Coopers Gap Wind Farm:

Coordinator-General's evaluation report on the environmental impact statement

March 2017

Queensland Government

The Department of State Development

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Synopsis

This report evaluates the potential impacts of the Coopers Gap Wind Farm (the project) in accordance with section 35 of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).

The proponent is Coopers Gap Wind Farm Pty Ltd, a subsidiary of AGL Energy Limited (AGL). AGL proposes to develop the Coopers Gap Wind Farm with a capacity of up to 460 megawatts (MW) and a maximum of 115 wind turbines.

Each turbine would have a maximum blade tip height of around 180 metres (m) and a rotor diameter of around 140 m. The wind turbines would be supported by infrastructure including a substation, switchyard facilities, and around 85 kilometres (km) of access tracks and cabling.

The project is located at Coopers Gap, between Dalby and Kingaroy, at around 180 km north-west of Brisbane. The project is proposed to connect directly to Queensland's energy grid.

The project's estimated capital expenditure is $500 million, with construction jobs expected to peak at 350 over the 27 month construction phase. For operations, up to 20 jobs would be required.

The environmental impact statement (EIS) study area involved 12 landholders who own 36 properties covering around 10,200 hectares (ha). The final project construction footprint would cover around 360 ha, and the operational footprint would be around 100 ha across 33 properties. AGL has advised preliminary agreements to host project infrastructure have been secured with all affected landowners. The agreements will need to be formalised prior to the project's construction.

In undertaking my evaluation, I have considered information including the EIS, issues raised in submissions during the EIS public consultation period, and advice I have received from local, State and Commonwealth government agencies.

The following provides an overview of key matters addressed in my evaluation.

Matters of State environmental significance (MSES)

The EIS found that the project could potentially result in clearing of up to 30 ha of regulated vegetation.

The EIS identified that there may be an impact on protected wildlife habitat of up to 379 ha and 350 ha for the spotted-tail quoll and collared delma respectively. Offsets required for regulated vegetation would also compensate for the loss of important habitat for these species.

The proponent has made a number of commitments to avoid or minimise project impacts on regulated vegetation, including locating all construction zones within existing cleared land, co-locating access roads and underground cabling, and imposing strict no-go zones to protect regulated vegetation.

To ensure the project does not have any adverse impacts on regulated vegetation I require all commitments incorporated into the EIS and included in this report to be fully implemented.

I have stated a recommendation to ensure that offsets are provided in line with requirements of the *Vegetation Management Act 1999* and the *Nature Conservation Act 1992*. My recommendations, along with the proponent's commitments, would adequately manage impacts that the project may have on MSES.

Land use and visual impacts

The assessment of visual impacts provided in the EIS found that the introduction of new wind turbines and associated infrastructure would change the existing character and visual amenity of views experienced by people living, working and visiting the project site and the surrounding area.

The region already contains a number of large infrastructure projects (such as the Tarong Power Station and the Queensland Curtis Liquefied Natural Gas project) and has experienced landscape changes such as new roads and extensive vegetation clearing for agriculture. The visual impacts from the wind farm will be less severe than if it was to be located in an undeveloped landscape.

However, at the local level there are some properties located within 3 km of the wind turbines where visual amenity could potentially be impacted.

I note the proponent has taken the visual impacts of the wind turbines into account when the project layout was developed, and that the project's visual impacts could be further addressed by moving the location of some wind turbines during the detailed design phase. The proponent has also committed to providing screening to some houses if necessary, and I require this to be undertaken.

I consider the visual impacts of the project and proposed mitigation strategies are acceptable. I have stated a condition requiring the wind turbine blades to have a low reflectivity finish which can help minimise their visual impacts.

Noise

The EIS presented an assessment of noise impacts of the project for the construction and operations phases, based on the methodology outlined in the Government's State Development Assessment Provisions wind farm state code (2016). The assessment considered separation distances from wind turbines to residences and noise limits stated in the wind farm state code.

The EIS stated that construction noise impacts can be controlled to acceptable levels and that residences over 200 m from work areas are not likely to be impacted by noise. The nearest residence to construction activities would be located around 1.3 km away.

To ensure that construction noise is properly managed I have stated a condition requiring the proponent to submit a construction management plan that complies with the wind farm state code to the Department of Infrastructure Local Government and Planning (DILGP) prior to construction.

To minimise any potential noise impacts, I have set a condition stating the project must be operated so that it stays within noise thresholds stated in the wind farm state code.

I have set further conditions requiring the proponent to provide a noise monitoring plan to DILGP for review prior to construction. The proponent is then required to report on the results of noise monitoring to DILGP no later than 12 months after the start of operations. After 12 months of operations, the proponent must also submit a noise compliance plan to DILGP, showing how the noise requirements of the wind farm state code have been met.

The potential impacts of wind farm noise on human health was also addressed in the EIS. I note that the current National Health and Medical Research Council advice states "there is no direct evidence that exposure to wind farm noise affects physical or mental health". The advice also provides that "there are unlikely to be any significant effects on physical or mental health at distances greater than 1500 m from wind farms"[1].

I am satisfied that the noise levels and separation distances required by the wind farm state code and the relevant conditions set in this report will minimise noise impacts.

Traffic and transport

The EIS identifies what the main traffic and transport impacts would be during construction due to project workforce traffic, transportation of equipment and oversize items, including the wind turbines. The wind turbines would be transported by road to the construction site.

The EIS stated that the main road impacts would occur on the Bunya Highway, Kingaroy-Jandowae Road and Niagara Road. As the primary access route connecting the project site to the greater road network, Niagara Road could experience an increase in traffic by an average of 728 vehicles annually during the construction phase.

Given the operational workforce would consist of up to 20 workers, I am satisfied that operational traffic impacts would be minimal.

I have made recommendations in Appendix 3 for the proponent to prepare a road impact assessment (RIA) and road use management plan (RUMP) in accordance with the Department of Transport and Main Road's (DTMR) guidelines for each stage of the project. I have also recommended that prior to the construction of significant construction works, the proponent must undertake necessary road and intersection upgrades, and other mitigation strategies as required by the RIA and RUMP.

The RIA and RUMP will need to be approved by DTMR and, for local roads, either South Burnett Regional Council (SBRC) or Western Downs Regional Council (WDRC). In addition, any infrastructure agreements required by DTMR, SBRC or WDRC to account for road impacts are required to be finalised before construction can commence.

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[1] National Health and Medical Research Council, *NHMRC Statement: Evidence on Wind Farms and Human Health*, February 2015, Australian Government, Canberra.

Given these requirements, I am satisfied that there are no significant traffic and transport issues or risks to public safety which cannot be managed and mitigated.

Greenhouse gas emissions (GHG)

The GHG emissions assessment included in the EIS considered emissions that could be generated during the construction of the project and the emissions that could be avoided through the supply of the wind farm's power into the electricity grid.

The EIS confirms GHG emissions produced during construction works will be managed by measures such as the use of solar and sensor lights, preparation and use of a GHG reduction management plan, GHG awareness training, and adhering to key performance indicators to track performance over time. I consider GHG emissions generated during construction will be appropriately managed by the proponent.

As a renewable energy project, the project's operation would not generate significant GHG emissions.

The Coopers Gap Wind Farm supports the Australian renewable energy target (RET) and the Queensland government's commitment to increasing renewable energy generation. The RET seeks to reduce GHGs in the electricity sector by encouraging the generation of electricity through sustainable and renewable sources.

The project could generate up to 460 MW of power and potentially supply power to more than 240,000 households from as early as 2020.

The proponent estimates that around 1 million tonnes per year of GHG emissions could be avoided through supply of the project's power into the electricity grid.

Electromagnetic interference (EMI)

The assessment presented in the EIS demonstrates that the proposed wind farm has been designed and sited in accordance with the wind farm state code to ensure minimal EMI on pre-existing digital, radio or television (TV) reception within 5 km of the wind farm site.

The proponent has committed to work with affected residents to appropriately mitigate any EMI impacts should concerns be raised. Potential actions may include relocating TV antennas or installing satellite TV.

To manage potential EMI issues, I have stated a condition requiring the proponent to restore any reception affected by EMI to a reasonable standard.

Shadow Flicker

Shadow flicker occurs when shadows cast by the moving blades of the wind turbine vary in brightness. This can potentially cause annoyance and stress for residents.

Performance outcomes specified in the wind farm state code require shadow flicker to not exceed 30 hours per year and 30 minutes per day within 50 m of a sensitive receptor (such as a residence).

The EIS investigations undertaken to determine the potential occurrence of shadow flicker indicated that six sensitive receptors could experience shadow flicker impacts higher than the limits set in the wind farm state code.

I note from the EIS that all sensitive receptors which could be potentially affected by shadow flicker are located on land that would host turbines. I further note that AGL will have an agreement with the potentially affected landowners which may state the level of exceedance that is acceptable to the landowner.

The proponent has committed to work with affected landowners to mitigate any shadow flicker impacts. Strategies such as using screening structures or plants to block shadows may be used. The proponent has also committed to implementing shadow flicker control strategies such as temporarily shutting down certain turbines if required.

To ensure the management of potential shadow flicker impacts, I have stated a condition that the project must meet the performance outcomes of the wind farm state code regarding shadow flicker.

Aviation operations

The aviation assessment undertaken in the EIS considered the potential risks associated with aviation operations in the project area. The EIS concluded that as there is the potential for low-level military jet operations to occur within or near to the project area, the project may increase risk for aviation activities.

In a submission on the EIS, the Department of Defence (DoD) noted that aviation obstacle lighting could be placed on some wind turbines to mitigate potential risks to military aviation operations. Accordingly, to minimise any potential impacts to aviation operations, I have stated a condition for lighting to be installed in line with DoD's requirements.

It was noted by the Civil Aviation Safety Authority (CASA) in its EIS submission that the wind farm meets the requirements for reporting of tall structures. Upon completion of the construction of the wind turbines, the exact locations of the turbines will be reported to AirServices Australia for inclusion in the Enroute Supplement Australia (ERSA), which is mandatory reference material for pilots.

The proponent has committed to continue to work with DoD and other key aviation stakeholders including CASA and AirServices Australia to manage any new safety concerns that may arise from the development of the wind farm.

Social and economic impacts

The EIS states the capital cost of the project is estimated to be around $500 million. In addition, during operations the project could contribute around $4 million annually to the local economy.

The project would deliver net social and economic benefits to the region and the State through increased local employment, use of local suppliers and spending in the region.

The proponent has committed to develop the following social impact action plans to manage the impacts of the project:

- workforce management action plan

- housing and accommodation action plan
- social infrastructure, community health and well-being action plan
- stakeholder and community consultation and engagement action plan.

To ensure the delivery of the project's social and economic benefits, I have imposed a condition requiring the proponent to submit to me an annual social impact management report for a period of five years from the start of the construction phase.

The report will require the proponent to demonstrate how they have addressed any stakeholder and community issues such as:

- community health, safety and wellbeing
- local and regional training and employment
- any impact on local and regional housing markets.

If the project does not commence construction within three years from the date of this report, I have set a condition requiring the proponent to update the social impact assessment presented in the EIS. This will ensure that the proposed social impact mitigation strategies are based on the latest available information.

Coordinator-General's conclusion

I consider that the environmental impact assessment requirements of the SDPWO Act for the Coopers Gap Wind Farm have been met and that sufficient information has been provided to enable a thorough evaluation of the potential impacts of the project.

I conclude that the project will present significant local, regional and state benefits and that any adverse environmental impacts can be avoided, minimised, mitigated or offset through the implementation of the actions and the proponent's commitments outlined in the EIS and included in this report. The conditions and recommendations I have specified in this report have been formulated in order to further manage potential impacts associated with the project.

Accordingly, I recommend that the project proceeds subject to the conditions and recommendations set out in the appendices of this report. In addition, I require the proponent's commitments to be fully implemented.

A copy of this report will be provided to the proponent and the relevant state government agencies and will also be made publicly available at www.statedevelopment.qld.gov.au/coopersgap

Barry Broe
Coordinator-General

1 March 2017

1. Introduction

This report has been prepared pursuant to section 34D of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act) and provides an evaluation of the environmental impact statement (EIS) for the Coopers Gap Wind Farm (the project).

This report does not record all the matters that were identified and subsequently addressed during the assessment. Rather, it concentrates on the substantive issues identified during the EIS process and the measures and conditions required to address the impacts.

The report:

- summarises the key issues associated with the potential impacts of the project on the physical, social and economic environments at the local, regional, state and national levels
- presents an evaluation of the project, based on information contained in the draft EIS, final EIS, submissions made on the EIS and information and advice from advisory agencies and other relevant authorities
- states conditions and makes recommendations under which the project may proceed
- documents the proponent's commitments.

2. About the project

2.1 The proponent

The proponent for the project is Coopers Gap Wind Farm Pty Ltd (ABN 95 126 594 714), a subsidiary company of AGL Energy Limited (AGL). AGL is an energy company providing electricity, gas and renewable energy services for residential and commercial use.

AGL currently operates the following wind farms across Australia:

- Hallett Wind Farm (1, 2, 4 and 5) – 350 megawatts (MW) (South Australia)
- Macarthur Wind Farm – 420 MW (Victoria)
- Oaklands Hill Wind Farm – 63 MW (Victoria).

In addition, AGL is currently constructing a wind farm at Silverton in New South Wales, near Broken Hill which is proposed to generate up to 200 MW.

2.2 Project description

The proponent proposes to develop the project with an installed capacity of up to 460 MW and a maximum of 115 wind turbines with ancillary infrastructure, including:

- wind turbine hardstand areas – approximately 20 m x 40 m
- around 85 km of access roads between the turbines – typically 6 m wide
- underground collector cables – underground cable collecting generation from the wind turbines and connecting to the cable marshalling points
- overhead feeders – conductors connecting the cable marshalling points to the main switchboard and the wind farm substation
- wind farm substation – consists of the main transformer, switchgear, protection, metering, associated electrical infrastructure and the operation and maintenance buildings
- Powerlink substation – provides the point of connection to the National Electricity Market (NEM) via Powerlink's 275 kV transmission lines.

The project could supply power to service around 180,000 households (assuming an average household uses 6.3 MW hours). The project is proposed to connect directly into Queensland's energy grid through Powerlink's Western Downs to Halys 275 kilovolt (kV) transmission line. For project components, refer to Section 2.2.2.

2.2.1 Location

The location of the project (Figure 2.1) is approximately 180 km north-west of Brisbane, 50 km south-west of Kingaroy, 70 km east of Chinchilla and 65 km north of Dalby. The closest townships to the project are Bell, which is around 30 km to the south and Kumbia, located around 30 km to the east.

The project is located in the South Burnett Regional Council and the Western Downs Regional Council local government areas (LGAs). The existing land use within and around the project site is predominately rural, characterised largely by cattle grazing within the localities of Cooranga North, Bilboa, Boyneside and Ironpot.

Figure 2.1 Project location

Site selection

The local wind resource at Coopers Gap is well understood by the proponent who has monitored the quality of the wind resource for a number of years.

There is limited locational flexibility for wind farms because they require windy locations, a good connection to the electricity grid and/or supply network, and a need to find a balance between maximising energy capture whilst minimising impacts. AGL considers that the project site meets these criteria.

2.2.2 Project components

Wind turbines

The EIS confirms that the final type of wind turbines will be determined as part of detailed design following approval of the project. Certification that the wind farm can meet its approved operational requirements will be carried out during the detailed design stage.

The project site has been designed to accommodate the following maximum turbine dimensions so that any potential impacts of the project on environmental values will be minimised.

The project site will accommodate turbines in the 2.5 MW to 4 MW range with a maximum height to blade tip of approximately 180 m above the base of the wind turbine tower. The turbines would be of the horizontal axis type, with a rotor consisting

of three blades and a maximum rotor diameter of around 140 m. The blades would be mounted to the wind turbine hub at a height which would allow for a maximum structure height of approximately 180 m.

Figure 2.2 illustrates the typical parts of a wind turbine which generate energy through converting the kinetic energy of wind into electrical energy. Wind passes over the turbine blades, which rotate and move an internal shaft connected to a generator to produce electricity through electromagnetic induction.

The electricity generated through this process passes through a transformer, which increases the voltage of the electricity to allow it to be transported long distances. The electricity generated by the wind turbines is then transported to substations, where it is converted to a lower voltage, allowing for safe usage in homes and buildings.

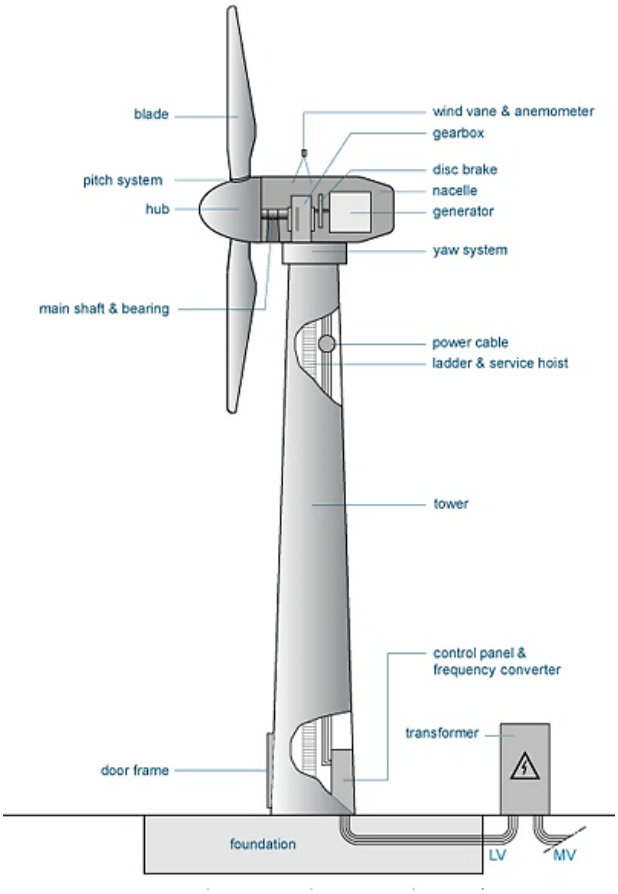


Figure 2.2 Wind turbine

Turbine foundations

Each turbine requires a reinforced concrete slab foundation. The foundations vary in size depending on imposed loadings, ground conditions, construction methodology and the drainage design. Foundations will be laid at sufficient depth so the top of the foundation is flush with the highest surrounding ground level.

On-site access tracks

The around 85 km of access tracks would be 6 m wide. During construction, the tracks may need to be expanded to up to 12 m to accommodate crane and delivery vehicle requirements. These areas will be rehabilitated to a maximum 6 m width.

Permanent meteorological masts

Separate to the wind turbines, meteorological monitoring masts are required to enable the measurement of the wind from all directions, and where possible to meet the criteria of the International Electrotechnical Commission for power performance testing.

Seven lattice masts (Figure 2.3) up to 110 m with concrete footings at mast base and guy wire anchor points are planned.

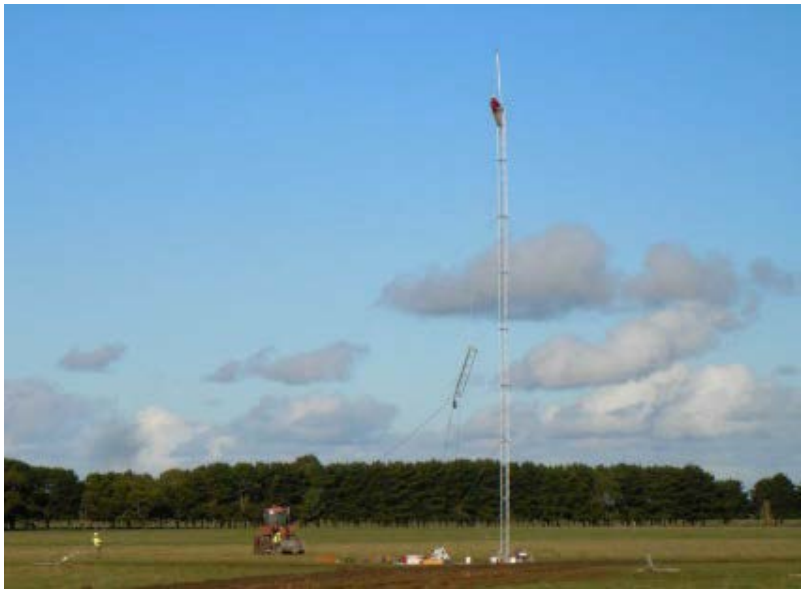


Figure 2.3 Meteorological mast

Electrical connections, substation and grid connection

The wind turbines would be connected to cable marshalling points and the onsite transformer through underground and overhead cabling.

The underground cables would be laid in trenches of around 0.5 m to 1.5 m in width, with a minimum depth of 800 millimetres (mm). From experience with other wind farm operations, AGL considers that this depth will allow current grazing activities to continue post-construction. There are no cropping activities affected by the project due to the steep slopes on which the turbines would be located.

