commencement of construction in order to make arrangements for re-routing their fixed point-to-point link crossing the Crookwell 2 Wind Farm site.

Vertical Telecoms has indicated that the project should not adversely impact on their services provided that the turbines remain outside an alternative exclusion zone. This alternative exclusion zone is considered to be less conservative than that calculated by DNV GL, and does not contain any turbines in proposed layout.

To date, no formal response has been received from the Ambulance Service of NSW, Radio Goulburn or Optus Mobile.

Point-to-Multipoint Microwave Links

There are two point-to-multipoint base stations listed in the ACMA database within 20km of the project boundary. These are owned by Goulburn City Council and Upper Lachlan Shire Council. Both councils have been consulted and have indicated that they do not foresee any potential impact on their point-to-multipoint systems.

There are a number of other point-to-multipoint stations at a distance of greater than 20km from the site. Although it is not possible to determine if there are any potential impacts without knowing the locations of each station in the multipoint network, it is unlikely that stations at this distance will be servicing customers in the vicinity of the site. DNV GL has contacted the operators of these stations to inform them of the project and seek feedback on potential impact. Responses have been received from a number of operators, and no concerns have been raised.

Other License Types

A review of other licences within 75km of the project site was conducted. Many of the licenses identified can broadly be described as base to mobile station style communication, and include radiobroadcasting, commercial and private mobile telephony. These licence types are generally not affected by the presence of wind turbines.

Emergency Services

Emergency services with radio communications in the vicinity of the site have been identified and have been contacted as part of the consultation process. Responses have been received from a number of operators, and no concerns have been raised to date apart from the potential for interference with fixed point-to-point links operated by Ambulance Service of NSW and NSW Rural Fire Service (described above).

Aircraft Navigation Systems and Aviation Radar

Impacts on aviation systems are covered under Section 7.5 of this report.

Meteorological Radar

It was found that the closest meteorological radar station is approximately 120km northeast of the site. Given this distance, it is unlikely that the project would have an impact on radar operations. DNV GL has contacted the Bureau of Meteorology (BoM) in regards to the project, and the BoM responded that the project is unlikely to cause significant interference.

Trigonometrical Stations

A total of 32 trigonometrical stations have been identified within 20km of the site, and although these are unlikely to host equipment that is susceptible to electromagnetic interference, Geoscience Australia and New South Wales Land and Property Information (NSW LPI) have been contacted as part of the consultation process to inform them of the project and to seek feedback about the likelihood of interference to their systems.

Geoscience Australia indicated that they do expect the project to impact their assets. However, NSW LPI has raised concerns about the potential for disturbance to a trigonometrical station located within the project boundaries and has requested appropriate measures be taken to identify and protect that station before and during construction.

DNV GL recommend that further discussions with NSWLPI are undertaken prior to construction of the project to plan for and carry out necessary actions to protect trigonometrical stations within the vicinity of the site.

CB Radio

It is considered that the impact of the project on the CB radio service will be minimal.

Mobile Phones

In general mobile phones are not susceptible to interference from wind turbines. The nearest mobile phone base station is located approximately 12km northwest of the site boundary.

Published mobile network coverage has been reviewed for the area around the project. It has been found that there is generally fair to good network coverage in most areas around the project, and mobile signals are unlikely to be affected. However, there are some areas where coverage may be marginal and therefore mobile signals may be susceptible to interference.

Optus, Telstra and Vodafone have been contacted as part of the consultation process to seek feedback on any potential impact.

Feedback from Telstra indicates that the project will have no impact on their operations and services, but no formal response has been received from either Optus or Vodafone to date.

Wireless Internet

Yless4U and ACE Internet Services may provide wireless internet services to houses in the vicinity of the project. These operators have been contacted as part of the consultation process, and both have indicated that they do not see any potential for interference to their services.

A review of the NBN availability map indicates that work for a fixed wireless network has not yet commenced in the area and is not planned at this stage. In the event that the NBN is provided to this area via satellite, it is considered unlikely that the signals from the satellite will be subject to interference from the project. NBN Co has been contacted in regards to the project, but no formal response has been received.

Satellite Television and Internet

DNV GL has reviewed the line-of-sight of commonly used TV and internet satellites, and has found that the project is unlikely to cause interference to the signals received from these satellites.

Radio Broadcasting

It is unlikely that the proposed project will have an impact on AM radio as the signals are able to propagate around obstructions and buildings. FM signals, however, may be susceptible to interference from objects such as wind turbines, resulting in hissing and distortion of signal.