The majority of the cable trenches would be located adjacent to the onsite access tracks, though in some limited cases the underground cabling may be required to be independent of the access tracks. Around 93 km of cable trenches would be required. Once the trenched areas have been backfilled, the disturbed area would be reinstated to promote the establishment of vegetation of the same species and density of cover as that of surrounding undisturbed areas.

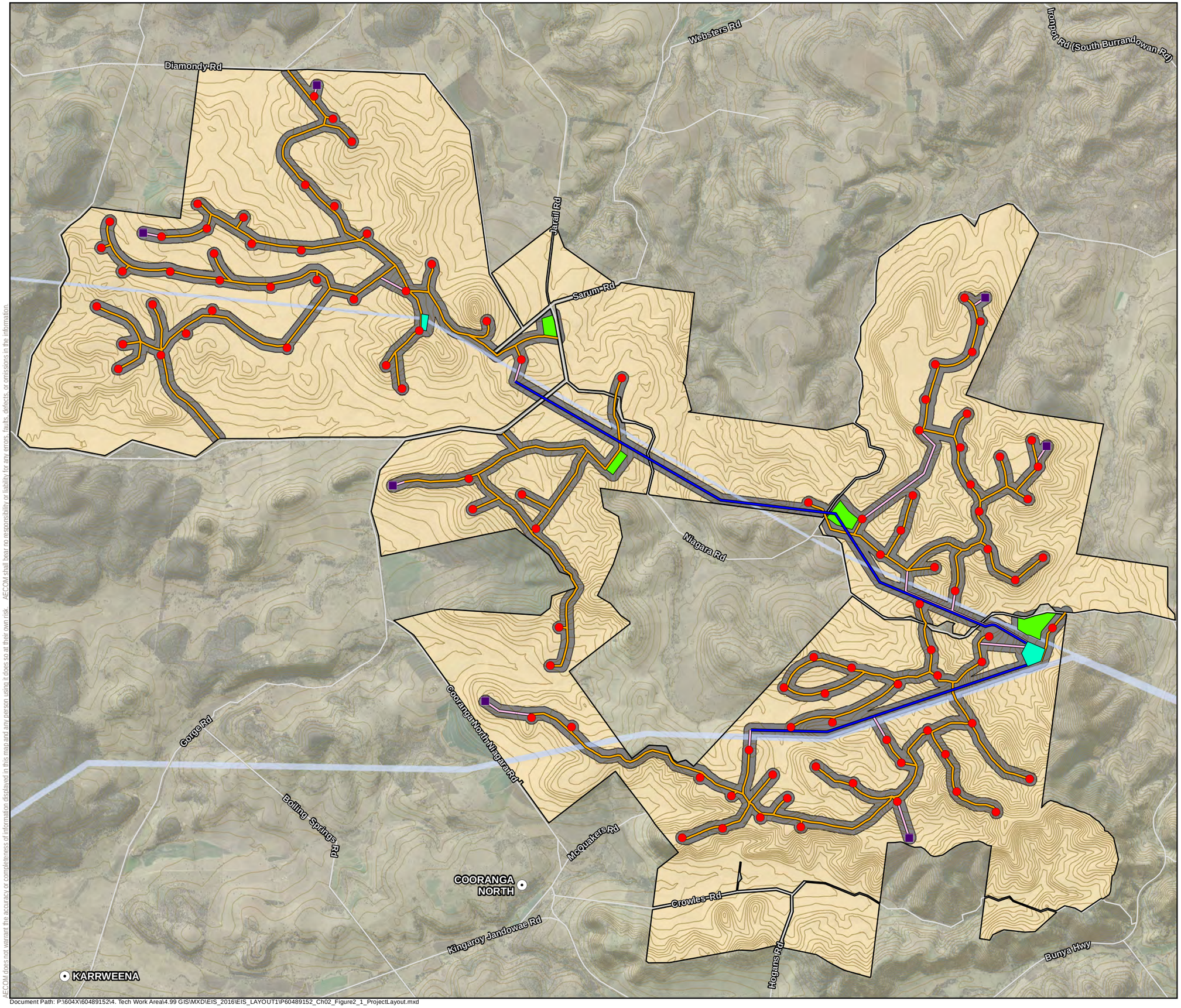
In addition to the underground cabling, there are likely to be overhead conductors (Figure 2.4) connecting the cable marshalling points to the substation. The overhead cables would be of sufficient height to allow site vehicles to pass beneath.

Figure 2.4 33 kV overhead feeder lines

A substation is proposed to connect the project to a Powerlink switchyard, which would be the point of connection to the National Electricity Market (NEM) via Powerlink's Western Downs to Halys 275 kilovolt (kV) transmission line. The EIS notes that a second substation may also be required. This will be confirmed during the detailed design stage.

The substation and Powerlink switchyard are proposed to be located on the eastern edge of the project site. The substation would be located on around 3 ha of land and the switchyard on around 4 ha of land. The exact specifications of the substation and switchyard are dependent on the type of wind turbines selected and so would also be finalised during detailed design.

Figure 2.5 shows the different project components across the site.



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AGL Energy in action. AECOM

DATUM GDA 1994, PROJECTION MGA ZONE 56

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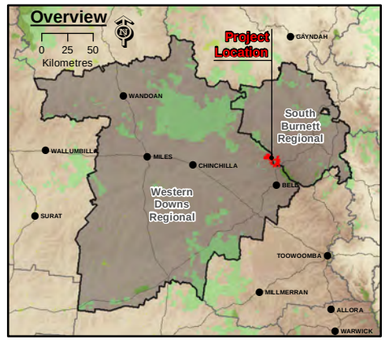
Kilometres

1:55,000 (when printed at A3)

Legend

- Project Site
- Study Area
- Locality
- Turbine
- Met Masts
- Proposed Service Road / Cable
- Proposed Underground Cable
- Proposed High Voltage Overhead Cable
- Contours 10m
- Road
- Existing High Voltage Transmission Line Easement
- Proposed Substation
- Proposed Laydown Areas



Data Sources:
1. Project Site, Turbine Layout © 2016 AECOM Australia Pty Ltd.
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8. Local Government Area (LGA) boundaries © Australia Bureau of Statistic (ABS), 2011.
9. Vegetation Management Watercourse and Drainage feature map (1:100 000 and 1:250 000) - version 1.4 dataset © State of Queensland (Department of Natural Resources and Mines) 2016
10.Background Image. Captured on 27/04/2011, Bing Maps.

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COOPERS GAP WIND FARM
ENVIRONMENTAL IMPACT STATEMENT

PROJECT **COMPONENTS**

PROJECT #:	60489152
CREATED BY:	BM
LAST MODIFIED:	BM: 2/12/2016
VERSION:	2

Figure 2.5

A3 size

2.2.3 Development stages

Pre-construction

Pre-construction project activities include detailed site investigations to inform final turbine locations and obtaining landowner's consent to lodge a material change of use (MCU) application with DILGP.

Construction

Construction is scheduled to commence in mid to late 2017, subject to obtaining relevant approvals. Construction of the project is expected to take around 27 months.

For construction of the project, the following activities will occur:

- site establishment, including temporary site facilities and lay down areas for equipment and materials
- earthworks for access roads and wind turbine hardstands
- excavation and construction of wind turbine foundations (bolt cage, reinforcement and concrete)
- installation of electrical and communications cabling and equipment (including overhead feeders from cable marshalling points to the substation)
- installation of wind turbine transformers and electrical reticulation works
- installation of towers for the wind turbines
- delivery of the wind turbine components to the project site
- erection of wind turbines, using high-level cranes
- construction of the project substation and Powerlink switchyard on the eastern edge of the project site (progressed in parallel with the project construction)
- commissioning of wind turbines, followed by reliability testing
- rehabilitation and restoration of the project site.

The activities listed above would largely occur in the order listed, however some of these activities would be carried out concurrently.

The proponent anticipates that connection to the electricity grid could occur in the first quarter of 2020.

Construction water supply

Construction activities that will require water include:

- worker facilities
- bulk earthworks and materials conditioning
- dust suppression
- concrete batching.

Water demand would vary over time and depend on the stages of the work. Different water quality standards would be required for different elements of construction.

Potable water for human consumption would be required at the site offices, with medium and low quality raw water for earthworks and dust suppression.

The proponent proposes using groundwater obtained under a water permit as the most appropriate option for the construction period. If the volume of groundwater to be extracted under the water permit is not sufficient to meet construction requirements, groundwater access may be negotiated with landholders who hold a water allocation.

Construction water supply options would be further considered during the detailed design of the project and sources confirmed prior to construction.

Site access

The three principal elements to be transported via the road network are the workforce, construction materials and construction equipment. Three indicative transport corridors have been identified (TC01, TC02 and TC03).

TC01 begins at the port of Brisbane and ends at Dalby. Route TC01 then splits into four alternative routes for travel between Dalby and the project site (TC01A, TC01B, TC01C and TC01D). Alternative routes between Dalby and the project site have been identified to provide a number of potential routes for the movement of oversized and heavy loads.

TC02 begins at Kingaroy and ends at the project site. TC03 begins at Jandowae and ends at the project site. These indicative transport corridors use sections of the Gateway Arterial Road, Cunningham Highway/Ipswich Motorway, Warrego Highway, Bunya Highway, Dalby-Jandowae Road and Kingaroy-Jandowae Road.

Concrete batching plants

On site concrete batching plants would be required to supply concrete for the construction of turbine footings and hardstands. It is anticipated that two batch plants would be required to produce around 94,500 tonnes of concrete during the construction period.

The batching plants are proposed to be located in the temporary construction laydown areas and will be bunded to prevent spillage. Where possible the batch plants will be located on cleared, elevated land away from surface water drainage lines.

Temporary construction laydown areas

There will be four potential locations for temporary construction laydown areas. The construction laydown areas are likely to be no larger than 440 m by 340 m and would accommodate portable offices and other facilities, storage containers, wash down facilities and sufficient parking for the workforce, deliveries and visitors.

Operations

During operations, the project will be managed by both on-site and off-site personnel. On-site personnel will be responsible for scheduled and unscheduled maintenance of the wind turbines and associated connection works. Ongoing maintenance of the access tracks and the electrification network will occur and a schedule for routine

maintenance of the turbines will be developed once the final type of wind turbine has been decided.

Decommissioning

At the end of the operational life of key project components (approximately 20 – 25 years), AGL may repower the wind farm by replacing the wind turbines or turbine components, such as the gearbox and generator.

If the project is decommissioned, it will involve the turbines and where agreed with the landowner, all other above-ground infrastructure being dismantled and removed from the project site. In addition, all redundant interconnection and substation infrastructure will be removed. The turbine foundations and other hardstands may be cut back to below ploughing levels, or top soil could be built up over the foundations to achieve a similar result. The land will be returned as close as possible to its prior condition and use (e.g. grazing).

The access roads, if not required for farming purposes or fire access, will be removed and the site reinstated to original conditions and use. Access gates, if not required for farming purposes, will also be removed.

The underground cables occur below ploughing depths and contain no harmful substances. They may be recovered if economically attractive, or left in the ground. Terminal connections will be cut back to below ploughing levels.

All such refurbishment and decommissioning work will be the responsibility of the proponent.

2.2.4 Project rationale

Project benefits

Energy for the South Burnett Regional Council and the Western Downs Regional Council LGAs is predominately supplied by the 1415 MW Tarong and the 450 MW Tarong North coal fired power stations.

The project would represent a significant investment in the construction of new energy infrastructure. The EIS states that the project would result in increasingly resilient energy supplies through infrastructure diversification.

Overarching project-wide benefits include:

- $500 million capital investment
- creation of an estimated 350 full-time construction jobs
- creation of up to 20 full-time operations jobs
- local and indirect state economic benefits
- improved reliability of electricity
- contribution to the Australian Renewable Energy Target (RET)
- contribution to the Queensland government's renewable energy policy
- reduction in carbon emissions

- direct and indirect local, regional and Indigenous employment opportunities beyond traditional agricultural sector roles
- local and regional contracting and supply opportunities for individuals and businesses
- economic development opportunities throughout the region.

Section 5.6 of this report provides an evaluation of the social and economic impacts resulting from the project.

Australia's Renewable Energy Target

Australia has set a target under the Paris Agreement to reduce carbon emissions by 26-28 per cent (on 2005 levels) by 2030. These emissions reductions could be achieved through the Australian government's Renewable Energy Target (RET). The RET seeks to reduce greenhouse gases (GHG) in the electricity sector by encouraging the generation of electricity through sustainable and renewable sources.

On 23 June 2015, the Australian government reformed the RET which encourages large-scale electricity generation of 33,000 GWh (gigawatt hours) by 2020. This target could be achieved if, by 2020, around 23.5 per cent of Australia's energy is generated from renewable sources. The RET scheme operates in two parts – the small-scale renewable energy scheme and the large-scale renewable energy target (LRET).

The LRET creates a financial incentive for the development or expansion of renewable energy power stations, such as wind by generating demand for Large-scale Generation Certificates (LGCs). LGCs are created for each MWh of renewable energy produced and can be sold to entities (mainly electricity retailers) who surrender them to the Clean Energy Regulator to demonstrate their compliance with the RET scheme. The revenue earned by the power station for the sale of LGCs is additional to that received for the sale of the electricity generated.

Australia's response to meeting the Paris Agreement targets could drive new developments and innovation in the climate change policy space. Developments such as the Coopers Gap Wind Farm, which when operational would be the largest wind farm in Queensland and one of the largest in Australia, are examples of industry's response to the Paris Agreement targets.

Queensland's renewable energy strategies

Queensland is currently the largest producer of GHG emissions of any State in Australia, contributing 26.4 per cent of Australia's total GHG emissions.[2] The electricity sector remains the largest emitting industry in Australia, accounting for more than half (55.3 per cent) of all reported scope one GHG emissions.[3]

In 2016 the Queensland Government established an Independent Expert Panel to provide advice on credible pathways to a 50 per cent renewable energy target for Queensland by 2030.

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[2] National Greenhouse and Energy Reporting, *2014-15 published data highlights*, 2016.
[3] Norton Rose Fulbright, *Australia's climate policy – The emerging patchwork,* 2017; National Greenhouse and Energy Reporting, *2014-15 published data highlights*, 2016.

A draft report, prepared by the panel, considered that Queensland has strong potential to grow its renewable energy industry, with falling technology costs, market dynamics and a current project pipeline of around 2500 MW of large scale renewable projects, primarily in regional Queensland. The Coopers Gap Wind Farm is considered in the current project pipeline.[4] The Expert Panel delivered its Final Report in November 2016. The Government is currently considering the recommendations provided in the Final Report.

AGL's current operations sources energy from both renewable and thermal supplies. The production of thermal energy involves generating electricity from the burning of coal and natural gas, which results in the production of GHG emissions.

The Coopers Gap Wind Farm would provide an avenue for reducing Queensland's GHG emissions and would offset GHG produced by AGL's thermal energy operations.

The project could generate up to 460 MW of power and potentially supply power to more than 240,000 households as early as 2020. As a renewable energy project, the project would not generate GHG emissions during operation.

The proponent estimates that around 1 million tonnes per year of GHG emissions could be avoided through supply of the project's power into the electricity grid. GHG emissions are further discussed in Section 5.12.

2.2.5 Assessment history

Community Infrastructure Designation process

In March 2011, AGL submitted an Initial Assessment Report (IAR) to begin the process for community infrastructure designation (CID) under Chapter 5, section 207 of the *Sustainable Planning Act 2009* (SPA). Consultation on the IAR was undertaken in accordance with *Guidelines for environmental assessment and consultation procedures for designating land for community infrastructure* (DSDIP 2014).

Thirty-one submissions were received on the IAR between 24 March 2011 and 21 April 2011. The submissions were used to inform an amended IAR. At this time, AGL decided not to progress further with public consultation of the amended IAR until a decision was made by the Australian government on a revised RET.

In early 2016, AGL decided not to pursue the CID process instead applying for a coordinated project declaration and EIS assessment. The decision was made on 7 June 2016.

Project referral to Commonwealth Department of the Environment

On 24 May 2011, AGL referred the project to the then Commonwealth Department of the Environment (EPBC 2011/5976). On 29 July 2011, the Minister for the Environment determined the project was not a 'controlled action' under the *Environment Protection*

[4] Queensland Renewable Energy Expert Panel, *Draft Report – Credible pathways to a 50% renewable energy target for Queensland,* 2016.

and Biodiversity Conservation Act 1999 (EPBC Act). Therefore, matters of national environmental significance are not evaluated in this report.

3. Environmental impact statement assessment process

In undertaking this evaluation, I have considered information including the following:

- the initial advice statement (IAS)
- the EIS
- issues raised in submissions on the EIS
- clarification material submitted by the proponent and advisory agencies
- technical reports
- revised reports and plans in response to the submissions on the EIS
- advisory agency advice from:
  - Department of Agriculture and Fisheries
  - Department of Environment and Heritage Protection
  - Department of Energy and Water Supply
  - Department of Infrastructure, Local Government and Planning
  - Department of Natural Resources and Mines
  - Department of National Parks, Sport and Racing
  - Department of Transport and Main Roads
  - Department of Tourism, Economy and Small Business
  - Queensland Ambulance Service
  - Queensland Fire and Emergency Services
  - Queensland Health
  - Queensland Treasury
  - Civil Aviation Safety Authority
  - Commonwealth Department of Defence
  - Ergon Energy
  - Powerlink
  - South Burnett Regional Council
  - Western Downs Regional Council.

The steps taken in the project's EIS process are documented on the project's webpage at www.statedevelopment.qld.gov.au/coopersgap.

3.1 Coordinated project declaration

Pre-lodgement discussions were undertaken between AGL, the Coordinator-General, the Department of Energy and Water Supply, the Department of Infrastructure, Local Government and Planning and Department of State Development (DSD), to identify the most suitable assessment methodology for the project.

On 7 June 2016, I declared the Coopers Gap Wind Farm to be a 'coordinated project' under section 26(1)(a) of the SDPWO Act. This declaration initiated the statutory environmental impact evaluation procedure of Part 4 of the Act, which required the proponent to prepare an EIS for the project.

3.2 Terms of reference

The draft terms of reference (TOR) for the EIS were released for public and advisory agency comment from 10 June 2016 to 11 July 2016. Comments were received from 23 submitters, made up of 13 submissions from state and commonwealth agencies, two submissions from local governments and eight from individual submitters. The following key issues were raised:

- compliance with the Wind Farm State Code
- social impacts to reflect the new government direction for social impact assessment
- updates to the TOR to reflect the South Burnett Regional Council Planning Scheme.

The draft TOR was amended having regard to comments received and issued to the proponent as the final TOR on 29 July 2016.

3.3 Review of the EIS

The draft EIS prepared by the proponent was released for public and agency comment from 26 September 2016 to 7 November 2016.

Twenty-six submissions were received including thirteen from advisory agencies, two from government-owned corporations, seven from private submitters, two from local councils and two from commonwealth agencies. The most prominent issues raised in public submissions and from advisory agencies included:

- community consultation
- visual impacts
- potential human health impacts
- transport
- noise
- impacts on flora and fauna
- shadow flicker from wind turbines
- electromagnetic interference
- aviation safety impacts
- hazards and safety.

4. Project approvals

Following the release of this report, the proponent will be required to obtain statutory approvals from state and local government agencies before the project can proceed. Table 4.1 provides a list of approvals required.

Table 4.1 Approvals required for the project to proceed

Project component/ activity	Relevant approvals	Legislation	Authority
Whole of project	Development permit for a material change of use	*Sustainable Planning Act 2009* – State development assessment provisions module 20 – State wind farm code.	DILGP
Whole of project	Operational Works Approval		Western Downs Regional Council, South Burnett Regional Council
Pre-construction	Development permit for reconfiguring a lot	*Sustainable Planning Act 2009*	South Burnett Regional Council
Whole of project	Cultural Heritage Management Plan	*Aboriginal Cultural Heritage Act 2003*	DATSIP
Whole of project	Electricity generator licence	*Electricity Act 1994*	DEWS
Construction	Development permit for a material change of use for ERA 16 for extractive and screening activities	*Sustainable Planning Act 2009*	DILGP
Construction	Development permit for operational works for excavation and/or filling	*Draft South Burnett Planning Scheme*	South Burnett Regional Council
		Kingaroy Shire IPA Planning Scheme	South Burnett Regional Council
		Planning Scheme for Wambo Shire	Western Downs Regional Council

		Draft Western Downs Planning Scheme	Western Downs Regional Council
Construction	Operational works approval (waterway barrier works development approval)	*Sustainable Planning Act 2009*	DILGP
Whole of project	Owner's consent for development applications	*Sustainable Planning Act 2009*	DNRM/DEHP/DTMR
Whole of project	Applications for assessable development within state controlled roads	*Transport Infrastructure Act*	DTMR
Construction	Permit for clearing of protected plants or tampering with a breeding place	*Nature Conservation Act 1992*	DEHP
Construction	Clearing of native vegetation	*Vegetation Management Act 1999*	DNRM
Construction	Water licence/permit	*Water Act 2000*	DNRM or South Burnett Regional Council
Construction	Riverine Protection Permit	*Water Act 2000*	DNRM

These approvals will be subject to separate application and assessment processes. Further information will be required to support the lodgement of applications.

Wind farm state code

The State Development Assessment Provisions (SDAP) is a key element of Queensland's planning system. The State Assessment and Referral Agency (SARA) is the agency responsible for the state's assessment of development applications.

The State Development Assessment Provisions (SDAP), prescribed in the Sustainable Planning Regulation 2009, contains the matters the chief executive of the *Sustainable Planning Act 2009* may have regard to when assessing a development application.

The Queensland Government identified the need for a consistent, coordinated, whole-of-government approach to assessing wind farms across the state. Previously, local governments were the assessment manager for wind farm development. However, few local government planning schemes included planning provisions that address the complex characteristics specific to wind farms.

The SDAP *Module 20: Wind farm development* (wind farm state code) (2016) provides a guide for the assessment of wind farms. The purpose of the wind farm state code is to protect individuals, communities and the environment from adverse impacts as a result of the construction, operations and decommissioning of wind farms. The code provides the performance requirements and acceptable outcomes wind farm developments must meet to obtain approval.

The preparation of the code and guideline was based on expert technical advice, review of recent and emerging research, the detailed review of national and international best practice and consultation with key inter-departmental and external stakeholders. The code was finalised after considering the results of extensive public consultation.

The wind farm code and guideline supports the role of the DILGP through SARA, as the assessment manager for all wind farm proposals in Queensland.

5. Evaluation of environmental impacts

5.1 Matters of state environmental significance

Matters of state environmental significance (MSES) are defined in the *Environmental Offsets Act 2014* (EO Act). The MSES found within the project area that may be impacted are:

- regulated vegetation ('endangered' and 'of concern' regional ecosystems (REs) and essential habitat for threatened flora and fauna), and remnant vegetation within the defined distance of a watercourse identified on the vegetation management watercourses map
- vegetation connectivity areas
- protected wildlife habitat (for protected plants and animals).

Submissions on the EIS

Submissions received on the EIS relating to MSES raised issues relating to:

- protection of the State biodiversity corridor between Diamondy State Forest and Bunya Mountains
- vegetation fragmentation due to clearing of remnant vegetation
- the development of an environmental offset strategy
- potential mortality of bird and bat species from direct strike with wind turbines and monitoring of species mortality
- the potential for lighting on turbines to attract insects (which in turn could attract birds and bats)
- vegetation clearing within a watercourse
- the requirement to better define areas of native vegetation clearing following detailed design.

I have considered each submission and how the information provided by the proponent has responded to submitter issues as a part of my evaluation.

5.1.1 Assessment methodology

The Queensland *Environmental Offsets Act 2014* outlines the framework for State environmental offsets and how they should be provided.

The provision of an offset should only be required following reasonable efforts to minimise, mitigate and avoid impacts.

Significant Residual Impact (SRI) guidelines are used to determine the significance of a residual impact on MSES values from prescribed activities. Should it be calculated that an SRI is generated by a development, consideration of an environmental offset is necessary.

The SRI guideline provided by the DILGP is applied to development assessment under the *Sustainable Planning Act 2009*.

The SRI guideline was used to inform the EIS and assess the potential for impacts on MSES values. Through the analysis, the EIS has determined SRI may occur on the values of regulated vegetation, vegetation connectivity areas and protected wildlife habitat.

Field assessment

The EIS notes that the project site and study area were assessed through desktop and on-site field surveys. Site assessments were undertaken as part of the EIS in 2008, 2010, 2012 and 2013. These assessments included the following:

- comprehensive flora surveys
- fauna habitat assessments
- diurnal bird surveys (in line with AUSWEA Guidelines)
- call playback and spotlighting for nocturnal birds
- call playback for amphibians
- ultrasonic bat detection
- opportunistic sightings of species and evidence of fauna activity.

5.1.2 Impacts and mitigation

The EIS notes that the project site covers an area of approximately 2048 ha but represents a broadly defined area where project infrastructure could be located and is taken as a worst case scenario in terms of potential impact. The construction footprint (potentially requiring vegetation clearing) could be much smaller at around 360 ha, with the majority of clearing being for the approximate 85 km of on-site access tracks.

The EIS notes that the majority of the study area has been extensively cleared in the past for pastoral purposes.

The EIS determined that the project site intersects approximately 1912 ha of non-remnant vegetation and around 50 ha of remnant vegetation. The EIS further notes that up to 30 ha of the potential vegetation to be cleared is regulated vegetation.

The EIS has identified that the proposed project layout may change as part of the detailed design of the project. Decisions on the final location of infrastructure during detailed design and construction may allow for the further protection of species, habitat and features of conservation significance. As such, the estimated vegetation impacts discussed in my assessment are considered upper-bound, worst case estimations which may be improved during detailed design.

Regulated vegetation

Regional ecosystems

The REs that are classed as 'endangered' and 'of concern' (under the *Vegetation Management Act 1999*) which have been field verified as occurring within the project area are provided in Table 5.1.

Table 5.1 Regional ecosystems within the project area and potential area of impact (ha)

RE type	VM Act class	Description	Area of potential impact (ha)
11.9.5	endangered	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	0
11.8.3	of concern	Semi-evergreen vine thicket on Cainozoic igneous rocks	12.42
11.9.4a	of concern	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	2.79
12.8.16	of concern	*Eucalyptus crebra* +/- *E. melliodora*, *E. tereticornis* woodland on Cainozoic igneous rocks	11.33
		Total	26.54

The EIS notes that the project is located in an already fragmented landscape that retains areas of remnant vegetation.

Remnant vegetation within the defined distance of a watercourse

The project is located in the Eastern Darling Downs province of the Brigalow Belt Bioregion. For this bioregion, the following distances are applied to identify remnant vegetation associated with a watercourse[5]:

- watercourse stream order 1 or 2 = remnant vegetation within 25 m
- watercourse stream order 3 or 4 = remnant vegetation within 50 m

[5] State Development Assessment Provisions, Module 8: native vegetation clearing, Table 2 (Department of Infrastructure, Local Government and Planning, 2016

- watercourse stream order 5 or greater = remnant vegetation within 100 m

The EIS identified five areas of remnant vegetation that are within the defined distance of a watercourse (four watercourses with stream order 1 and one watercourse with stream order 3). For these locations, around 3 ha of remnant vegetation is located within the defined distance of a watercourse.

Potential impacts

Regional ecosystems

The 'of concern' and 'endangered' REs to be potentially cleared by the project, along with the estimated area of impact, are detailed in Table 5.1 above. The EIS assessment has determined that no 'endangered' RE within the project area would be impacted.

Remnant vegetation within the defined distance of a watercourse

The EIS identifies that at the upper limits of development, a total of approximately 3 ha of remnant vegetation within a defined distance of a watercourse would be required to be cleared during the construction phase of the project.

Mitigation measures

Measures the proponent has committed to in order to mitigate potential impacts on regulated vegetation include:

- design of the project could encourage retention of remnant vegetation throughout the project area
- minimisation of construction activities within areas of remnant vegetation
- avoidance of all 'of concern' RE for placement of wind turbines and associated infrastructure unless no suitable alternative is possible
- development and implementation of a management and rehabilitation plan for 'of concern' RE
- imposition of strict no-go areas for workforce and equipment within remnant vegetation
- where possible, location of construction sites including site offices, soil stockpiles and equipment storage in already disturbed or cleared areas.

I support these commitments and require them to be undertaken. These commitments are included at Appendix 1 of this report.

Offsets

The project would potentially result in clearing of up to 30 ha of regulated vegetation (around 27 ha of 'of concern' REs and an estimated 3 ha of remnant vegetation within a defined distance of a watercourse) which require an offset.

Coordinator-General's conclusion – regulated vegetation

In accordance with the SRI Guideline[6], the impact on regional ecosystems would be likely to have an SRI due to the following:

- clearing of over 5 ha of 'of concern' RE vegetation in any one area
- overall clearing of over 5 ha of 'of concern' RE vegetation
- potentially clearing that separates an 'of concern' RE community.

The project is likely to have an SRI on remnant vegetation within a defined distance of a watercourse as it is likely to require:

- the permanent clearing of remnant vegetation within the defined distance of streams with orders 1 and 3
- potential clearing of over 0.5 ha of 'of concern' remnant vegetation within the defined distance of a watercourse.

To account for the potential loss of approximately 27 ha of RE and around 3 ha of remnant vegetation within a defined distance of a watercourse, I have made a recommendation to ensure that offsets are accounted for when the proponent submits applications for land clearing under the *Vegetation Management Act 1999* (VM Act) and the *Nature Conservation Act 1992*.

The proponent notes that the project approach to the delivery of offsets, which may involve the identification of land to be used, will not be determined until detailed design has been developed and a determination of the actual on-ground extent of impacts has been completed.

I note that disturbance areas will be finalised during detailed design and could confirm offset requirements to inform a subsequent application for vegetation clearing under the VM Act.

Vegetation connectivity areas

Areas of remnant vegetation containing prescribed REs required for ecosystem functioning which are located outside of urban areas are termed a connectivity area.

The EIS determined that the project has the potential to impact on connectivity areas as it contains areas of remnant vegetation which are outside an urban area and are over 1 ha in size.

Potential impacts

The EIS notes that the study area is within a highly fragmented landscape that retains areas of remnant vegetation and is itself characteristic of this broader fragmented landscape.

The EIS states that to the greatest extent possible, the design process has sought to minimise further fragmentation of remnant vegetation by locating the project in the more highly disturbed areas of the study area.

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[6] Department of Infrastructure, Local Government and Planning, 2016

As part of the EIS an assessment was undertaken using the 2016 DEHP Landscape Fragmentation and Connectivity Tool[7] which determined that there would be no impact to vegetation connectivity by the project.

Mitigation measures

Proponent commitments included in Appendix 5 note that the proponent could minimise impacts on vegetation connectivity by undertaking the following:

- detailed design could work to minimise further vegetation fragmentation in areas of regulated vegetation
- pre-clearance surveys to inform detailed design
- prevention of degradation of vegetation communities and habitats by avoiding further fragmentation of existing small patches (<5 ha).

Coordinator-General's conclusion – vegetation connectivity

The EIS assessment of impacts on vegetation connectivity confirmed that the project will not change the number of core remnant areas on site and the impact on core remnant vegetation could be minimal.

I consider that no offset would be required for this MSES value due to the minimal impacts.

Protected wildlife habitat

The EIS assessment indicates that the project could potentially result in impacts to wildlife habitat for animals listed as 'endangered' or 'vulnerable' or 'special least concern' under the NC Act.

Potential impacts to protected wildlife habitat were assessed as a worst case in the EIS as more definitive clearing amounts would not be finalised until detailed design has been completed.

While all suitable habitat type for each specific species has been included as a part of the assessment, only areas of regulated vegetation are required to be considered for offsets.

The EIS has identified the likelihood of occurrence of threatened fauna species and their status under the NC Act within the study area as below:

- koala (*Phascolarctos cinereus*), vulnerable, confirmed within the study area
- eastern long-eared bat (*Nyctophilus corbeni*), vulnerable, confirmed within the study area
- echidna (*Tachyglossus aculeatus*), special least concern, confirmed within the study area
- collared delma (*Delma torquate*), vulnerable, likely to occur within the study area

[7] The Landscape Fragmentation and Connectivity Tool (DEHP, 2016).

- spotted-tailed quoll (*Dasyurus maculatus maculatus*), vulnerable, likely to occur within the study area
- double-eyed fig parrot (*Cyclopsitta diophthalma coxeni*), endangered, possible within study area
- regent honeyeater (*Anthochaera phrygia*), endangered, possible within study area
- black-breasted button-quail (*Turnix melanogaster*), vulnerable, possible within study area
- squatter pigeon (southern) (*Geophaps scripta scripta*), vulnerable, possible within study area
- painted honeyeater (*Grantiella picta*), vulnerable, possible within study area
- large-eared pied bat (*Chalinolobus dwyeri*), vulnerable, possible within study area
- yakka skink (*Egernia rugose*), vulnerable, possible within study area
- Dunmall's snake (*Furina dunmalli*), vulnerable, possible within study area.

Koala

Existing environment

The EIS notes that koala (*Phascolarctos cinereus*), listed as vulnerable under the NC Act, inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by eucalyptus species[8].

The EIS confirmed that the project area includes suitable forage and shelter habitat for this species and has remnant and regrowth vegetation with two or more known koala food tree species.

The habitat type potentially suitable for koala within the project area is made up of eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and fringing riparian woodlands (RE 11.3.25).

During field surveys undertaken in 2013 as a part of the EIS assessment, koalas were identified within and surrounding the project area.

Potential impacts and mitigation

Within the 2048 ha project area, approximately 354 ha of suitable habitat for the koala that occurs within the project area has the potential to be cleared by the project as a worst case.

The EIS determined that the vegetation within the project area is already highly fragmented and forms small pockets within a predominately rural/agricultural landscape.

A koala habitat assessment undertaken in accordance with the EPBC Act referral guidelines was undertaken as part of the EIS. The koala habitat assessment indicated that:

[8] Refer to EIS Section 12.5.5.2, Table 12.11

- there is no habitat critical to the survival of the koala within the project area
- the project would not adversely impact on habitat critical for the koalas' survival
- the project would not interfere significantly with the recovery of the koala (through the exacerbation of key threats).

The EIS notes that potential impacts could be mitigated through the preparation of a vegetation and fauna management plan to provide clear guidance on areas to be cleared and retained; methods for clearing; role of the spotter catcher during clearing and other relevant environmental protection measures. The proponent commits to, where possible; avoid removing any large hollow-bearing trees or logs that may provide habitat to this species.

As a part of revegetation activities, the proponent has committed to ensuring that disturbed areas are replanted with suitable, locally endemic flora species (including koala food trees) in a configuration which maximises connectivity and habitat for koalas and other fauna species likely to occur in the area.

In addition, the proponent commits to the following:

- locating construction sites, offices, soil stockpiles and equipment storage in already disturbed or cleared areas to minimise disruption to wildlife habitat, where possible
- workforce to avoid driving during dusk and dawn and ensure speed limits are enforced to avoid fauna collisions
- a detailed pest management plan being developed to mitigate and manage the potential spread of pest flora and fauna
- the use of fauna spotter catchers during clearing activities to ensure disruptions to this species are reduced
- all personnel to be made aware of sensitive fauna/habitat areas and requirements for protection of these areas.

I support these commitments, included in this report at Appendix 5, and require them to be undertaken by the proponent.

SRI assessment

The EIS SRI assessment determined that an SRI would be unlikely for the koala. The SRI assessment determined that given the availability of similar habitat in the region, the potential clearing impacts are not anticipated to lead to a long-term decrease in the size of koala populations. The assessment also determined the project would not reduce the extent of occurrence of the species. Habitat for the species would not be isolated and potential impacts would not fragment any existing populations.

The EIS SRI assessment notes that project activities would not result in invasive species becoming established in habitat suitable for the koala and would not introduce disease to any existing populations.

Coordinator-General's conclusion

I am satisfied with the assessment undertaken in the EIS and consider that project activities would not have a significant residual impact on this species.

Eastern long-eared bat

Existing environment

In Queensland, the eastern long-eared bat (*Nyctophilus corbeni*), listed as vulnerable under the NC Act, is recorded primarily in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park. It occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodland[9].

Suitable habitat within the project area for eastern long-eared bat includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1), fringing riparian woodlands (RE 11.3.25), vine thickets (REs 11.8.3 and 11.9.4) and non-eucalypt open forest (RE 11.9.5). The EIS notes that much of the potential habitat within the project area is in a poor condition.

During field surveys undertaken in 2010 as part of the EIS assessment, the eastern long-eared bat was recorded as *Nyctophilus* species. *Nyctophilus* species cannot be distinguished on calls alone. However, as the study area contains suitable habitat for, and is within the range of, the eastern long-eared bat (*Nyctophilus corbeni*), the EIS confirms the *Nyctophilus* spp. was treated as *Nyctophilus corbeni* as a precautionary approach.

Potential impacts and mitigation

Within the 2048 ha project area, around 382 ha of suitable habitat for the eastern long-eared bat occurs within the project area and has the potential to be cleared by the project as a worst case.

Submissions on the EIS raised concern over the potential for mortality of bat species from direct strike with wind turbines. As there is potential habitat in the area for the eastern long-eared bat, this may be a potential impact for the species. The proponent commits to developing and implementing a fauna welfare plan to address issues arising from bird and bat strike. Turbine lighting will also be minimised and red lights used, where required, to prevent attraction of insects which provide food for the bat.

The EIS notes that the project will use fauna spotter catchers during clearing activities to ensure disruptions to this species are reduced.

Additional mitigation measures will include those discussed for the large-eared pied bat.

SRI assessment

The EIS SRI assessment determined that the project is unlikely to reduce the extent of occurrence of this species or fragment an existing population into genetically distinct populations. The assessment notes that the project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of suitable habitat to the extent that could lead to a long-term decrease in the size of a local population.

[9] Refer to EIS Section 12.5.5.2, Table 12.11

The EIS assessment notes that the project is unlikely to introduce or spread disease within the project area which may cause the species to decline. The project is not considered to interfere with the recovery of the species or to cause disruption to ecologically significant locations of the large-eared pied bat.

I support these commitments, included in this report at Appendix 5, and require them to be undertaken by the proponent.

Coordinator-General's conclusion

Based on the information in the EIS and the proposed mitigation measures I consider that it is unlikely the project would have a significant residual impact on the habitat of this species due to there being abundant habitat throughout the region and the poor condition of much of the existing habitat within the project area.

Collared delma

Existing environment

The EIS notes that the collared delma (*Delma torquate*), listed as vulnerable under the NC Act, usually inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats of exposed rocky outcrops. The EIS identified that the study area is within the known range of the species and there is suitable habitat available in the study area, particularly in the east where rocky slopes are common. Searches of the Atlas of Living Australia determined that a sighting of the species was recorded approximately 7 km to the south-east of the study area in 2016;[10] however, field surveys undertaken as a part of the EIS did not record the collared delma within the project area.

The habitat type suitable for this species within the project area is made up of eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and fringing riparian woodlands (RE 11.3.25).

Potential impacts and mitigation

Potential impacts within the 2048 ha project area include the clearing of around 350 ha of suitable habitat type as a worst case scenario. The EIS notes that RE 11.10.1 is considered important habitat for the collared delma.

Potential impacts and mitigation measures proposed for this species would be in line with those detailed for the Dunmall's snake and yakka skink and would include but not be limited to:

- the implementation of a vegetation and fauna management plan which will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing; a detailed pest management plan being developed to mitigate and manage the potential spread of pest flora and fauna

[10] Atlas of Living Australia, found at: http://www.ala.org.au/

- the use of fauna spotter catchers during clearing activities to ensure disruptions to this species are reduced.

SRI assessment

Based on the project area being within the known range of the collared delma, the potential loss of approximately 350 ha of suitable habitat for this species, and that sightings of the species within 10 km of the study area have been confirmed as recently as 2016, I consider that an SRI may be likely.

The EIS also notes that RE 11.10.1, which is found within the project area, is considered important habitat for this species. This evaluation is confirmed in a submission from DEHP on the EIS relating to the EIS's SRI assessment.

Coordinator-General's conclusion

Even though a significant residual impact is likely for this species and the consideration of offsets is required, only approximately 11 ha of suitable habitat potentially impacted is regulated vegetation requiring offsets. I consider that offsets already required for regulated vegetation would compensate for any loss of habitat for this species.

Spotted-tailed quoll

Existing environment

The EIS states that the spotted-tailed quoll (*Dasyurus maculatus maculatus*), listed as vulnerable under the NC Act, is a forest-dependent species which has been recorded in rainforest, wet and dry sclerophyll forest and woodland habitats. The EIS notes that the species preferred habitat includes escarpments, gullies, saddles and riparian habitat as well as rocky areas potentially suitable for den sites[11].

The EIS notes that the project area is located within the range of a reported population (Eastern Darling Downs – Inglewood Sandstone provinces of the Brigalow Belt South Bioregion).

Suitable habitat for the spotted tail quoll within the project area is eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1), fringing riparian woodlands (RE 11.3.25) and vine thickets (REs 11.8.3 and 11.9.4).

Field surveys undertaken as a part of the EIS did not record the spotted tail quoll within the project area.

Potential impacts and mitigation

Within the 2048 ha project area, around 379 ha of suitable habitat for the spotted-tailed quoll occurs within the project area and has the potential to be cleared by the project as a worst case.

The EIS notes that potential impacts could be mitigated through the preparation of a vegetation and fauna management plan which will provide guidance on vegetation to

[11] Refer to EIS Section 12.5.5.2, Table 12.11

be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing. The proponent has committed that where possible, removing any large hollow-bearing trees or logs that may provide habitat to this species could be avoided.

In addition, the proponent commits to the following:

- locating construction sites, offices, soil stockpiles and equipment storage in already disturbed or cleared areas to minimise disruption to wildlife habitat, where possible
- workforce to avoid driving during dusk and dawn and ensure speed limits are enforced to avoid fauna collisions
- a detailed pest management plan being developed to mitigate and manage the potential spread of pest flora and fauna
- the use of fauna spotter catchers during clearing activities to ensure disruptions to this species are reduced
- all personnel to be made aware of sensitive fauna/habitat areas and requirements for protection of these areas
- revegetating disturbed areas as soon as practicable after works have been completed using appropriate native and locally endemic species that have high habitat value.