Television Broadcasting

Broadcast towers around the project were investigated to see if television interference is likely. Digital terrestrial broadcasts have now replaced analogue broadcasts in New South Wales and are generally much less susceptible to interference from wind farms. However, interference is possible in some areas of low signal strength.

DNV GL has highlighted the areas around the project site where interference to terrestrial television broadcasts is more likely to occur. A total of 30 houses were identified in the potential interference zone for the Canberra Broadcast tower, including seven dwellings belonging to participating landowners. Totals of 12, 36, 19, and 35 houses were identified in the potential zones from the Goulburn, Crookwell, Illawarra and Central Tablelands towers, respectively.

The project is in a location for which there is 'variable' digital terrestrial televisions coverage across much of the area surrounding the site, and therefore interference could be encountered.

It is understood that the Upper Lachlan Shire Council has recently installed a new free-to-air repeater on the existing Crookwell broadcast tower at Wades Hill. Although planning approval had been granted for the Crookwell 2 Wind Farm prior to the installation of the repeater, the signal may be intercepted by turbines, and therefore it is possible that the turbines could impact upon the performance of the repeater.

7.6.4 Mitigation

Fixed Point-to-Point Links

To mitigate the potential impact to their services, the NSW Rural Fire Service has indicated that they are willing to consider re-routing their link provided that they are not expected to cover the cost. It is recommended that further discussions with the NSW Rural Fire Service be held prior to the commencement of construction in order to make arrangements for re-routing their fixed point-to-point link crossing the Crookwell 2 Wind Farm site.

Trigonometrical Stations

DNV GL recommend that further discussions with NSWLPI are undertaken prior to construction of the project to plan for and carry out necessary actions to protect trigonometrical stations within the vicinity of the site.

Mobile Phone

If interference is encountered, mitigations options are available, such as installation of an external antenna or moving a short distance until the signal improves.

Radio Broadcasting

Potential inference to FM signals can be mitigated through the installation of a high quality antenna.

Television Broadcasting

For residents whose television reception is made worse by the project, there is a range of mitigation options available, including (in order of increasing cost):

- Realigning the TV antenna more directly towards the existing transmitter;
- Tuning the TV antenna into an alternative source of the same or suitable TV signal;
- Installing a more directional and/or higher gain antenna;
- Relocating the antenna to a less affected position;
- Installing cable/satellite (dwellings may be eligible for a Government funded satellite television service); and
- Installation of a TV relay station.

Upper Lachlan Shire Council has indicated that they will be seeking to impose conditions of consent that will require all necessary actions to protect the signal from the newly installed free-to-air repeater at Wades Hill.

It is recommended that further discussions with the Council be held prior to construction to determine arrangements for monitoring and assessing any potential interference, and establish a process for resolving issues should interference be encountered.

7.7 Traffic and Transport

7.7.1 Introduction

GTA Consultants has been commissioned by Crookwell Development Pty Ltd to prepare a traffic and transport impact assessment for the proposed modifications to the Crookwell 2 Wind Farm. Refer to **Appendix 12** for the full report. The report provides an assessment of the anticipated transport implications of the proposed development.

7.7.2 Methodology

The impact assessment includes the following:

- Identification of appropriate construction vehicle routes to the site for general construction vehicle and oversize/overmass construction vehicles;
- Traffic generating characteristics of the proposed development during construction and operation phases;
- Suitability of the proposed access arrangements for the site; and
- The transport impact of the development proposal on the surrounding road network.

7.7.3 Results

The report concludes that traffic impacts of the proposed modifications will be lower compared to the approved design, especially during the construction phase of the development, as the number of turbines being constructed has reduced. The report also highlights that these impacts are manageable and can be mitigated.

No changes are proposed to the preferred access routes. The nominated transport route for the turbine blades remains as outlined in the documentation provided as part of the original EIS for the development.

This route includes State and National routes up to Goulburn, and continues via local roads to the site. The route from Port Kembla to the site is as follows:

- Picton Road (Main road 88), Hume Highway, Cowper Street, Clinton Street, Deccan Street, Fitzroy Street, Crookwell Road

Restricted Access Vehicles (i.e. oversize and overmass vehicles) will be used to deliver the turbine components to the project area. Whilst they will contribute the smallest percentage of trips to the project area during the construction period, they will be the most critical from a vehicle access perspective and will require some road and intersection upgrades to the existing network.