I support these commitments, included in this report at Appendix 5, and require them to be undertaken by the proponent.

SRI assessment

Based on there being a reported population within the project area it is likely that the project may fragment the population or reduce the extent of occurrence of this species.

With the potential loss of around 379 ha of suitable habitat for this species, I consider that an SRI on habitat for the spotted-tailed quoll may be likely. This evaluation is confirmed in a submission from DEHP relating to the SRI assessment undertaken as a part of the EIS.

Coordinator-General's conclusion

Even though an SRI is likely for this species and the consideration of offsets is required, only approximately 27 ha of suitable habitat potentially impacted is regulated vegetation (RE 11.8.3, 11.9.4a and 12.8.16) requiring offsets. I consider that offsets already required for regulated vegetation could compensate for any potential loss of habitat for this species.

Double-eyed fig-parrot

Existing environment

The double-eyed fig-parrot (*Cyclopsitta diophthalma* coxeni) is listed as endangered under the NC Act. The EIS states that recent records of this species are from subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, sub-littoral

mixed scrub, riparian corridors in woodland, open woodland and otherwise cleared land, and urbanised and agricultural areas with fig trees.

The project area is located outside of or at the western extent of the species range. Vine thicket vegetation (REs 11.8.3 and 11.9.4) was identified as part of the EIS as having potential to support this species and is found within the project area.

Field surveys undertaken as part of the EIS did not identify this species within the project area. According to the Atlas of Living Australia,[12] no sightings have been recorded within or surrounding the study area for over 30 years.

Potential impacts and mitigation

Within the 2048 ha project area, around 28 ha of suitable habitat for the double-eyed fig-parrot may potentially be impacted by the project. However, the EIS notes this is considered secondary habitat, as the double-eyed fig-parrot favours areas with a high fig diversity, where fruiting is staggered along wet and altitudinal gradients.

In addition to the mitigation measures previously proposed for other bird species, in its submission on the EIS, DEHP recommends that, to assist in mitigating impacts, if a fig tree favoured by the species is identified, then every attempt should be made to avoid impacts and maintain connectivity with forests. The proponent has committed to this undertaking, and it is included in this report at Appendix 5. I require this commitment to be adhered to.

SRI assessment

The EIS SRI assessment determined that the project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that could lead to a long-term decrease in the size of any potential local populations. The assessment notes that the project is unlikely to reduce the extent of occurrence of the species or to fragment an existing population.

The assessment determined that the project is unlikely to introduce invasive species or disease which may cause the species to decline.

The SRI assessment notes that the project is not considered to interfere with the recovery of the species and not expected to adversely affect habitat critical to the survival of the species.

Coordinator-General's conclusion

The impact of clearing would not be significant due to the low presence of fig trees in the project area and therefore I consider it unlikely that there would be a significant residual impact on habitat for this species. However, as per the above commitments, I require the proponent to avoid fig trees wherever possible as detailed design is progressed.

[12] Atlas of Living Australia, found at: http://www.ala.org.au/

Regent honeyeater

Existing environment

The EIS notes that the regent honeyeater (*Anthochaera Phrygia*), listed as endangered under the NC Act, are strongly associated with box-ironbark eucalypt associations, and appear to prefer wetter more fertile areas, such as broad river valleys, creek flats and lower slopes within this vegetation community. River she-oak, and the associated mistletoe, also appears to be important, especially in years when flowering is poor in the eucalypt woodlands.[13]

The EIS notes that the project site is located on the western extent of the species' known range. Vegetation within the project site was determined to support ironbark species (*E. crebra*); however, this was identified as not being a key foraging species for the regent honeyeater.

Suitable habitat for the regent honeyeater within the project area includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and fringing riparian woodlands (RE 11.3.25).

Searches of the Atlas of Living Australia determined that a sighting of the species was recorded approximately 11 km to the south-east of the study area in 2012.[14] Desktop assessment and field surveys completed as part of the EIS did not identify any populations of regent honeyeater within the project area.

Potential impacts and mitigation

Within the 2048 ha project area, around 350 ha of habitat suitable for the regent honeyeater occurs within the project area and has the potential to be cleared for the project as a worst case.

In its submission on the EIS, DEHP stated that while the project site may be within the distribution for the species, the distribution is contracting from the northern extent and the key tree and mistletoe species for the regent honeyeater are not likely to be present in the project area.

Public submissions on the EIS raised concern over the potential for mortality of bird species from direct strike with wind turbines. As there is potential habitat in the area for the regent honeyeater, this may be a potential risk for the species.

Mitigation and management measures for this and additional potential impacts could follow those proposed for the painted honeyeater and bat species, which includes:

- preparation of a vegetation and fauna management plan which will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing.
- to revegetate disturbed areas as soon as practicable after works using appropriate native and locally endemic species that have high habitat value.

[13] Refer to EIS Section 12.5.5.2, Table 12.11
[14] Atlas of Living Australia, found at: http://www.ala.org.au/

I support these proposed mitigation and management measures, which have been committed to by the proponent (see Appendix 5), and I require these to be undertaken.

SRI assessment

The EIS SRI assessment determined that the project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that could lead to a long-term decrease in the size of any potential local populations. The assessment noted that the project is unlikely to reduce the extent of occurrence of the species or to fragment an existing population.

The assessment determined that the project is unlikely to introduce invasive species or disease which may cause the species to decline.

The SRI assessment further noted that the project is not considered to interfere with the recovery of the species and not expected to adversely affect habitat critical to the survival of the species.

Coordinator-General's conclusion

Based on the information in the EIS I consider that project activities would not have a significant residual impact on this species. Subsequent advice from DEHP has confirmed this assessment.

Black-breasted button-quail

Existing environment

The EIS states that the black-breasted button-quail (*Turnix melanogaster*), listed as vulnerable under the NC Act, occurs in semi-evergreen vine thicket, low microphyll vine forest, Araucarian microphyll forest, Araucarian notophyll vine forest, Brachychiton spp. scrubs, low thickets or woodlands with a dense understorey but with little ground cover, littoral situations, acacia thickets and areas densely covered in shrubs.[15]

Suitable habit of vine thickets (REs 11.8.3 and 11.9.4) occur within and adjacent to the project site.

During target field surveys and passive observation undertaken as part of the EIS over a five year survey period, the black-breasted button quail has not been recorded within the project area. The EIS notes that no populations are known to occur within the project area.

Potential impacts and mitigation

Potential impacts within the 2048 ha project area include clearing of approximately 28 ha of suitable habitat for this species.

The proponent commits to developing and implementing the following plans and programs to address potential impacts to this species:

[15] Refer to EIS Section 12.5.5.2, Table 12.11

- a vegetation and fauna monitoring plan which will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing
- a detailed pest management plan to mitigate and manage the potential spread of pest flora and fauna.

The proponent also commits to revegetate disturbed areas as soon as practicable after works with appropriate native and locally endemic species that have high habitat value. The EIS notes that all site personnel are to be made aware of sensitive fauna/habitat areas and requirements for protection of these areas.

The proponent commits to locating construction sites, offices, soil stockpiles and equipment storage in already disturbed or cleared areas to minimise disruption to wildlife habitat, where possible. The proponent further commits that fauna spotter catchers during clearing activities will ensure disruptions to the species are reduced.

I support these proposed mitigation and management measures, which have been committed to by the proponent (see Appendix 5), and I require these to be undertaken.

SRI assessment

The EIS SRI assessment determined the project is unlikely to lead to a long-term decrease in the size of any potential local populations and is unlikely to reduce the extent of occurrence of the species. The assessment does not envisage significant impacts to connectivity as a result of the project.

The assessment notes that the project is unlikely to introduce invasive species or disease to the study area which may lead to species decline and is unlikely to interfere with the recovery of the species.

Coordinator-General's conclusion

Based on the EIS assessment I consider that a significant residual impact is unlikely given the species was not recorded within the project area and that there is availability of suitable habitat within the area.

Squatter pigeon (southern)

Existing environment

The EIS notes that the squatter pigeon (*Geophaps scripta scripta*), listed as vulnerable under the NC Act, is mainly associated with dry, grassy woodland and open forest, mainly in sandy sites close to water.[16]

Suitable habitat for the squatter pigeon (southern) within the project area includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1).

The EIS notes that this species has not been observed during field surveys within the study area over a period of five years and notes that no populations are known to occur within the study area.

[16] Refer to EIS Section 12.5.5.2, Table 12.11

Potential impacts and mitigation

Within the 2048 ha project area, there is around 1668 ha of suitable habitat type for the squatter pigeon that, as a worst case, has been assessed as potentially being cleared.

The proponent commits to developing and implementing the following plans and programs to address potential impacts to this species:

- a vegetation and fauna management plan which will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing
- a detailed pest management plan being developed to mitigate and manage the potential spread of pest flora and fauna.

The proponent also commits to revegetate disturbed areas as soon as practicable after works with appropriate native and locally endemic species that have high habitat value. The EIS notes that all site personnel are to be made aware of sensitive fauna / habitat areas and requirements for protection of these areas.

The proponent commits to, subject to approval and in line with the final siting of the wind turbines during detailed design, locating construction sites, offices, soil stockpiles and equipment storage in already disturbed areas to minimise disruption to wildlife habitat, where possible. The proponent further commits that fauna spotter catchers will ensure disruptions to the species are reduced during clearing activities.

I support these commitments, included at Appendix 5 of this report, and I require these to be undertaken.

SRI assessment

The EIS SRI assessment determined that the project is unlikely to lead to a long-term decrease in the size of any potential local populations or reduce the extent of occurrence of the species.

The assessment notes the project is unlikely to fragment an existing population and due to the large extent of suitable habitat within the study area, and that the species is highly mobile, connectivity between populations will be maintained. In addition, the SRI assessment notes, the project is not expected to adversely affect habitat critical to the survival of the species, or disrupt the breeding cycle of a population.

Coordinator-General's conclusion

Based on the information presented in the EIS I consider it is unlikely the project would have a significant residual impact on habitat suitable for the squatter pigeon (southern). The EIS notes the availability of similar habitat within the region and that the species is known to utilise a wide range of different habitats.

Painted honeyeater

Existing environment

The painted honeyeater (*Grantiella picta*) is listed as vulnerable under the NC Act. The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black

box and river red gum, box-ironbark-yellow gum woodlands, acacia dominated woodlands, paperbarks, casuarinas, callitris and trees on farmland or gardens.[17]

The project area is located near the northern extent of the range of the painted honeyeater. The EIS determined the project area contains suitable eucalypt habitat and there is a possible likelihood of occurrence of the species within or near to the project area.

The painted honeyeater was not recorded within the project area during field surveys undertaken as a part of the EIS assessment. Based on searches of the Atlas of Living Australia,[18] between 2002 and 2013 there have been 3 recorded sightings of painted honeyeater approximately 25 km south-west of the study area.

Habitat type where the painted honeyeater could potentially occur within the project area includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and fringing riparian woodlands (RE 11.3.25).

Potential impacts and mitigation

Within the 2048 ha project area, there is around 350 ha of suitable habitat type for this species that, as a worst case, has been assessed as potentially being cleared.

The EIS determined there is suitable habitat (particularly eucalypt woodland and open forest) available within the greater region and therefore considers that vegetation clearing required to be undertaken for the project should not significantly impact the painted honeyeater.

Submissions on the EIS raised concern over the potential for mortality of bird species from direct strike with wind turbines. As there is potential habitat in the area for the painted honeyeater, this may be a potential impact for the species. The proponent has committed (Appendix 5) to developing and implementing the following plans and programs to address potential impacts to this species:

- a vegetation and fauna management plan will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing
- a fauna welfare plan will be implemented to address issues arising from bird and bat strike and will include establishing a relationship with a veterinarian suitably experienced in the management of native wildlife, and a wildlife carers group experienced in the rehabilitation of injured fauna
- a detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species
- an adaptive management monitoring program to be developed to document bird and bat mortalities and assess and revise the effectiveness of controls.

[17] Refer to EIS Section 12.5.5.2, Table 12.11
[18] Atlas of Living Australia, found at: http://www.ala.org.au/

The EIS notes that to reduce potential impacts, fauna corridors to the north and south of the project area would be avoided. Detailed design could further work to minimise impacts on vegetation including suitable habitat for the painted honeyeater.

The proponent has also committed to revegetate disturbed areas as soon as practicable after works with appropriate native and locally endemic species that have high habitat value. I am satisfied these measures are appropriate to manage impacts.

SRI assessment

Assessments included in the EIS confirms the project is unlikely to lead to a decrease in the extent of occurrence of the painted honeyeater, was unlikely to fragment an existing population or lead to a long-term decrease in the size of any populations of the species that may visit the project area.

The EIS assessment further determined the project is unlikely to interfere with the recovery of the species or introduce disease which may cause the species to decline. The assessment notes the project is not expected to adversely affect habitat critical to the survival (i.e. breeding, feeding, nesting, migration or resting areas) of the painted honeyeater.

Coordinator-General's conclusion

The EIS notes the key potential impacts for this species are vegetation clearing of suitable habitat and direct strike with the wind turbines. I am satisfied the EIS has properly considered impacts on the painted honeyeater. Based on the EIS SRI assessment and the proposed mitigation measures included in the proponent's commitments, I consider that the project is unlikely to have a significant residual impact on habitat that may be used by the painted honeyeater.

Large-eared pied bat

Existing environment

Within Queensland, the large-eared pied bat (*Chalinolobus dwyeri*), listed as vulnerable under the NC Act, inhabits areas with extensive cliffs and caves, mainly in the central Queensland sandstone belt associated with the Carnarvon Ranges, Blackdown Tableland and Cania Gorge.[19]

The species was not recorded during field surveys and no populations are known within the project area. Based on searches of the Atlas of Living Australia,[20] the most recent sighting of this species was in 2011 approximately 100 km to the south-east of the study area.

The EIS states that this species is dependent on the presence of diurnal roosts for shelter. These roosts are utilised during the day and also at night when not feeding, as well as for raising of young.

[19] Refer to EIS Section 12.5.5.2, Table 12.11
[20] Atlas of Living Australia, found at: http://www.ala.org.au/

While the study area is within the range of this species, habitat critical to the survival of the large-eared pied bat (i.e. sandstone cliffs used for roosting and fertile wooded valley habitat) was not identified during assessments undertaken as a part of the EIS.

However, around 342 ha of eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) that is listed as suitable for the large-eared pied bat is present in the project area.

Potential impacts and mitigation

The EIS identified that, subject to confirming the location of infrastructure during detailed design phase, there is the potential for approximately 342 ha of suitable habitat for this species to be cleared within the project area as a worst case.

Submissions on the EIS raised concern over the potential for mortality of bat species from direct strike with wind turbines. As there is potential habitat in the area for the large-eared pied bat, this may be a potential impact for the species.

The proponent has committed to developing and implementing a fauna welfare plan to address issues arising from bird and bat strike. Turbine lighting will also be minimised and red lights used, where required, to prevent attraction of insects which would attract the bats.

In addition, the proponent commits to the following:

- a vegetation and fauna management plan will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing to revegetate disturbed areas as soon as practicable after works using appropriate native and locally endemic species that have high habitat value
- a detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species
- an adaptive management monitoring program to be developed to document bird and bat mortalities and assess and revise the effectiveness of controls
- all site personnel to be made aware of sensitive fauna/habitat areas and requirements for protection of these areas.

SRI assessment

The EIS SRI assessment determined that the project is unlikely to reduce the extent of occurrence of this species or fragment an existing population into genetically distinct populations. The assessment notes that the project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of suitable habitat to the extent that could lead to a long-term decrease in the size of a local population.

The EIS assessment notes that the project is unlikely to introduce or spread disease within the project area which may cause the species to decline. The project is not considered to interfere with the recovery of the species or to cause disruption to ecologically significant locations of the large-eared pied bat.

Coordinator-General's conclusion

Based on the information in the EIS identifying large areas of suitable habitat within and surrounding the project area and that no records of this species exist within the study area, I consider that the project is unlikely to have a significant residual impact on the potential habitat for the species.

Yakka skink

Existing environment

The EIS states that the yakka skink (*Egernia rugose*), listed as vulnerable under the NC Act, occurs in dry eucalypt and acacia woodland and open woodlands. Suitable habitat for the yakka skink within the project area includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and non-eucalypt open forest (RE 11.9.5). The EIS notes the availability of over 2400 ha of suitable habitat within the EIS study area.

Field surveys and habitat searches undertaken as part of the EIS did not identify the species within the project area and the EIS notes that no populations are known in the vicinity of the study area.

Potential impacts and mitigation

Within the 2048 ha project area there is around 345 ha of suitable habitat type for the yakka skink that, as a worst case, has been assessed as potentially being cleared.

The EIS notes that potential impacts could be mitigated through the preparation of a vegetation and fauna management plan which will provide guidance on vegetation to be cleared and retained; targeted clearing methods; and will include that a qualified spotter catcher is to be present during clearing.

In addition, the proponent commits to the following:

- locating construction sites, offices, soil stockpiles and equipment storage in already disturbed or cleared areas to minimise disruption to wildlife habitat, where possible
- to avoid fauna collisions, the workforce is to avoid driving during dusk and dawn where possible and ensure speed limits are enforced
- a detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna
- the use of fauna spotter catchers during clearing activities to ensure disruptions to this species are reduced
- all personnel to be made aware of sensitive fauna habitat areas and requirements for protection of these areas.

The EIS states that disturbed areas are to be revegetated as soon as practicable after works have been completed using appropriate native and locally endemic species that have high habitat value.

I commend these commitments, and include them in this report at Appendix 5. I require these actions to be undertaken.

SRI assessment

The EIS SRI assessment determined that any clearing relating to the project is not anticipated to lead to a long-term decrease in the size of any local populations or reduce the extent of the species. The SRI assessment noted that due to the large extent of suitable habitat within the study area, no significant impacts to connectivity are expected and the project is unlikely to fragment an existing population.

The SRI assessment identified that the project is unlikely to introduce or spread any invasive species population beyond current levels and unlikely to introduce any disease which may cause species to decline. The assessment further noted that the project is unlikely to adversely affect habitat critical to the survival of the species or disrupt the breeding cycle of a population.

Coordinator-General's conclusion

Based on the SRI assessment undertaken as part of the EIS and the mitigation measures proposed, I consider that it is unlikely for there to be a significant residual impact to the habitat of the species within the project area.

Dunmall's snake

Existing environment

The EIS notes that the Dunmall's snake (*Furina dunmalli*), listed as vulnerable under the NC Act, has been found in a broad range of habitats, including: forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (*A. burrowii, A. deanei, A. leiocalyx*), native Cypress (*Callitris* spp.) or Bull-oak (*Allocasuarina luehmannii)* various Spotted Gum (*Corymbia citriodora*), Ironbark (*Eucalyptus crebra* and *E. melanophloia*), White Cypress Pine (*Callitris glaucophylla*) and Bull-oak open forest and woodland associations on sandstone derived soils.[21]

Suitable habitat within the project area for Dunmall's snake includes eucalypt woodland or open forest (REs 12.8.16, 11.8.5 and 11.10.1) and non-eucalypt open forest (RE 11.9.5). The EIS notes the availability of over 2400 ha of suitable habitat within the study area.

Based on searches of the Atlas of Living Australia,[22] Dunmall's snake was recorded approximately 30 km to the east of the study area in 1996 and more recently, in 2000, around 80 km south-west of the study area. However, field surveys undertaken as part of the EIS did not confirm the presence of Dunmall's snake within the project area.

Potential impacts and mitigation

Within the 2048 ha project area, there is approximately 345 ha of suitable habitat type for the Dunmall's snake that, as a worst case, has been assessed as potentially being cleared.

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[21] Refer to EIS Section 12.5.5.2, Table 12.11
[22] Atlas of Living Australia, found at: http://www.ala.org.au/

The EIS states that disturbed areas are to be revegetated as soon as practicable after works have been completed using appropriate native and locally endemic species that have high habitat value. This action has been included in the project commitments. The proponent commits to avoiding the removal of any large hollow-bearing trees or logs that may be used as habitat where possible.

In addition, mitigation measures proposed for the yakka skink could assist in reducing impacts for this species. These would include the preparation of a vegetation and fauna management plan which will provide guidance on vegetation to be cleared and retained, targeted clearing methods, and will include that a qualified spotter catcher is to be present during clearing.

All these actions have been included in the project commitments (Appendix 1) which must be undertaken.

SRI assessment

The EIS SRI assessment determined that any clearing relating to the project is not anticipated to lead to a long-term decrease in the size of any local populations or reduce the extent of the species. The SRI assessment notes that due to the large extent of suitable habitat within the study area, no significant impacts to connectivity are expected and the project is unlikely to fragment an existing population.

The SRI assessment identified that the project is unlikely to introduce or spread any invasive species population beyond current levels and unlikely to introduce any disease which may cause species to decline. The assessment notes that the project is unlikely to adversely affect habitat critical to the survival of the species or disrupt the breeding cycle of a population.

Coordinator-General's conclusion

Based on the SRI assessment undertaken as part of the EIS and the mitigation measures proposed, I consider that it is unlikely for there to be a significant residual impact to the habitat of the species within the project area. I am satisfied with the commitments actions the proponent will undertake in order to manage any impacts.

Echidna (special least concern)

Existing environment

Echidna (*Tachyglossus aculeatus*), listed as special least concern under the NC Act, were recorded within the project site during a field survey in 2012 undertaken as a part of the EIS. The EIS notes the high availability of echidna habitat throughout and surrounding the project area. The species is not a habitat specialist and is able to use a wide variety of habitat.

Potential impacts and mitigation

Echidna may be susceptible to vehicle strike during construction of the project. To assist in mitigating this potential impact the proponent commits to avoiding vehicle

movements on roads during dawn and dusk where possible. The proponent also commits to ensuring speed limits are enforced to avoid collisions with fauna.

The proponent also commits to developing and submitting a fauna construction management plan to DEHP in order to obtain an approved species management plan (SMP) for 'least concern' fauna.

The EIS states that disturbed areas are to be revegetated as soon as practicable after works have been completed using appropriate native and locally endemic species that have high habitat value. These commitments, which I support, are included at Appendix 5 of this report.

Coordinator-General's conclusion

Based on the information in the EIS and the mitigation measures proposed I consider that it is unlikely for there to be a significant residual impact on this species as the amount of clearing is insignificant in relation to the amount of suitable habitat available.

5.1.3 Coordinator-General's conclusion matters of state environmental significance

I am satisfied that impacts on regulated vegetation resulting from the project have been identified and assessed. I note that, given up to 30 ha of regulated vegetation may be impacted, a SRI on this value is likely and therefore an offset could be required.

The proponent will finalise areas of disturbance during detailed design which could work to reduce vegetation impacts and so also reduce offset requirements. I have stated a recommendation requiring the proponent to confirm the extent of impacts on regulated vegetation and to submit the information with any application for vegetation clearing under the VMA.

I note that the EIS determined there is unlikely to be an SRI on vegetation connectivity and there is not a requirement to consider offsets for this value. Based on the information provided, I support this finding.

I note that there is likely to be an SRI on protected wildlife habitat for two species, namely, the spotted-tail quoll and collared delma. Around 27 ha and 11 ha of suitable habitat for each of these species respectively are considered to be regulated vegetation requiring an offset. I consider that offsets already required for regulated vegetation could compensate for any loss of habitat for these species.

I am satisfied with the assessment undertaken on MSES within the project area and that any potential adverse impacts could be reduced or avoided employing the mitigation measures included in commitments (Appendix 5). In line with my recommendations, any potential impacts that are unable to be reduced or avoided will be offset in line with the *Queensland Environmental Offset Act 2014*.

5.2 Land use and visual impacts

The existing land use within the study area is predominantly rural, characterised largely by cattle grazing and small areas of cropping activity. Nearby surrounding land uses are also predominantly rural.

In addition to the 12 landowners who would be hosting wind turbines on their property, there are 41 non-participating landowners (mostly rural homesteads) located within 3 km of the nearest wind turbines. The EIS states that within 3 km, turbines with a blade tip height of up to 180 m would be clearly evident, and in some cases would visually dominate the landscape.

The minimum distance of a turbine to a non-affected residence would be 1,500 m, which is the separation distance specified in the wind farm state code as being an adequate distance to reduce visual impacts. The nearest township to the project is Bell, located approximately 15 km to the south, with a population of approximately 270.

The Bunya Mountains provide a distant backdrop to the south-east of the project site, including elevated densely forested ridges and peaks reaching up to 1,136 m AHD at Mt Kiangarow.

The region features a number of large infrastructure projects (such as the Tarong Power Station and the Queensland Curtis Liquefied Natural Gas project), new/upgraded electricity transmission facilities, including the Western Downs substation and associated 275 kV transmission line and Surat Basin to Halys 500 kV transmission line. The region has also experienced landform changes such as new roads and extensive vegetation clearing for agricultural activities. At the local level there is little built infrastructure other than electricity transmission lines. .

Relevant legislation, statutory instruments and guidelines

Wind farm state code

As noted in section 2.1.5 of this report, the wind farm code is the primary piece of legislation that DILGP uses to assess wind farm applications. A key purpose of the wind farm code is to ensure that wind farm development does not unreasonably impact on the character, scenic amenity and landscape values of the locality. It also seeks to ensure that the wind farm and its component infrastructure are designed to minimise impact.

The term ‘scenic amenity’ is defined in the wind farm code as a ‘measure of the relative contribution of each place in the landscape to the collective appreciation of open space as viewed from places that are important to the public’. The term ‘landscape values’ means ‘areas protected under a regional plan and/or local government planning scheme, such as biodiversity networks, natural economic resources areas (including rural production), scenic amenity areas and landscape heritage areas’.

Other planning legislation

In addition to the wind farm code, consideration of other relevant planning legislation is required to assess the impact of wind farms on existing land uses and landscape

character. For this project, the other relevant legislation includes the State Planning Policy (SPP), applicable regional plans and local government planning schemes.

The project extends across two regional planning areas – the Darling Downs Regional Plan and the Wide Bay Burnett Regional Plan areas. The regional plans seek to provide strategic direction to achieve regional outcomes that align with the state's interest in planning and development.

The project also extends across two local government areas – Western Downs and South Burnett Regional Councils. Both local governments are in the process of producing consolidated planning schemes following local government amalgamations in 2008. However, the provisions of the Wambo Shire Planning Scheme and Kingaroy Shire Planning Scheme currently apply to the project area.

State Planning Policy

Agriculture is one of the key state interests within the SPP. The SPP seeks to protect agricultural resources from incompatible activities that would compromise existing or potential productivity. Parts of the project site are mapped as important agricultural areas and Class A and Class B agricultural land (under the agricultural land classification (ACL)) on the SPP interactive mapping system.

Darling Downs Regional Plan (October 2013)

The Darling Downs Regional Plan[23] (DDRP) was prepared with a strong focus on resolving land use competition between the agricultural and resource sectors, and driving economic development.

It notes that the region encompasses a variety of landscapes, including urban and rural holdings, agricultural production, resource and mine sites, and protected areas. It also contains features of both national and state environmental significance. However, despite the region's biological values, loss of vegetation has been experienced across the region as a result of historical clearing for residential development and major industries including the agriculture and resources sectors.

The DDRP identifies part of the study area as a Priority Agricultural Area (PAA), which are strategic areas of the most regionally significant agricultural production. Within these areas, agriculture is to be the priority land use. Other land uses are not prohibited within the PAA, however any other land uses, particularly resource activities, must co-exist with the priority land use. It is noted that the proposed wind farm is not classified as a resource activity under the *Regional Planning Interests Act 2014* (RPI Act) and therefore a regional interests development approval, which would consider impacts on the PAA, is not required under the RPI Act.

Wide Bay Burnett Regional Plan (September 2011)

The Wide Bay Burnett Regional Plan also has a strong focus on protecting agricultural land to prevent loss, alienation, fragmentation, urban development or other high impact

[23] Department of State Development, Infrastructure and Planning, October 2013, The State of Queensland, *Darling Downs Regional Plan*

development. Landscape protection is a key objective of the Wide Bay Burnett Regional Plan[24] (WBBRP). It has a regional landscape objective that notes:

> "it is important to recognise that landscape values are not limited only to natural environmental features. Rural towns and rural activities, such as cropping and grazing, contribute to the character of the region, and illustrate their importance, not only to the economy, but also to the regional landscape." (Wide Bay Burnett Regional Plan, 2011 p.65)

Wambo Shire Planning Scheme (April 2005)

The portion of the study area that falls within the Wambo Shire boundary is zoned as rural. Wind farms are not a use contemplated by the planning scheme. Requirements for non-rural uses within the rural zone include protecting landscape values and scenic qualities of the zone, and not prejudicing the productive capacity of existing or future rural land.

The Bunya Mountains are identified in the planning scheme as being a protected area of high scenic amenity value, which should be protected and enhanced through compatible development.

Amended Draft Western Downs Planning Scheme (August 2016)

When adopted, the draft Western Downs Planning Scheme would replace the Wambo Shire Planning Scheme. Proposed zoning and requirements for non-rural uses (as applicable to the study area) are the same as under the current Wambo Shire scheme.

The draft scheme contains a new scenic amenity overlay code which applies to the study area and aims to ensure that development does not adversely affect scenic amenity and landscape values within the Western Downs region. This would be achieved through the following overall outcomes:

(a) development protecting and enhancing the significant landscape elements and features which contribute to the unique character and identity of the Western Downs region including:
    (i) high landscape value areas
    (ii) scenic routes
    (iii) urban gateways.

Kingaroy Planning Scheme (2006)

The portion of the study area that falls within the Kingaroy Planning scheme boundary is designated as rural. Wind farms are not a use contemplated by the planning scheme. The overall outcomes for the rural area focus on protecting land for rural purposes, except where a use could be reasonably expected to locate in a rural area, and uses are compatible with the amenity and character of adjacent areas.

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[24] *Wide Bay Burnett Regional Plan*, September 2011, State of Queensland, Department of Local Government and Planning

No specific scenic amenity values were identified in the Kingaroy Planning Scheme. The planning scheme generally requires that development protects the scenic values of the diverse rural and natural landscapes in the shire, particularly those seen from major transport corridors and vantage points.

Kingaroy Shire IPA Planning Scheme Amendment No. 1 (not dated)

The key change to the scheme relevant to the project was the inclusion in the rural zone of a provision that buildings or structures are not higher than 12 m "other than for a telecommunication facility or a major utility (electricity works)". The proposed wind farm would be considered a major utility under the scheme.

Draft South Burnett Planning Scheme 2016

Under the new draft planning scheme (which was out for public consultation for 13 weeks until 31 October 2016), the project site falls within an area of land zoned rural. This area also contains an infrastructure corridor which provides for the existing high voltage electricity transmission lines. The Bunya Mountains are classified as nature conservation/open space within the environmental management and conservation zone.

The new draft scheme also includes a statement on the strategic objectives for rural areas which contemplates the use of rural areas for non-rural activities stating that:

> "Rural areas can provide suitable locations for non-rural activities – including major industries, clean energy projects or resource extraction enterprises – where they hold significant benefits to a local or wider community … The proviso is that due deference is given to overriding considerations relating to the viability of rural activities and the character of rural landscapes" (draft South Burnett Regional Council planning scheme 2016, p11).

Additionally, the rural zone code intends to:

> "provide opportunities for non-rural uses that are compatible with agriculture, the environmental features, and the landscape character of the rural area where they do not compromise the long-term use of the land for rural purposes" (draft South Burnett Regional Council planning scheme 2016, p159).

The priority infrastructure plan proposed for the new draft scheme considers wind farms as a 'low impact rural' use (refer Table 4.2.1 within the infrastructure plan).

Guidelines

The key guidelines that informed the Landscape Visual Impact Assessment (LVIA), were the *Draft National Wind Farm Development Guidelines*[25], and the *Wind farm planning guideline*[26]. The *Draft National Wind Farm Development Guidelines* are referenced in the wind farm planning guideline and outline best practice assessment methods.

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[25] *National Wind Farm Development Guidelines - Draft*, Environment Protection and Heritage Council, July 2010, Commonwealth of Australia, Adelaide

[26] *Wind farm state code planning guideline,* Department of Infrastructure, Local Government and Planning, July 2016, State of Queensland, Brisbane.

Submissions

The key issues regarding land use and landscape character/visual impacts raised in submissions on the EIS and AEIS included the following:

- the ongoing and sustainable use of land for agricultural purposes, including a desire for no net loss in the availability of Class A and Class B land
- potential impacts from wind turbine operation on the welfare and production of large mammals (i.e. cattle, pigs, horses)
- impacts on potential future sensitive land uses (i.e. residential dwellings)
- effects of the project on scenic/visual amenity for nearby landowners.

5.2.1 Landscape character and visual impacts

As noted in the wind farm planning guideline, the height and potential scale of wind farms creates an unavoidable level of visibility, and may impact on local perceptions of scenic amenity or landscape value.

In comparison with other, well-established, forms of development in the rural areas (e.g. associated with farming and grazing industries), wind turbines are relatively unfamiliar, prominently vertical and have the unique characteristic of movement. Individually or in groups, they form distinctive features in the landscape.

Assessment methodology

The landscape and visual impact assessment (LVIA) presented in the EIS considered a development scenario comprising 102 wind turbines with a blade tip height of 180 m and a hub height of 117 m.

For the LVIA a 17 km radius was established, based on the boundaries of the project site.

The LVIA in the EIS took a two-pronged approach to identify the potential impacts of the project on scenic amenity and landscape values. It assessed the impacts of the wind turbines on the landscape character of the area and also visually identified the impacts of the turbines on sensitive receptors, including homesteads/residences – whichever is being used.

The potential physical changes to the landscape, as well as perceptual changes to the landscape character, were identified for all phases of the project. A field survey was undertaken to ground truth the findings of the preliminary assessment and to undertake an on-site assessment of landscape character and visual amenity.

Based on an understanding of the project in relation to the key views and viewers likely to be affected, 12 viewpoints were selected for detailed assessment in the EIS and are identified in Table 5.2 below. Potential impacts on residential properties were largely addressed through the selection of public viewpoints close to affected residential properties. These views are not exhaustive but are intended to be representative of the range of views likely to be experienced and the range of receptor groups likely to be affected by views of the project.

Table 5.2 Selected viewpoints for detailed assessment

View-point	Description	Distance to nearest turbine	Key visual receptors
VP1	Niagara and Jarail Road Junction	744 m to the west of this viewpoint	Residents, visitors and workers travelling along Niagara Road and Jarail Road
VP2	Niagara Road	4.2 km east of this viewpoint	Residents, visitors and workers travelling along Niagara Road
VP3	Niagara Road East	1.9 km north west of this viewpoint	Residents, visitors and workers travelling along the eastern section of Niagara Road, between Cooranga North and the Bunya Highway
VP4	Kingaroy-Jandowae Road	Approximately 4 km north of this viewpoint	Residents, visitors and workers travelling along Kingaroy-Jandowae Road
VP5	Bunya Highway North	11.0 km west of this viewpoint	Residents, visitors, workers and tourists travelling along the Bunya Highway
VP6	Ironpot Road	7.4 km south west of this viewpoint	Residents, visitors and workers travelling along Ironpot Road; also representative of views from a nearby residence
VP7	Mt Kiangarow summit, Bunya Mountains National Park	10 km north west of this viewpoint	Tourists and recreational visitors to Bunya Mountains
VP8	Bunya Highway South	2.9 km north of this viewpoint	Residents, workers, visitors and tourists travelling along the Bunya Highway; also representative of views from a nearby residence.
VP9	Boiling Springs Lookout	4.4 km east of this viewpoint	Residents, workers, visitors and tourists travelling along Dingo Fence Tourist Drive
VP10	Diamondy Road	875 m south of this viewpoint	Residents, workers and visitors travelling along Diamondy Road
VP11	Cooranga North	2.3 km north east of this viewpoint	Residents, visitors and workers travelling along Cooranga North-Niagara Road; also representative of views from the southern edge of Cooranga North township (near Cooranga North historic school site)
VP12	Ironpot Creek, Niagara Road	1.7 km north east and 2 km west of this viewpoint	Residents, visitors and workers travelling along Niagara Road; also representative of views from a nearby residence

A series of photomontages were developed to demonstrate the anticipated visual impacts of the development from the key sensitive receptor viewpoints. The photomontages seek to represent an illustrative worst case scenario.

Examples of the likely construction visual impacts were provided using images from previous AGL projects in Australia such as the Cape Bridgewater Wind Farm, Clements Gap Wind Farm, Hallett Hill Wind Farm, and Snowtown Wind Farm.

Landscape character assessment is a tool for identifying what makes one place different from another. This approach has been used to establish the existing character of the landscape and to provide a framework for measuring the impact of the project on landscape character.

There is no standard methodology for the quantification of the magnitude of effects; however, it is generally based on the scale or degree of change to the landscape resource, the nature of the effect and its duration.

Impacts and mitigation

Construction visual impacts

The construction phase of the project is estimated to last approximately 27 months. The EIS concluded that during the construction phase the project would generate significant, albeit temporary, effects on the landscape character, views and visual amenity. This is as a result of the presence of construction crews (including transportation of the crew between the project site and nearby towns) and large scale machinery installing the wind farm infrastructure in a remote and elevated rural landscape.

The visual perception of the increase in traffic on rural roads was also identified as a potential issue.

The EIS notes that given the sparse settlement pattern and remote location of the project site, construction visual impacts would be experienced by a small number of people. These would include people living on rural properties, working locally (e.g. farmers) and visitors to the local area, including those travelling along the Bunya Highway.

Operational visual impacts

The EIS predicts that the residual loss of landscape features (such as mature vegetation) as a result of installing the wind farm components and associated infrastructure is likely to be relatively small, and notes that the turbines and associated infrastructure will be situated to avoid vegetation wherever possible. Modifications to the landform and drainage required as a result of installing the wind farm components within the project site (e.g. levelling of land and an increase in impermeable surfaces in the landscape) is also predicted to be minimal.

The EIS states that within 3 km, turbines with a blade tip height of up to 180 m would be clearly evident, and in some cases would visually dominate the landscape. Beyond

3 km, visual impacts would be reduced, due to the reduction in visibility. The EIS notes that wind turbines are potentially visible within 17 km depending on weather conditions.

The EIS assessment identified that the turbines are unlikely to be seen from VP7, Mt Kiangarow summit (the highest point) in the Bunya Mountains National Park (BMNP) due to intervening landform and vegetation. Established walking tracks and other lookouts typically do not overlook the project site.

Elsewhere, the inherent character of the wider BMNP will experience little perceptual change due to the distance (greater than 3 km to the nearest turbine) and limited visibility to the wind farm from walking tracks and lookouts. This contrasts with other infrastructure that can be viewed from the Bunya Mountains, including the Tarong Power Station around 20 km to the east. Furthermore, there will not be a direct impact on the scenic or landscape features of the BMNP.

The assessment in the EIS concluded that the introduction of new wind turbines and associated infrastructure (including access roads, substation and 33 kV overhead feeder lines) would change the existing character and visual amenity of views experienced by people living, working and visiting the wind farm site and the surrounding area.

Photomontages

The EIS presented illustrations of the proposed visual impacts on the selected viewpoints in Table 5.2 by incorporating ‘before and after’ photos. Figure 5.1 – Figure 5.4 show the extent of the visual impacts of the wind farm from these selected viewpoints.

Figure 5.1 Existing view from Viewpoint 3: North westerly view from Niagara Road East

Figure 5.2 Photomontage view from Viewpoint 3: North westerly view from Niagara Road East

Figure 5.3 Existing view from Viewpoint 11: Elevated northerly views from Cooranga North-Niagra Road

Figure 5.4 Photomontage view from Viewpoint 11: Elevated northerly views from Cooranga North-Niagra Road

Predicted extent of wind farm visibility

The EIS states in the flatter landscapes to the east of the site, local screening features such as trees are predicted to be effective in reducing views of the turbines, so the actual visibility could be less than anticipated.

At greater distances from the project site, the turbines would be expected to form a smaller part of the overall landscape view and appear as less dominant elements than those experienced closer to the project site, where fewer but more dominant turbines are visible. Additionally within the forested landscapes of the Bunya Mountains to the southwest, dense vegetation is likely to substantially reduce the visual impact of the turbines.

However, the project is likely to be visible for a wide area around the project study area.

Cumulative impact assessment

In the EIS, nine projects (some new projects, some extensions to existing projects) across the region were considered for the cumulative visual impact assessment.

These projects ranged from the proposed South Burnett Coal project to the Surat Gas project approximately 30 km west of the wind farm (see EIS table 5.36 for complete list). The EIS concluded that none of the new proposed developments or proposed project extensions would be likely to be seen at the same time as the project. This is primarily due to the large distance between the developments, combined with the presence of vegetation and ridges in the landscape providing enclosure to views.

Impacts during decommissioning

It is anticipated that the impacts that would result from decommissioning of the project site would be similar to those during the construction phase, as it is essentially a reversal of the construction process, although potentially quicker.

Accordingly, there are likely to be significant, albeit temporary, changes and effects on the landscape character, views and visual amenity as a result of the presence of construction crews and large scale machinery removing the project components and rehabilitating the affected sites (e.g. grading landform, spreading topsoil and seeds).

Mitigation measures

The EIS confirms that detailed design of the project would prioritise eliminating or minimising adverse landscape and visual impacts through careful design and siting of infrastructure.

The wind turbines could be visible from 17 km away (depending on weather conditions). The EIS states that it would not be practical to plant trees to reduce all views of the wind turbines. However, the proponent has made a commitment to new planting to assist in visual screening of the turbines where necessary and possible (refer to Appendix 5 for proponent commitments).