Based on an inspection of the nominated transport route and a vehicle swept path assessment, GTA has determined that the transportation of the 64m blades from Port Kembla to the Crookwell 2 Wind Farm via the nominated transport route is manageable with the temporary removal or relocation of various roadside elements at nine key intersections. The locations of the nine intersections are included in Figure 8 below and **Appendix 12**.

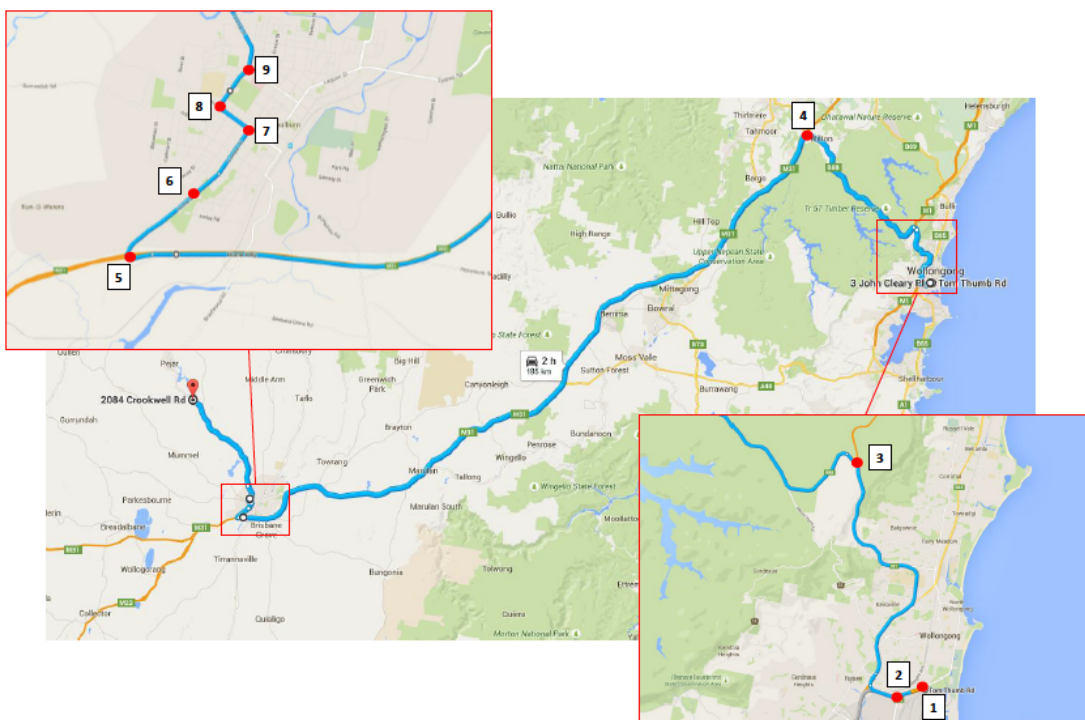


Figure 8: Preferred Route and Key Intersections
Source: GTA Consultants, 2016

Whilst traffic generation during the typical operation of the Crookwell 2 Wind Farm is not expected to change under the proposed modification, remaining as per Modification-1, GTA undertook an analysis of the traffic generated during the construction period. They determined that the peak daily traffic generation for both the construction and operation of the wind farm would remain consistent with Modification-1. However, given the reduced number of turbines it was found that the impact of construction and overall traffic generation is expected to be lower than that approved.

A comparison of traffic movements generated as part of the delivery of turbine components, equipment and materials is outlined in Table 4 below.

Table 6. Delivery of Components and Equipment (Number of Vehicles)									
Component	Traffic Generation per Turbine ^[1]			Total Traffic Generation ^[1] (2009 Mod-1 Approved)			Total Traffic Generation (Mod-2 Application)		
	Semi-Trailer	Over-Size	Over-mass	Semi-Trailer	Over-Size	Over-mass	Semi-Trailer	Over-Size	Over-mass
Turbine Components & Equipment	3	7	1	138	322	46	99	231	33
Crane				4	1		4	1	
Concrete	66			3,036			2,178		
Total	69	7	1	3,178	323	46	2,281	232	33

Source: GTA Consultants, 2016

The proposed development modification would result in a reduction of approximately 1,000 vehicles accessing the site for the development.

7.7.4 Mitigation Measures

A number of road and intersection upgrade works have been identified as necessary for the project. These are provided in tabular form in the full assessment at **Appendix 12**.

The main issues that have been addressed by the report in relation to 64m blade swept paths include:

- Mitigating impacts on street furniture, signage, poles, traffic signal infrastructure.
- Ensuring safety; and
- Minimising impacts on road infrastructure, including concrete medians, kerbs and road safety barriers.

Once the final specifications for the restricted access vehicles to be used to transport the blades are known, a detailed traffic management plan should be prepared in consultation with Roads and Maritime Services and affected Councils. The plan should be provided to DP&E for approval prior to delivery of the turbine equipment to site.

7.8 Biodiversity

7.8.1 Introduction

Crookwell Development Pty Ltd commissioned Brett Lane and Associates Pty Ltd to carry out a Supplementary Ecological Impact Assessment. The assessment involved:

- A review of previous literature documenting flora and fauna within the Crookwell 2 Wind Farm site;

- An investigation of the possible impacts of the larger turbines on flora and fauna.

Brett Lane and Associates were also commissioned to prepare a Turbine Micrositing Biodiversity Management Plan in order to ensure that any potential future micrositing of turbines does not result in impacts to biodiversity beyond those outlined in the Supplementary Ecological Impact Assessment.

Refer to **Appendix 13** for the Supplementary Biodiversity Impact Assessment and **Appendix 14** for the Turbine Micrositing Biodiversity Management Plan.

7.8.2 Methodology

A number of previous reports related to the Crookwell 2 Wind Farm project were reviewed to determine the ecological values within the project site. The modified proposal was then considered in light of these ecological values to determine potential impacts of the modified proposal.

The online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (Department of the Environment 2015) and Schedule 1 to the NSW *Threatened Species Conservation (TSC) Act 1995* (NSW) were also consulted to determine whether ecological communities listed after the 2009 assessment, undertaken by Biosis Research, potentially occurred in the study area. This was based on the ecological conditions described in the reports referred to as URS 2004a, URS 2004b and Biosis Research 2009.

7.8.3 Results

Fauna

Analysis of the height distribution of bird movements shows that the vast majority (92.45%) of flights were recorded below the proposed modified lower rotor swept area (RSA) height. Very few bird movements (0.15%) were recorded above a height of 90m.

The proposed increase in the upper RSA height to 160m and reduction of the lower RSA height to 30m will have an insignificant effect on birds at the Crookwell 2 Wind Farm given so few birds fly above a height of 30m.

The proposed modification of the blade length from 47m to 64m will result in the RSA area for each turbine increasing from 7,235m² to 13,267m². This will result in a proportional increase in risk to birds flying at the RSA height of collision. However, though the proposed modifications will increase the total wind farm RSA area by 32% from 332,780m² to 437,795 m² the modifications also involve a reduction in the number of turbines from 46 to 33, which will contribute to reducing potential impacts on bird and bats.

The risk of bird collision at wind farms is considered low. Most birds are able to detect turbines and take action to avoid colliding with them. It is likely that collisions will mostly involve common farmland species. Any additional collisions due to the net increase in RSA extent are unlikely to have a significant effect on the local or regional populations of these common species.

Any net increase in the extent of the RSA may result in an increase in the number of bats exposed to a risk of fatal collision. However, the effect of the changes to the RSA is not considered to substantially increase the risk of collisions with bats as most bat activity will remain below the lower RSA heights

Flora

Previous studies found the dominant habitat within the site to be introduced grassland. Aquatic habitats were described as degraded with poor cover and

diversity of fringing vegetation. Large patches of woodland habitat occurred mostly outside the wind farm boundary. A few smaller woodland patches were scattered throughout the site, mostly to the north and west. Low bird diversity and abundance reflected the limited extent of treed habitat within and surrounding the wind farm site.

No areas of the native grassland and woodland communities recorded within the site would be impacted as a result of the proposed modifications. As per Modification-1, a small number of paddock trees (<20) would either need to be removed or lopped for turbine installation and road network/creek crossing works. Removal and replanting of some existing windrows would also be required.

It is therefore considered that the proposed modifications would have no additional impacts on flora and native vegetation compared with the approved Modification-1 layout.

7.8.4 Mitigation Measures

As noted above, a Turbine Micrositing Biodiversity Management Plan has been prepared by Brett Lane and Associates. This plan identifies habitats of ecological sensitivity on the Crookwell 2 Wind Farm site; provides a checklist to avoid potential impacts to biodiversity—beyond those contemplated as a result of the proposed modifications—resulting from micrositing of turbines; and provide mitigation measures for the project should potential impacts to biodiversity resulting from micrositing of turbines, beyond those contemplated by the proposed modifications, be identified.