The proponent has also committed to other measures, tailored to the specific location, to further manage visual impacts, including:

- facilities to be designed / located to minimise tree and other vegetation removal where practicable
- after dark construction lighting will be controlled to minimise effects on sensitive visual receptors
- a construction management plan (CMP) will be developed to assist in managing landscape and visual effects
- a site waste management plan will be prepared to ensure waste is minimised and to reduce impacts on landscape character, views and visual amenity
- a post-decommissioning rehabilitation plan would be prepared for the implementation, establishment and maintenance of the proposed landscape / rehabilitation works in order to reinstate the project site to its pre-existing (or enhanced) condition.

I have also stated a condition in Appendix 2 that requires the wind turbine blades to have a low reflectivity finish/treatment that will reduce glare from the reflection of the sun.

5.2.2 Coordinator-General's conclusion – Landscape character and visual impacts

I consider the EIS provided a detailed and comprehensive landscape character and visual impact assessment of the project for all project phases. In particular, the visual examples provided in the EIS help to indicate the likely visual impacts of the project.

I note that although the project site comprises scenic and rural character, the local area has a history of extensive vegetation clearing for farming practices and already contains 275 kV transmission line infrastructure. In addition, it is a sparsely-populated location which limits the number of affected visual receptors.

I agree with the conclusion in the EIS that due to the size of the proposed structures it is not possible to 'screen' or 'hide' all the turbines or associated infrastructure within the landscape. However, I expect the proponent to fulfil their commitment to work with any affected sensitive receptors, and where reasonable and practicable, provide tree planting as screening at properties to minimise visual impacts when turbines can be viewed from houses.

In addition to my stated condition that the wind turbine blades are to have a low reflectivity finish/treatment, I have also stated a condition requiring the proponent to report to government when the project is proposed to be decommissioned. The report would include measures for decommissioning including such as reinstating temporary access roads. I am satisfied that the proposed mitigation measures, proponent commitments and conditions I have stated will reduce the perceived visual impacts of the turbines.

5.2.3 Land use impacts

Impacts on agricultural land uses

The EIS notes that the project site (2,048 ha) represents approximately 20 percent of land available for agriculture within the study area (10,200 ha).

The construction footprint of the project will be approximately 360 ha and the operational footprint will occupy approximately 100 ha, which is approximately one percent of the land available within the study area.

The EIS found that the impact on existing cropping areas would be minor, being limited to the footprint of the turbines and access tracks. After construction, land not occupied by infrastructure could continue to be used for cropping or grazing. The EIS found that grazing and animal husbandry operations within the study area will be able to continue as the project infrastructure will not affect the ability for cattle or other animals to graze and move about on host properties.

In terms of future potential cropping in the study area, it is noted that the proposed wind turbines are primarily located along ridgelines to maximise exposure to the wind resource. Intensive cropping activities are unlikely to be viable along ridgelines due to steep topography and soil conditions.

It was acknowledged by DAF in the department's submission on the EIS that the ALC mapping is broad and should the project site be reviewed in detail, the ALC's current class A and B classification may not be correct along these ridgelines.

DAF has suggested that if the land attributes need to be remapped, the proponent may provide updated mapping data to the Department of Science, Information Technology and Innovation (DSITI) to action. AGL has confirmed this is proposed to be undertaken following the EIS assessment process.

The proponent has included commitments to minimise impacts to agriculture caused by the construction and operation of the wind farm. The commitments include consultation with landowners to determine methods to prevent disruption to agricultural practices and development of a CEMP outlining how disruption will be minimised, and where it cannot be avoided, measures to minimise impacts. I expect the proponent to implement this commitment so that agricultural land impacts are avoided where possible or minimised.

I consider that the project would not result in significant loss, severance or alienation of potentially productive land. I am of the view that the estimated loss of one percent of land available for agricultural purposes would be a relatively minor loss of land.

I agree with the EIS's finding that agricultural activities could continue in the study area, as wind farms do not preclude on-going agricultural activities such as cropping or animal husbandry. The project infrastructure could co-exist with these activities and not compromise long-term use of the land for rural purposes, therefore the priority use of land will remain agricultural.

The proponent intends to submit a development application to South Burnett Regional Council seeking a development permit to reconfigure a lot to accommodate the

substation. The proponent anticipates the reconfiguration will be to create a new 4 ha freehold lot parcel from an existing 513 ha freehold lot. The Council will need to undertake an assessment of the compatibility of the lot reconfiguration with the applicable codes and other relevant planning instruments in accordance with Section 313 of SPA. Key considerations will be the impact on rural land use, infrastructure and servicing requirements.

The land subject to the reconfiguration is located at the junction of existing high voltage transmission lines and proposed project infrastructure including a service road, and underground and overhead cables. I am of the view that while the substation would represent a change in the priority land use, the reconfiguration of 4 ha is relatively minor and is acceptable in the proposed location given the characteristics of the land, and ability for continued agricultural use on the remailing 509 ha of the lot.

There is some anecdotal evidence that the sound and vibrations caused by wind turbines can negatively impact large mammals and in turn affect grazing and animal husbandry operations. However, there is a lack of formal research or evidence into this matter.

As discussed in the EIS, there are many examples of livestock continuing to graze close to turbines for extended periods, seemingly unaffected by the turbine operations, and as such there has been no pressing need to conduct formal research in this area. I agree with the EIS finding that there is unlikely to be a negative impact on the long-term viability of grazing and animal husbandry operations in the study area. Therefore, I do not propose a condition related to this matter.

Impacts on future sensitive land uses

The concern was raised in submissions that the turbines could preclude the future development of new residential dwellings on adjoining non-host lots, as the turbines would be too close to potential locations of new dwellings.

The wind farm state code sets criteria for the consideration of impacts to sensitive land uses, however these relate to either existing or approved dwellings.

I consider that it is unreasonable to require the project layout to anticipate future potential dwellings and it is more appropriate to assess impacts on future sensitive land uses as part of any future land development application. Therefore I have not proposed a condition related to this matter.

5.2.4 Coordinator-General's conclusion – Agricultural and sensitive land uses

I am satisfied the EIS identified the potential impacts of construction and operation of the project on land uses in the study area, and that the proponent has taken steps to locate and design project infrastructure to minimise land use impacts.

I consider the proponent's commitments would further reduce impacts on rural productivity through consultation with landowners and development of a CMP and I

require the proponent to fulfil these commitments. Furthermore, I have stated a condition requiring the proponent to submit the CMP to DILGP prior to construction.

With respect to planning legislation considerations, I consider that the project is compatible with agricultural land uses and would not compromise existing or potential productivity. Agriculture would remain the priority land use. Therefore, I am of the view the project primarily advances the desired outcomes sought by the planning legislation.

5.3 Noise

5.3.1 Introduction

Noise may have physical impacts such as diminution of hearing, and emotional impacts such as annoyance. The human ear has different sensitivities to continuous, ongoing noise compared to short, sharp bursts of noise. Some people are highly sensitive to noise while others are less so.

As the wind farm will be sited in an area with low ambient acoustic levels, the project will generate noise different to that currently experienced in the predominantly rural area of the project.

Human health and wind farm noise

As noted by the Senate Select Committee on Wind Turbine in its final report issued in August 2015[27], there has been considerable conjecture and controversy worldwide about the health impacts of wind turbines.

National Health and Medical Research Council advice

In Australia, the main source of official advice on the health impact of wind turbines is the National Health and Medical Research Council (NHMRC).

The 2015 NHMRC Statement: Evidence on Wind Farms and Human Health states:

> There is no direct evidence that exposure to wind farm noise affects physical or mental health. While exposure to environmental noise is associated with health effects, these effects occur at much higher levels of noise than are likely to be perceived by people living in close proximity to wind farms in Australia. The parallel evidence assessed suggests that there are unlikely to be any significant effects on physical or mental health at distances greater than 1500 m from wind farms.[28]

The NHMRC has recognised that the body of direct evidence on wind farms and human health is 'small and of poor quality'. In February 2015 the NHMRC announced a targeted call for research to encourage independent, high quality research investigating possible health effects and their causes, particularly within 1500 m from a wind farm. There are, as yet, no published results from this research.

[27] http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Wind_Turbines/Wind_Turbines/Final_Report
[28] https://www.nhmrc.gov.au/guidelines-publications/eh57

5.3.2 Regulation of wind farm noise

Wind farm state code

The wind farm state code is the primary regulatory instrument in Queensland for managing the noise impacts of wind farms. It seeks to manage and minimise risks to human health, wellbeing and quality of life by ensuring acceptable levels of amenity (through separation distances) and acoustic emissions (via prescribed noise levels) at sensitive land uses.

The code prescribes different sound level requirements for sensitive land uses such as houses, schools etc. to landowners that will host infrastructure on their land.

AGL will need to obtain owner's consent from landholders in order for the development application to be properly made and lodged with the DILGP for assessment.

Separation distances

The wind farm state code prescribes a separation distance of 1500 m to achieve adequate separation between wind turbines and existing or approved sensitive land uses on non-infrastructure hosting properties. Separation distances for landholders that do have infrastructure on their properties can be negotiated with AGL through a deed of release agreement.

Acoustic criteria in the wind farm state code

The noise levels prescribed in the wind farm state code for adjoining and nearby property owners who have not signed an agreement with AGL is 37 dB(A) during the day time and 35 dB(A) for night time, which is 10 pm – 6 am.

AGL must not exceed a maximum noise level of 45 dB(A) during night time for landholders who have entered into an agreement with AGL.

Wind turbine noise characteristics

The wind farm state code - planning guideline (2016) categorises noise characteristics associated with wind farms generally into two categories:

- *mechanical noise*—produced from the gearbox and generator, bearings, and other mechanical parts of wind turbines
- *aerodynamic noise*—produced by the rotation of turbine blades through the air.

The main source of sound from wind farms is aerodynamic, and contains many different frequencies, with dominant frequencies in the 200–1000 Hz range.

5.3.3 Noise measures

Decibels

The decibel (dB) scale provides a way of measuring the wide range of sound pressures that humans can detect. The scale of human hearing is typically 0 dB to 130 dB, which is the threshold of pain.

Sound power level

Sound power is the quantity of sound that is generated and released at the source of sound. The sound pressure level at some location away from the source is the result of the radiation of that sound and depends on the surrounding environment.

For example, if a wind turbine generator has a sound power level of 100 dB(A) at the generator, at a distance of 400 m from the turbine, the sound pressure would be equivalent to 37 dB(A) due to the distance from the generator. The sound pressure level at this distance would also be further reduced by other effects such as ground absorption[29].

Weighting networks

Scientists have developed frequency weighting networks to correlate objective sound measurements with the subjective human response.

A-weighted network (dB(A))

The most common weighting used in environmental noise measurement is the A-weighting which was designed to approximate the response of the human ear. Sound pressure levels with an A-weighting (written as dB(A)) generally indicate how loud a sound is to the human ear, regardless of its frequency.

The dB(A) scale is suited to the measurement of steady (non-varying) noise.

C- and G-weighted networks (dB(C) and dB(G))

Like the human ear, the A-weighted network is less sensitive to low frequencies. Therefore, the C-weighting has been developed to measure sounds with a significant low frequency component (between 200 Hz and 20 Hz).

The G-weighting has been developed to measure sounds in the infrasound range (less than 20 Hz). The hearing threshold for infrasound can be approximated using the G-weighted network.

L_{eq}

The L_{eq}, (or L_{Aeq} when measured in A-weighted decibels) is the equivalent continuous sound pressure level. As sound levels usually vary over time, this measure converts the varying levels to an equivalent constant level of sound.

Centile levels

The 90th centile level (L_{90}) is the sound level exceeded for 90 per cent of the measurement period. For example, if sound measurements are taken over 10 minutes, L_{90} will be the noise level which is exceeded for 9 minutes of that time.

L_{90} is useful when the noise emissions from a source are constant (e.g. from a fan or air conditioner) but the ambient noise level is variable (e.g. due to traffic noise).

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[29] Bellhouse G. *Low frequency noise and infrasound from wind turbine generators: a literature review.* Wellington NZ: Energy Efficiency and Conservation Authority, 2004

Low frequency noise

Low frequency noise (less than 200 Hz) has characteristics which differ from mid (200 – 2000 Hz) and high (2000 – 20,000 Hz) frequency sounds. The hearing threshold increases as the frequency decreases, particularly below 200 Hz.

Low frequency noise has a narrow audible range and needs to be at higher sound levels than other frequencies to be audible. Once a low frequency noise is audible, the level only needs to increase by a small amount (relative to the increase required at mid and high frequencies) to be considered loud.

Because hearing sensitivity varies between individuals, a low frequency noise which is inaudible to some people may be audible and annoying to others.

Infrasound

Infrasound is very low frequency noise and usually refers to noise with a frequency below 20 Hz. The human ear can perceive sounds in this range if they are at very loud levels, with 85 dB(G) being the internationally recognised audibility threshold for infrasound.

A 2012 study[30] notes that infrasound is prevalent in urban and coastal environments at similar levels to the level of infrasound measured around 77 m from a wind turbine. A 2012 study concluded that the level of infrasound is well below the audibility threshold of 85 dB(G). Table 5.3 provides a variety of measures of infrasound from different built infrastructure and natural sources at various distances.

Table 5.3 Measured levels of infrasound[31]

Noise source	Measured level db(G)
Beach at 25 m from high water line	75
250 m from coastal cliff face	69
8 km inland from coast	57
Gas fired power station at 350 m	74
Adelaide CBD at least 70 m from any major road	76
Clements Gap Wind Farm at 85 m	72
Clements Gap Wind Farm at 185 m	67
Clements Gap Wind Farm at 360 m	61
Cape Bridgewater Wind Farm at 100 m	66
Cape Bridgewater Wind Farm at 200 m	63
Cape Bridgewater Wind Farm ambient	62

[30] Turnbull C, Turner J, Walsh D. Measurement and level of infrasound from wind farms and other sources. *Acoustics Australia*, 2012; 40(1): 45–50.
[31] Turnbull C, Turner J, Walsh D. Measurement and level of infrasound from wind farms and other sources. *Acoustics Australia*, 2012; 40(1): 45–50.

It is widely agreed that the sensation of audible infrasound is different to that of higher frequencies. Below 16–20 Hz, the sensation of tone (the recognisable pitch of the sound) disappears.

Amplitude Modulation

As the blades of a wind turbine rotate, they generate a regular rise and fall (or modulation) in the level of sound. This normal level of amplitude modulation is expected to occur and causes a 'swish' sound. It is considered inaudible at typical residential distances (between 1000 m – 1500 m) from wind farms.

Tonality

The EHP Noise Measurement Manual[32] defines tonal noise as having a prominent frequency and characterised by a defined pitch. According to the wind farm state code planning guideline, a correctly operating wind turbine may exhibit sound with tonal characteristics. These sounds can be minimised or avoided by careful design, vegetation screening, and the choice of wind turbine.

5.3.4 Submissions on the EIS

In my evaluation of the project I have considered all of the submissions on the EIS, and the responses provided by the proponent on matters raised in the submissions and my assessment is provided in the relevant sections below, including Appendix 4.

The key issues regarding noise impacts raised in public submissions on the EIS included the following:

- difficulties in ascertaining the actual impact of the turbines on individual properties
- some submitters referenced submissions to the 2015 Senate Select Committee on Wind Turbines[33] that claimed effects from wind turbines may be felt up to 10 kilometres away
- potential impact of wind farm noise (including low frequency noise and) on human health
- uncertainty about what measures are available to change the operations of the wind turbines if noise limits are exceeded
- expectation that an independent acoustic engineer verify the correctness of the models used to predict the noise impacts of the wind farm
- noise levels permitted in the "Managing noise and preventing hearing loss at work Code of Practice 2011"[34] would be more appropriate than the wind farm state code
- concerns that the cumulative impacts from six turbines located near a property boundary would generate noise levels that would prevent safe work practices in the area, affecting operational efficiency and productivity

[32] Department of Environment and Heritage Protection, *Noise measurement manual*, Brisbane, State of Queensland 2013
[33] Senate Select Committee on Wind Turbines, Final report, August 2015, Commonwealth of Australia, Canberra
[34] https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0009/58176/managing-noise-preventing-hearing-loss-cop-2011.pdf

- noise levels permitted by the wind farm state code are greater than those allowed under the Environmental Protection (Noise) Policy 2008 (EPP Noise)
- low frequency noise should be under 30 decibels measured using the A-weighting scale (d(BA)) (see definition below) in line with the World Health Organisation guideline as it has the potential to disrupt sleep
- concerns that infrasound (typically below 20 Hertz (HZ) generated by the wind turbines could be detected in a home 10 kilometres away
- turbines should be set back further than 1500 metres (m) from buildings.

5.3.5 Impacts and mitigation

Background noise modelling assessment

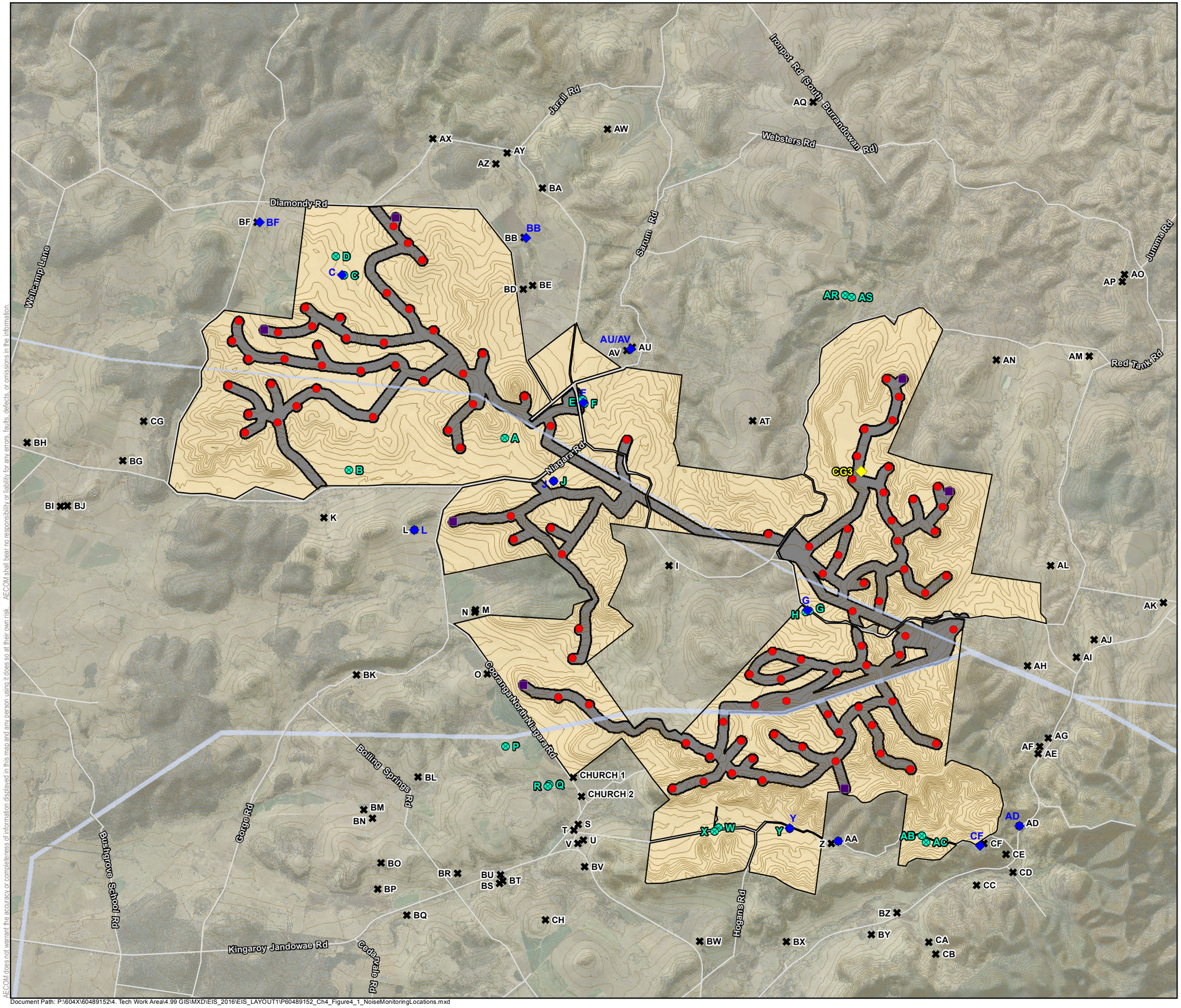
The baseline noise monitoring conducted for the project and presented in the draft EIS was not in strict accordance with the wind farm state code planning guideline. As such, the proponent updated the baseline noise monitoring and presented an updated background noise analysis in the final EIS.

The wind farm state code planning guideline explains that the purpose of monitoring the existing noise environment is to:

(1) describe the ambient noise environment of the area surrounding the wind farm during the day and night period

(2) determine the background noise levels ($L_{A90,10min}$) correlated for a range of hub height wind speeds for the day and night periods to determine the relevant outdoor wind turbine noise criteria at the selected representative noise monitoring locations.

The acoustic environment in the area was evaluated by undertaking a baseline background noise monitoring program at 17 representative locations near the project site. Noise monitoring locations were selected to represent areas that are expected to have the greatest noise impact from the project. Figure 5.5 identifies the noise monitoring locations used.



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AECOM

DATUM GDA 1994, PROJECTION MGA ZONE 56

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Kilometres

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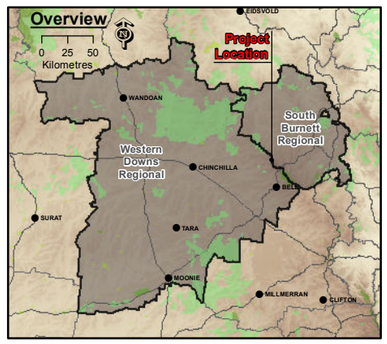
Legend

- Project Site
- Study Area
- Met Masts
- Exisgting Met Mast used in noise modelling
- Turbines
- Participating Landowners
- Non-Participating Landowners
- Noise Monitoring Locations
- Contours 10m
- Road



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COOPERS GAP WIND FARM
ENVIRONMENTAL IMPACT STATEMENT

NOISE MONITORING LOCATIONS

PROJECT #:	60489152
CREATED BY:	BM
LAST MODIFIED:	BM: 25/11/2016
VERSION:	1

Figure 5.5

A3 size

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In accordance with the wind farm state code, background noise monitoring was conducted for six weeks. Throughout the monitoring, both wind speed and noise data was collected in 10-minute blocks.

In all cases, background noise was measured with a microphone at a height of 1.5 m above ground level, and at least 5 m from any significant vertical noise-reflecting surface. Similarly, the noise monitors were placed as far as practicable from significant vegetation such as trees because they can create extraneous sound, and potential sources of domestic noise.

As required by the wind farm state code, the background noise data collected at each site was correlated with wind speed data measured at a meteorological mast in operation on site during the measurements. The data measured by the mast at various heights was extrapolated to a hub height of 117 m above the ground, which is likely to be the height of the proposed wind turbines.

In the EIS, the predicted A-weighted equivalent noise level for wind farm development was assessed as free-field (measurements generally used to assess noise conditions set at property boundary) noise levels at all existing or approved sensitive land use receptors, at the wind farm state code required height of 1.5 m above ground level.

Noise models

The wind farm state code planning guideline mandates that a suitable noise model must be selected to predict the worst-case noise level at sensitive land use receptors in the minimum octave band frequency range from 63 Hz to 4 kHz. The guideline prescribes two types of modelling to predict the noise impacts of the project on nearby sensitive land use receptors – the CONCAWE noise propagation model or *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2).

ISO 9613-2 was used for the EIS and is commonly used for wind turbine noise assessments. It specifies a method for predicting L_{Aeq} noise levels at a distance from the source under meteorological conditions that are favourable to noise propagation such as sensitive receptors being downwind or a moderate ground-based temperature inversion.

A number of inputs to the noise model are required by the wind farm code guideline, including temperate and humidity levels and topographical ground contours at 1 m or 5 m. The wind farm state code requires L_{Aeq} noise levels to be modelled for each sensitive land use receptor. The noise levels must be determined for each wind turbine's hub height wind speed and visually over-plotted on a noise criteria curves graph to compare the predicted wind turbine noise level with the relevant day and night noise level criteria.

Instrumentation

The EIS states that the assessment used sound level meters which carried a current calibration certificate from a National Association of Testing Authorities (NATA) accredited laboratory. The sound level meters were calibrated in the field at the start

and end of the measurement periods using a Class 1 acoustic calibrator, as required by the wind farm state code.

In addition, a portable weather station was used to measure wind speeds and rainfall at 10 minute intervals synchronised with the noise monitors. The weather station was installed at 2 m above ground level.

Wind data measurements were taken at the project site and extrapolated to wind turbine hub heights by using equations specified in the wind farm state code planning guideline. This information was then used to predict the applicable environmental noise limits at all the nearest residences to the project. Wind speed data measured at the meteorological mast on the project site for the duration of the noise monitoring periods was correlated with the noise data to establish the applicable noise limits.

Low frequency noise

In addition to the $L_{Aeq,10min}$ noise limits, a low frequency noise limit of 60 dB(C) $L_{Ceq,10}$ ($L_{Ceq,10}$ like $L_{Aeq,10min}$ provides an continuous equivalent sound level, just measured in the C-weighting network) was applied to the background noise level results in order to assess the potential impacts of any low frequency noise emissions.

Operational impacts

For the assessment of operational noise impacts, the EIS assumed that during commissioning, undue amplitude had been addressed, and that the wind turbines would be properly maintained to avoid noise emissions due to turbine wear.

Background noise and wind speed data

Background noise levels for the project area were monitored at 17 participating sensitive land use receptors, particularly residences, and 70 non-participating sensitive land use receptors. The noise limits at the sensitive land use receptors were determined by applying the wind farm state code noise criteria to background noise levels.

The results were then correlated with the proposed 117 m hub height wind speed (between approximate wind turbine start up speed and the approximate speed of rated power) and plotted to form a scatter plot of the data for each of the day and night periods. This information was used to predict the $L_{Aeq,10min}$ noise criteria generated by the project at various wind speeds at the sensitive land use receptors. The results of the impacts on each sensitive land use receptor were presented in Volume 3, Appendix F (Noise and Vibration) of the project's EIS.

Wind farm operational noise modelling

The EIS confirms a three-dimensional computer noise model of the project site was created in SoundPLAN Version 7.4 acoustic modelling software to predict operational noise levels for the project. Environmental noise predictions were carried out using the algorithms from ISO 9613-2, as required by the wind farm state code planning guideline. Details of the inputs to the noise model can be found in Chapter 4 Noise and Vibration of the project's EIS.

The EIS found that the noise predictions complied with the wind farm state code noise limits at all 87 locations at, or close to, sensitive receptors.In addition to the EIS noise assessment, AGL conducted facade testing at 5 sensitive land use receptors, at the request of the some members of the Community Consultative Committee. The August 2016 report was published on the AGL web site. This assessment determined that, with windows fully open, there was an 8 to 13 dB(A) reduction in noise levels between outdoors and indoors. The level of reduction was dependent on the construction material of the residence.

I have stated a condition requiring the proponent to provide an updated noise impact assessment to DILGP prior to construction which to confirm the noise modelling presented in the EIS. The updated noise impact assessment must be prepared in accordance with the acoustic criteria of wind farm state code and planning guideline.

Low frequency noise assessment

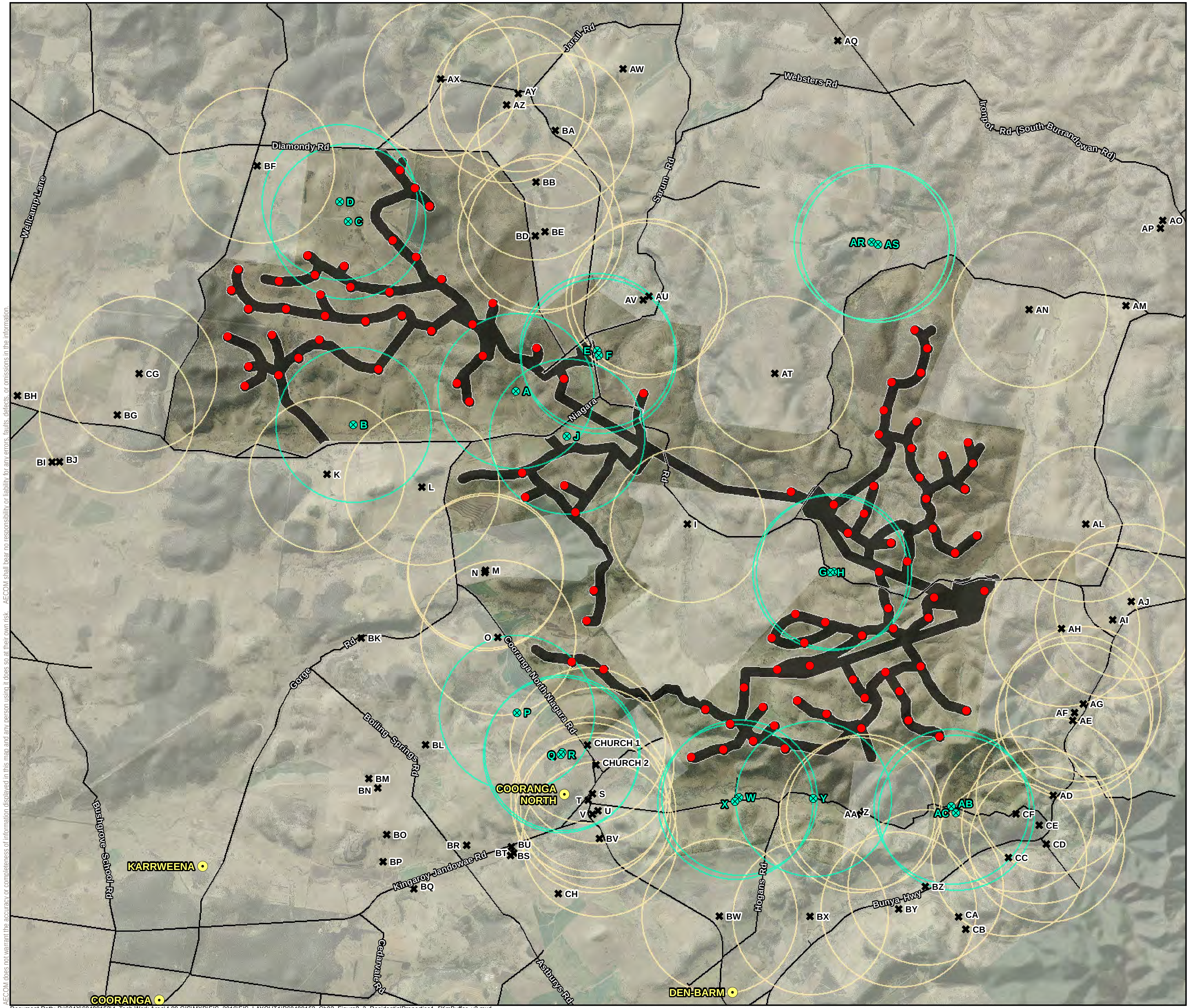
The EIS states that wind farms are not a significant source of low frequency noise, although some submitters raised concerns that there would be low frequency noise impacts. As there are no performance outcomes for low frequency noise included in the wind farm state code, a noise limit of 60 dB(C) $L_{Ceq,10}$ was used in the EIS to assess the potential impacts of any low frequency noise emissions. This level has been adopted by the NSW Department of Planning and Infrastructure Draft NSW Planning Guidelines: Wind Farms (2011) The EIS also presented a low frequency noise compliance assessment during the worst-case turbine noise emission scenario. The noise levels presented in the EIS are free-field $L_{Ceq,10min}$ noise levels at the receptors, assessed against a 60 dB(C) night time limit.

The EIS confirmed the noise predictions comply with this noise limit at all but one receptor. The $L_{Ceq,10}$ low frequency noise limit was exceeded by less than 1 dB(C) at receptor G during the evening with clear conditions, which assists noise to travel further. AGL will need to secure a deed of agreement with the landholder, which could incorporate this minor exceedance. Additionally, low frequency noise is not regulated under the wind farm state code.

Furthermore the conservative assumptions made when building the model mean that the measured noise levels would likely be lower than those predicted as part of this assessment. As such, noise compliance at receptor G with a 60 dB(C) noise limit is expected. Also, as previously stated under Section 5.3.3, it is unlikely that the human ear can hear below 85 dB(G).

Separation distances

The project's wind turbine layout was designed to ensure compliance with the separation distance requirements for host and non-host lots prescribed in the wind farm state code. The separation distances also align with the advice on wind farms issued by the National Health and Medical Research Council. Figure 5.6 demonstrates the project's compliance with the 1500 m separation distance requirements prescribed in the wind farm state code.



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Kilometres

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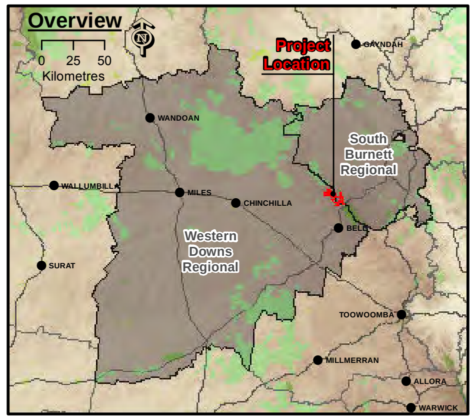
Legend

- Project Site
- Locality
- Turbines
- Participating Landowners
- Non-Participating Landowners
- Road
- 1,500m setback – Participating Landowners*
- 1,500m setback – Non-Participating Landowners*

Note:
*only setbacks intersecting Study Area shown

Overview



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10.Background Image, Captured on 27/04/2011, Bing Maps.

COOPERS GAP WIND FARM
ENVIRONMENTAL IMPACT STATEMENT

SENSITIVE LAND USE SEPARATION

PROJECT #:	60489152
CREATED BY:	BM
LAST MODIFIED:	BM: 5/09/2016
VERSION:	1

Figure
5.6

A3 size

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Potential impacts of wind farms on human health

The WHO guidelines for community noise identify the health impacts from noise as:

- noise-induced hearing impairment
- interference with speech communication
- disturbance of rest and sleep
- psychophysiological, mental-health and performance effects
- effects on residential behaviour (i.e. closing windows, not using balconies) and annoyance
- interference with intended activities.

The EIS presented a report containing key findings of peer-reviewed scientific literature on wind farms and health. References included epidemiological studies of wind farms and health (direct evidence) and a number of studies that provide useful information on exposure and disease where the direct evidence is limited (background evidence).

Negative reactions to noise are broadly termed annoyance. Negative reactions could develop into anger, depression, agitation and stress and can thus have an impact on quality of life.[35] When combined with sleep deprivation, annoyance may contribute to physiological stress on the body and further contribute to a lack of sleep and exacerbate the effects of the noise on the individual.

As stated in the introduction to this report, noise affects people differently with certain noises creating annoyance for some people, while not being heard by others. However there has been no scientific evidence that concludes that the noise generated by wind farms is at a level, frequency or exposure length to cause physical damage to hearing. As noted in the EIS, the most relevant effects are indirect and often triggered by effects on people's quality of life, well-being or social environment.

Proposed mitigation strategies

Proposed compliance plan

The EIS states that compliance noise measurements will be undertaken at a number of the adjacent sensitive land use receptors once the wind farm is operational, to demonstrate that compliance with the wind farm state code acoustic criteria has been achieved.

A preliminary compliance management plan was developed and included in the EIS. In lieu of a compliance methodology within the wind farm state code and guideline the compliance measurement methodology was developed using guidance from the following documents:

- NSW Department of Planning & Infrastructure Draft NSW Planning Guidelines – Wind Farms, December 2011

[35] World Health Organisation, Burden of disease from environmental noise: WHO European Centre for Environment and Health, 2011.

- Victoria Department of Planning and Community Development Policy and Planning Guidelines for development of wind energy facilities in Victoria, July 2012
- New Zealand Standard NZS6808:2010 Acoustics – Wind farm noise.

I have set a condition requiring the proponent to provide a noise monitoring plan (i.e. compliance plan) for approval by DILGP prior to the commencement of construction, to demonstrate that the wind farm is operating in compliance with the noise limits of the wind farm state code. I require this noise monitoring plan to incorporate the improvements suggested by the DILGP peer review (see below) of the draft compliance plan included in the EIS.

At 3 months, and again at 12 months following the wind farm being fully operational, I have stated a condition requiring the proponent to undertake operational noise monitoring and submit to DILGP a noise monitoring report, outlining the results of the monitoring. After 12 months of operations, I require the proponent to develop an operational strategy outlining all measures the proponent will use to ensure the wind farm complies with the noise levels I have conditioned.

Noise monitoring for noise complaints

Where noise monitoring is required in response to complaints, monitoring will be used to measure the noise levels to determine whether or not approved noise limits have been exceeded. Should noise complaints continue, there are adjustments that can be made to the operation of the wind farm, such as slowing down or shutting down specific turbines during periods of worst impact.

Cumulative impacts

No new or proposed developments have been identified within the study area that are likely to result in combined noise impacts with the project. Cumulative noise impacts to sensitive receptors are therefore considered to be unlikely.

Peer review of noise impacts presented in the EIS

In preparation for the MCU assessment under SPA, DILGP had the noise assessment presented in the EIS independently peer reviewed. The proponent was provided with an opportunity to comment on the review of the noise assessment and a number of agreed actions were identified to update the report for the MCU application. Suggested improvements included:

- update noise samples to exclude all data below the turbine cut-in wind speed
- for noise model inputs, allow for concave topography
- proponent to require that the manufacturer guarantee that tonality will not be experienced at residences.

The independent peer review also made a number of suggestions to improve the project's proposed compliance management plan including specifying how there will be consistency between pre-construction and post-construction measurements in treating:

- wind mast location

- wind speed
- noise measurement locations
- extraneous noise
- wind induced noise.

I expect the proponent to address these comments in the compliance plan that is to be approved by DILG prior to construction.

Construction noise impacts and proposed mitigation strategies

It is anticipated that the construction work may include excavation, rock hammering, drilling and bulldozing. Noise would be generated by mobile plant such as excavators, bulldozers, mobile cranes and semi-trailers delivering or removing material from construction sites.

Construction noise and vibration was assessed in the EIS against operational requirements for construction management prescribed in the wind farm state code.

The EIS concluded that construction noise impacts can be controlled to acceptable levels and that residences/sensitive receptors at distances of 200 m and greater from work areas are not likely to be impacted by construction noise or vibration.

Mitigation measures

The EIS includes the commitment that construction equipment for the project would be selected on the basis of low noise emissions. Noise emissions would be reduced by fitting exhaust mufflers, using reversing alarms that emit a broadband noise (e.g. white noise) rather than a beep, maintaining plant in good working order and following best practice construction methodologies. Construction hours are proposed to be between 6.30 am and 6.30 pm, Monday to Saturday and the proponent has committed to notifying all potentially affected landowners of upcoming construction work.

The EIS states a construction management plan that complies with the wind farm state code would be developed for approval to manage possible noise and vibration impacts from construction and submitted to DILGP for approval. This plan will include a:

- description and location of sensitive land uses that may be affected by noise, vibration and dust emissions from the construction work
- description of the activities and equipment likely to generate noise, vibration and dust emissions
- description of the noise, vibration and dust impact control measures to be implemented to minimise noise, vibration and dust impacts at sensitive uses
- description of how equipment will be managed to minimise noise impacts
- community consultation activities to notify sensitive land uses of potential noisy construction work in advance
- description of the methods to be used to monitor performance and receive, record and respond to complaints.

I note that the proponent made commitments (Appendix 5) to keep the community regularly informed of the progress of construction and to provide an avenue for the community to complain about construction noise. I have also conditioned the proponent to prepare a community engagement plan which will incorporate these requirements.

Construction vibration impacts and proposed mitigation measures

Based on typical levels of vibration from construction activities, it is expected that residences at distances of 200 metres and greater from the works area would not be able to perceive construction vibration.

Should concerns be raised during construction by the public about vibration, the proponent has committed to appropriately investigating the complaint.

If high levels are recorded the proponent has committed to:

- move the plant and equipment further away from the sensitive receptor
- replace plant equipment with equipment that does not produce large levels of vibration
- undertake building structure surveys to identify if there has been any damage caused by vibration.

5.3.6 Coordinator-General's conclusion - noise

I note that some submitters have raised concerns about the noise generated by the wind farm. By requiring the proponent to meet the noise limits prescribed in the wind farm state code, I am satisfied that the health and wellbeing of all landholders near wind turbines could be appropriately protected.

The EIS predicts a minor exceedance of low frequency noise levels at one residence, although the wind farm state code does not regulate low frequency noise. AGL needs to formalise an agreement with the landowner to host the wind farm infrastructure and I expect that this minor exceedance to be addressed in the deed of release agreement.

I stated a condition for the proponent to provide an updated noise impact assessment to DILGP prior to construction which will confirm the noise modelling presented in the EIS. The updated noise impact assessment must be prepared in accordance with the acoustic criteria of wind farm state code and planning guideline.

I have set a condition requiring the proponent to provide a noise monitoring plan for approval by DILGP prior to the commencement of construction, to demonstrate that the wind farm is operating in compliance with the noise limits I have set. I require this noise monitoring plan to incorporate the improvements suggested by the DILGP peer review of the draft compliance plan included in the EIS.

At 3 months, and again at 12 months following the wind farm being fully operational, I have stated a condition requiring the proponent to undertake noise monitoring and submit to DILGP a noise monitoring report, outlining the results of the operational noise monitoring. After 12 months of operations, I require the proponent to develop an operational strategy outlining all measures the proponent will use to ensure the wind

farm complies with the noise levels I have conditioned. Therefore I am satisfied that the proponent will be able to demonstrate compliance with the noise levels required by my conditions of 35 dB(A) at night times for adjoining landowners who have not signed an agreement with AGL. My conditions also require the wind farm not to exceed the maximum level of 37 dB(A) for adjoining landowners during day time hours.