Both a Construction Flora and Fauna Management Sub Plan and an Operation Flora and Fauna Management Sub Plan must be prepared as part of the Environmental Management Plan required under the original development consent conditions. These sub-plans must include maps and plans, methods to manage impacts on flora and fauna species and their habitat (such as fencing), design details to reduce the risk of bird and bat strike, vegetation rehabilitation details, a weed management plan (detailing such matters as the use of certified weed-free mulch) and details for monitoring and reporting.

Preparation and implementation of a Bird and Bat Adaptive Management Program is also a requirement of the current development consent. This requirement provides the means for monitoring bird and bat impacts.

A *Turbine Micrositing Biodiversity Management Plan* has also been prepared to make certain that micrositing within 100 meters of the proposed turbine locations does not have an impact on biodiversity at the site beyond that contemplated by the proposed modifications.

In regards to turbine lighting, bird and bat mortality can be mitigated by reducing the period of illumination. This can be achieved by using strobe lighting (at 20 to 60 flashes per minute) rather than using continuous lighting. Furthermore, reducing the beam intensity and using red lights will further mitigate any potential impacts.

7.9 Social and Economic Impacts

The proposed modifications are not anticipated have any adverse social or economic impacts. The detailed socio-economic analysis submitted with the application for the original Crookwell 2 Wind Farm is considered still relevant and authoritative. This analysis concluded that the project would provide a positive contribution to the economy and local community. Specifically, the analysis found that:

- The Crookwell 2 Wind Farm would have a positive net present value, and as such, would provide a positive contribution to the economy and local community;
- The Crookwell 2 Wind Farm would provide capital investment, direct and flow-on economic benefits through permanent and temporary employment;
- The Crookwell 2 Wind Farm would help maintain the existing agricultural activities; and
- The Crookwell 2 Wind Farm would have support national and international efforts to reduce the potential impacts of global warming and climate change.

All of these benefits would be maintained or improved upon through the proposed modifications, which features better, more efficient technology and fewer turbines.

7.10 Cumulative Impacts

The previous sections of this report describe the impact assessments undertaken for the proposed modifications to the Crookwell 2 Wind Farm. In many cases these assessments include consideration of the cumulative impacts of the proposed modifications, specifically with regards to the operating Crookwell 1 Wind farm and the proposed Crookwell 3 Wind Farm. Key cumulative impacts are summarized below. For additional detail, refer to the relevant specialist report.

7.10.1 Shadow Flicker

Results of the cumulative impact assessment contained in the Shadow Flicker and Blade Glint Assessment prepared by DNV GL show that no shadow flicker from the Crookwell 1 Wind Farm and Crookwell 3 Wind Farm turbines is expected to affect the dwellings that receive shadow flicker from the Crookwell 2 Wind Farm turbines.

7.10.2 Noise

The noise impact assessment prepared by SLR is a combined report that considers the proposed modifications to the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm. Additional noise monitoring was also undertaken around the outside perimeter of the Elmgrove property in order to confirm the current noise emissions from the Crookwell 1 Wind Farm.

The report provides an analysis of compliance with noise standards in terms of the cumulative noise from all three Crookwell wind farms. In conclusion the report has found that noise compliance can be achieved using a mitigated layout where a number of turbines are placed into Noise Management Mode.

7.10.3 Telecommunications

Possible cumulative impacts from the proposed modifications to the Crookwell 2 Wind Farm and neighbouring wind farms have been considered by DNV GL in its EMI Assessment report. The possibility exists for there to be some cumulative impacts on point-to-point and point-to-multipoint links, mobile phones, wireless internet, CB radio and some televisions services. However, options exist to mitigate most interference issues should they occur.

7.10.4 Traffic and Transport

For the proposed modifications to the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm the majority of the anticipated road and key intersection upgrade works, especially on National and State roads, will be the same. At this stage, it is anticipated that both the Crookwell 2 Wind Farm and Crookwell 3 Wind Farm will be constructed sequentially, and therefore there is no foreseen cumulative impacts as a result of traffic or transport.

7.11 Ecologically Sustainable Development (ESD)

The proposed modification is consistent with the key principles of ESD as detailed below.

The precautionary principle – If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The proposed modifications are not expected to lead to serious or irreversible environmental damage. Effective mitigation measures have been identified for potential environmental impacts.

Inter-generational equity – The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The proposed modifications provides for the utilisation of advanced wind energy technology and will help Australia meet renewable energy targets for the benefit of future generations.

Conservation of biological diversity and ecological integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.

A supplementary ecological report has been prepared for the proposed modifications as a fundamental consideration. The report concludes that the modification would have no additional impacts on flora and native vegetation compared with the approved development. Furthermore, the risk of bird collisions is low and the effect of the changes to the rotor swept area is not considered to substantially increase the risk of collisions with bats.

Improved valuation, pricing and incentive mechanisms – Environmental factors should be included in the valuation of assets and services.

One key aspect of this principle is that the users of goods and services should pay prices based on the full life cycle costs of providing goods and services. In accordance with this principle, the proponent is committed to funding the decommissioning of the project and rehabilitation of the project area in accordance with the result of consultation with relevant stakeholders at the time of decommissioning.

8 Environmental Management

This chapter provides a summary of the management and mitigation measures and strategies for monitoring the efficacy of those measures. These measures and strategies are essentially the same as those identified for the Crookwell 2 Wind Farm under the original application. No special additional measures or tools have been identified as necessary for the proposed modifications.

8.1 Environmental Management Plan

The Environmental Management Plan (EMP) is a procedural document which outlines the environmental goals of the project, the safeguard measures to be implemented, the timing of the implementation in relation to the progress of the project, responsibilities for implementation and management, and a review process. The EMP will be prepared to address each stage of the proposed wind farm development, namely, site preparation, construction and operation phases.

The key objectives of the EMP would include:

- Ensuring that works are carried out in accordance with appropriate environmental statutory requirements and relevant non-statutory policy;
- Ensuring that works are carried out in accordance with the goals and requirements;
- Ensuring that works are carried out in such a way as to minimise the likelihood of environmental degradation occurring;
- Ensuring that works are carried out in such a way as to manage the impact of the works on neighbouring properties (e.g. noise, traffic);
- Ensuring that all employees engaged in the works comply with the terms and conditions of the EMP;
- Providing clear procedures for management of environmental impact including corrective actions; and
- Identifying management responsibilities and reporting requirements to demonstrate compliance with the EMP.

A standalone Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) would form an integral part of the EMP for the proposed development and would be consistent with the requirements of ISO 9001:2000 and ISO 14001.

Preparation of the CEMP would be a condition of a contractual agreement between the proponent and the nominated contractor, ensuring the plan is prepared prior to commencement of construction. Similarly the OEMP would be prepared prior to the commencement of operation.

The EMPs would be prepared following assessment and approval of the Project, and would serve as working documents to be used throughout the detailed design, construction and operation of the proposed wind farm.

The CEMP and OEMP would typically include:

- Establishment of environmental goals and objectives;
- Conditions of project approval;
- List of actions, timing and responsibilities;
- Supervision protocols fully identifying areas of responsibility for environmental management of the project;

- Statutory requirements;
- A structured reporting system detailing all relevant matters on a regular basis;
- Procedures and forms for documentation and reporting of issues;
- Standard specifications incorporating environmental safeguards;
- Training of personnel in environmental awareness and Best Practice Environmental Management Systems;
- Guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- Calibration and measuring of testing equipment;
- Process surveillance and auditing procedures;
- Review procedures and protocols for modification of the CEMP or OEMP;
- Complaint handling procedure;
- Site management and control procedures;
- Monitoring procedures; and
- Quality assurance procedures.

Appendix 1: Declaration of State Significant Development

Appendix 2: Original Conditions of Consent for
DA-176-8-2004-I

Appendix 3: Conditions of Consent Modification-1

Appendix 4: Letter of Intent to Department of
Planning and Environment



Appendix 5: Department of Planning and
Environment Requirements for Environmental
Assessment

Appendix 6: Visual Impact Assessment

Appendix 7: Shadow Flicker and Blade Glint Assessment

Appendix 8: Noise Impact Assessment

Appendix 9: Supplementary Heritage Impact
Assessment

Appendix 10: Aviation Impact Assessment

Appendix 11: Electromagnetic Interference (EMI) Assessment

Appendix 12: Traffic and Transport Impact Assessment

Appendix 13: Supplementary Ecological Impact
Assessment

Appendix 14: Turbine Micrositing Biodiversity
Management Plan



Appendix 15: Consultation Advertisements

Appendix 16: Newsletter with Turbine Layout