The community and engagement strategy presented in the social impact assessment of the EIS and the proponent commitments (Appendix 5) provide me with confidence that affected landholders will be able to raise concerns about the impacts of construction and operation noise generated by the project.

The proponent will provide formal avenues for appropriate investigation of noise complaints and the proponent is proposing to engage a dedicated Community Consultation Officer to provide an opportunity for affected landowners to discuss issues with someone face to face. In combination with my conditions for reporting on community engagement activities, I am satisfied that AGL will work with affected landowners to resolve any noise issues that may arise.

5.4 Traffic and transport

5.4.1 Introduction

The EIS traffic and transport chapter presented the results of the assessment of potential project-related traffic impacts on the road network within, and surrounding the project area.

Relevant policies and legislation

The below legislation and policy assists in guiding transport assessments in Queensland:

- the *Transport Infrastructure Act 1994* (TI Act)
- the Transport Infrastructure (State Controlled Roads) Regulation 2006 (TI Regulation)
- the *Transport Operations (Road Use Management) Act 1994* (Transport Operations Act) and associated subordinate legislation
- Guidelines for Assessment of Road Impacts of Development (GARID)
- wind farm state code
- regional and local planning instruments.

5.4.2 Existing environment

Roads

The EIS identified the following six state-controlled roads (SCR) and a single regional council road (RCR) as likely to be used for the project:

- Gateway Arterial Road (SCR)

- Cunningham Highway (SCR)
- Warrego Highway (SCR)
- Bunya Highway (SCR)
- Kingaroy-Jandowae Road (SCR)
- Dalby-Jandowae Road (SCR)
- Niagara Road (RCR).

The EIS found that the annual average daily traffic (AADT) on State controlled roads ranged from 113 vehicles on Kingaroy-Jandowae Road to 22,481 vehicles on the Warrego Highway. Niagara Road is the only RCR which intersects the project area and has an AADT of 38 vehicles.

The Logan Motorway and Gateway Extension Motorway would form part of the project's transport corridors. These motorways have high traffic volumes.

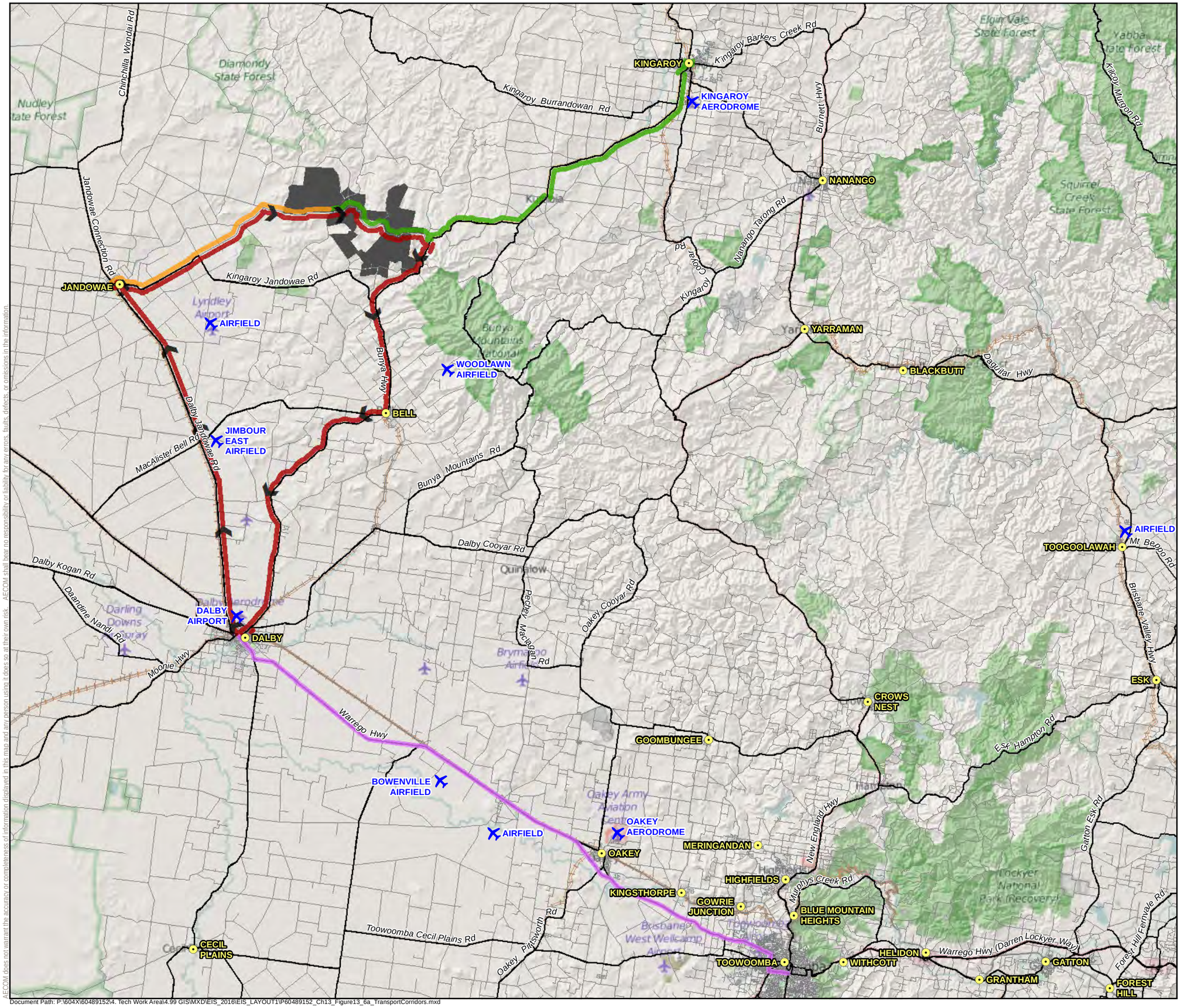
The EIS has identified three potential transport corridors to be used for the transport of workforce, equipment and construction materials for the project:

- Port of Brisbane to Dalby (TC01)
- Kingaroy to project site (TC02)
- Jandowae to project site (TC03).

The project proposes to transport the over-size and/or over-mass goods (i.e. turbine blades and components) from the Port of Brisbane to Dalby (TC01) and then use one of four potential alternative routes from Dalby to the project site. General construction materials, equipment and workforce would generally use TC02 from Kingaroy to the project site, or TC03 from Jandowae to the project site or one of the TC01 alternative routes from Dalby to the project site.

The EIS has identified four possible alternative routes between Dalby and the project site (i.e. TC01 splits in four). These are:

- Dalby to project site and back to Dalby (clockwise, one-way loop) (TC01A—see Figure 5.7)
- Dalby to project site and back to Dalby (anti-clockwise, one-way loop) (TC01B)
- Dalby to project site (via Jandowae) (TC01C)
- Dalby to project site (via Bunya Highway) (TC01D).



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DATUM GDA 1994, PROJECTION MGA ZONE 56

0 5 10 Kilometres

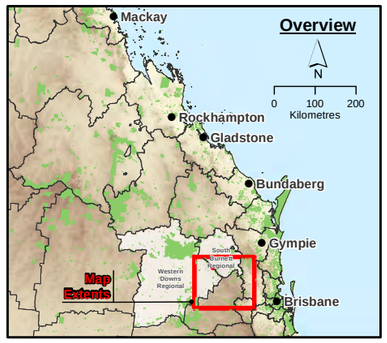
1:450,000 (when printed at A3)

Legend

- Study Area
- Airport / Airfield
- Locality
- Railway
- State Controlled Roads
- Regional Council Controlled Roads

Transport Corridor

- TC01
- TC01A
- TC02
- TC03
- Direction of travel



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COOPERS GAP WIND FARM
ENVIRONMENTAL IMPACT STATEMENT

TRANSPORT CORRIDORS
TC01-3 and A

PROJECT #:	60489152
CREATED BY:	BM
LAST MODIFIED:	BM: 5/09/2016
VERSION:	1

Figure **5.7**

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Other transport modes

The closest major commercial airport to the project area is the Brisbane West Wellcamp Airport, located at Toowoomba, with smaller airports in Dalby, Chinchilla and Kingaroy.

The rail network closest to the project area is the Western System rail-line which is owned and operated by Queensland Rail (QR). The nearest port is the Port of Brisbane. There is one stock route that runs through the project site.

5.4.3 Assessment methodology

As the primary transport network for this project is the road network, this was the focus of the EIS traffic and transport assessment. The GARID[36] was used to identify the impact from the project activities on SCR. A desktop survey was undertaken to find a baseline or 'without development' scenario for proposed transport routes and corridors traffic. This data was compared to a 'with development' scenario of projected potential traffic impacts of the project.

Information used for the baseline study was gathered from the Department of Transport and Main Roads (DTMR) and regional council data.

Impact assessment

The EIS considered the road network as the major mode of transport to potentially be impacted by the project. The EIS also assessed other project-affected modes of transport including road, rail, air and sea.

The impact assessment undertaken for the EIS consisted of:

- preliminary road impact assessment
- preliminary traffic operation impact assessment
- preliminary pavement impact assessment
- port, airport and rail impact assessment.

Due to advice received in the submission on the EIS from DTMR and in subsequent consultation with the agency on the issue, the proponent completed additional route analysis on the route starting from the Brisbane Port, traveling along the Warrego Highway through Toowoomba and Dalby, and then up the Bunya Highway to Niagara Road to the project site.

This additional assessment was focused on the transport of the 70 m wind turbine blades and consisted of:

- identifying key intersections and truck turning movements
- investigating the most appropriate turning path for the truck at the key locations
- determining any temporary or permanent mitigation measures that will be required for the truck to safely complete the turning movement.

[36] Department of Transport and Main Roads (DTMR), *Guidelines for Assessment of Road Impacts of Development,* DTMR, Brisbane, 2006.

Road impact assessment

The road impact assessment (RIA) identifies and addresses the implications of the project on SCRs and includes a pavement impact assessment and traffic operation assessment.

GARID outlines the performance criteria for the RIA as summarised below:

Table 5.4 Road impact performance criteria[37]

Assessment type	Performance criteria
Pavement impact assessment	Impacts are considered to occur where construction or operational traffic generated by the development equals or exceeds 5% of the existing Equivalent Standard Axles (ESA)[38] on a road section
Traffic operation assessment	Impacts are considered to occur where construction or operational traffic generated by the development equals or exceeds 5% of the existing annual average daily traffic (AADT) on a section of road, or for intersection movements or turning movements

All potential impacts assessed as a part of the RIA, are based on vehicle movements associated with the project workforce and the delivery of project-related construction materials and equipment using the road networks.

Traffic operation impact assessment

The EIS estimated project generated traffic volumes (based on construction activities) and these were compared to the background traffic in order to determine the likely level of impact.

In the route analysis conducted following the EIS TC01D was assessed further as the most likely route for the transport of the wind turbine blades.

Pavement impact assessment

The EIS undertook a preliminary desktop assessment of potential pavement impacts using available existing background traffic data for relevant sections of the road network.

Traffic volumes were converted into equivalent standard axles (ESA) based on an assumption of the heavy vehicle classes to be used on the project for various construction activities. During the public notification period for the EIS, the proponent undertook consultation with South Burnett and Western Downs regional councils on the pavement impact assessments.

[37] Department of Transport and Main Roads (DTMR), *Guidelines for Assessment of Road Impacts of Development,* DTMR, Brisbane, 2006, page 7.
[38] See Glossary of this report for a definition.

Port, airport and rail impact assessment

As part of the EIS assessment, a high level desktop review was conducted of the relevant ports, airports and rail services in the vicinity of the project area.

The review focused on identifying major infrastructure in the area for use by the project and determining the extent of potential impacts of sea delivery, increased flights for project workforce and an increased number of trains as a result of project related rail freight.

Submissions on the EIS

The key traffic and transport issues raised in public and advisory agency submissions on the EIS included:

- potential impacts on both local and state controlled roads and stock routes during the construction and operational phases of the project
- development of traffic management plans
- potential cumulative impacts on transport infrastructure in the region
- potential impacts on school bus routes
- potential impacts from transportation of wind turbines on tourism in the region during the peak tourism periods
- potential impacts on roads due to transportation of aggregate for concrete
- ability for oversize vehicles to manoeuvre through intersections
- continued consultation with local councils and DTMR on road impact assessments
- requests for infrastructure agreements to be completed
- movement of oversized and heavy loads over a proposed two year construction period which have the potential to create annoyance for people living on or near the transport route.

DTMR also noted that until it is confirmed that there are viable routes for haulage or there are accepted mitigation measures to upgrade routes so that they become viable haulage routes, there is a significant risk for the project as the construction traffic may not be able to physically deliver the turbine blades.

I have considered each submission and the responses provided by the proponent in my evaluation of the potential impacts of the project.

5.4.4 Impacts and mitigation

The EIS states that the project is in the planning and early design phase and as such has used a number of assumptions in the assessment of impacts, some of which are referred to in this chapter.

Potential impacts during construction

During the 27 month construction phase, the EIS states works could potentially occur for 12 hours per day, six days per week.

Transport impacts during construction would result from transportation of the project workforce, construction materials including turbines and associated infrastructure, and construction equipment.

The EIS has identified that construction equipment-related transport movements would be no more than two oversized vehicles per day and have been accounted for as a part of the traffic operation and pavement impact assessment.

Potential impacts arising from these trips relate to driver safety, and more specifically driver fatigue with mitigation measures for these forming a part of the road use management plan.

Based on reasonable assumptions for the traffic assessments, the EIS provided a breakdown of the indicative traffic distribution per construction activity.

In order to forecast project traffic volumes along each of the three proposed transport routes, the indicative material quantities identified in the EIS were distributed among each transport corridor.

The potential daily project related traffic volumes for all vehicle types, for all construction activities (two-way) over the three transport corridors are as follows:

- TC01 (Port of Brisbane to Dalby): 426 total trips
- TC02 (Kingaroy to Coppers Gap Wind Farm): 270 total trips
- TC03 (Jandowae to Coopers Gap Wind Farm): 90 total trips.

Traffic operation impact assessment

For the impact assessment relating to the performance of the road network, the EIS assessed four scenarios which consisted of four alternative transport routes (i.e. TC01A, TC01B, TC01C and TC01D) for the transport of material and equipment between Dalby and the project site. TC01D was assessed further as the most appropriate route for the wind turbine blades in the route analysis conducted following the EIS.

Under all four of the scenarios, the EIS assessment indicated that the Bunya Highway, Kingaroy-Jandowae Road and Niagara Road are all potentially impacted by project related traffic. Under certain scenarios, some sections of the Dalby-Jandowae Road may likely also be affected.

As Niagara Road is the primary access road connecting the project site and the external road network, it is likely to be the worst affected in terms of increase in AADT from existing (38 vehicles to 786 vehicles). The majority of vehicle trips (702 out of a total 786 vehicle trips) generated by the project will be light vehicle trips transporting the project workforce and are unlikely to significantly impact traffic operations based on overall magnitude.

Pavement impact assessment

The pavement impact assessment for the EIS used the same four scenarios as presented above.

The results of the EIS assessment indicate that for all four scenarios, all sections of the Bunya Highway, Kingaroy-Jandowae Road and Niagara Road, and a single section of the Warrego Highway will exceed five per cent of background ESA.

As with the traffic operation impact assessment, the pavement impact assessment also indicated Niagara Road to be the worst impacted in terms of increase in ESA (from 58 background traffic ESA to 1183 development related ESA) for scenarios three and four. This significant increase in impact for Niagara Road is primarily due to low background traffic volumes.

The EIS identified five key intersections which could be potentially affected by the project:

- Warrego Highway / Bunya Highway
- Bunya Highway / Niagara Road
- Kingaroy-Jandowae Road / Niagara Road
- Dalby-Jandowae Road (High Street) / George Street (Kingaroy-Jandowae Road)
- Kingaroy-Jandowae Road / George Street.

The route analysis for TC01D undertaken following the EIS identified eight key locations (between the Port of Brisbane and the project site) that may require modifications in order to accommodate the trucks transporting the wind turbine blades. These locations are:

- Bishop Drive/Lucinda Drive
- Port Drive/Kite Street
- Warrego Highway/James Street
- Warrego Highway/Karrool Street
- Warrego Highway/Bridge Street
- Warrego Highway/Bunya Highway
- Bunya Highway/Crawshay Street
- Bunya Highway/Niagara Road.

The route analysis report notes that the most significant of these locations is the Warrego Highway/Bunya Highway intersection in Dalby.

Potential impacts during operations

The EIS predicts a small workforce would be required for the wind farm during operations. As previously discussed the EIS assumed the workforce would be using light vehicles and not carpooling. No significant impact on SCRs is predicted during operations.

The EIS states operational traffic along sections of Niagara Road would potentially be in excess of five per cent of background volumes. As the volumes generated during construction are much greater, all mitigation and management measures employed during this stage would be sufficient to mitigate impacts during operations.

Additional workforce and equipment would be required for major maintenance if necessary. The EIS states that DTMR and the relevant local council would be consulted prior to any major maintenance works being undertaken and traffic management measures would be implemented.

Potential impacts during decommissioning

A decision will be made at the end of the operational life of the project to either replace components and repower the wind farm or decommission the project and remove relevant infrastructure from the project site.

The EIS states that regardless of the final plan of decommissioning, this phase is unlikely to have a greater impact on transport networks than the impact during construction of the project. A condition has been stated in Appendix 2 requiring the proponent to submit a report to the DILGP about the proposed impacts of decommissioning the project.

Potential cumulative impacts

Two projects within the vicinity of the Coopers Gap Wind Farm were considered in assessing the potential cumulative impacts of road impacts: the proposed New Acland Coal Mine: Stage 3 Project and the proposed South Burnett Coal Project.

The proposed New Acland Coal Mine: Stage 3 Project is likely to use sections of the Warrego Highway (TC01). Results noted for the evaluation for that project indicated it is not expected to severely impact either traffic operation or pavement condition. The impact is considered low enough that the cumulative impacts of both projects would not be expected to be significant.

The South Burnett Coal Project proposes using a different transport corridor during construction. Potential cumulative impacts on local roads would be minor due to the distance between the projects and therefore cumulative impacts are not considered significant.

Potential port, airport and rail impacts

The wind turbines are to be sourced from the overseas market as they are not currently manufactured in Australia. Turbine components will travel by ship to the east coast of Australia where they are transported via the road network to the project site. While the Port of Bundaberg and the Port of Gladstone are available as options, the Port of Brisbane has been identified in the EIS as the most likely port to be used in view of its location and handling capacity.

The EIS states that a proposed transport strategy, in relation to ports, would be to import infrastructure components at a rate in line with the rate at which the wind turbines are able to be transported and erected on site. This will spread the overall freight task and assist in reducing potential impacts to Queensland Ports. Shipping and port logistics would be investigated, in consultation the port authorities, prior to commencement of construction.

The EIS is not proposing to use a fly-in/fly-out workforce for either construction or operations phases. The road network will be utilised for the transport of all construction material, equipment and the workforce. Therefore, the project is not predicted to impact on regional flights. In addition, the project is not located close to any major airports and wind turbines are not considered to pose a hazard to those aircraft. Further information on aviation safety is included in Section 5.13.

With regard to rail network impacts, as stated above, the EIS is only proposing transport by overland freight and therefore the project would not generate any additional rail traffic.

Other potential road impacts

As part of the traffic and transport impact assessment, the EIS considered impacts to the following:

- school bus routes
- stock routes
- tourism routes.

The EIS states that due to the relatively low number of heavy vehicle movements each day and the short operational period of school buses, any potential impacts on these routes are expected to be minor.

The stock route identified in the EIS, while it is within the project area, is not a part of the proposed transport corridors and therefore is not expected to be impacted. The proponent notes that the layout of the project has been designed to avoid impacts to the stock route. This undertaking is included in the project's commitments at Appendix 1 of this document, and I require this action.

The project is unlikely to impact on tourist routes (i.e. the Dingo Fence tourist drive and the Great Bunya drive) as it is unlikely that there would be a significant amount of tourist related traffic on the proposed transport corridors.

Proposed mitigation measures

The project proposes to establish mitigation measures to assist in minimising potential traffic and transport related impacts through the development of a road use management plan and additional management plans as required.

The road use management plan will demonstrate how project related road impacts, particularly from heavy vehicle use, will be managed. The preliminary road use management plan will be prepared in consultation with DTMR and in accordance with the Guideline for preparing a Road Use Management Plan (GARID).[39]

[39] Department of Transport and Main Roads (DTMR), *Guideline for preparing a Road Use Management Plan,* DTMR, 2016. Available from DTMR at MDP@tmr.qld.gov.au.

Prior to construction, a traffic management plan (TMP) will be prepared in accordance with the most current version of the 'Manual of Uniform Traffic Control Devices: Part 3— Works on Roads'[40] and DTMR's specification "MRTS02—Provision for traffic".[41]

The proponent has committed to develop and put in place operational traffic management measures which include driver fatigue management and an emergency response/disaster management plan.

These plans will be prepared in consultation with DTMR, regional councils and other authorities and implemented as part of the construction environmental management plan.

During the detailed design phase the proponent will consult with DTMR, local councils and emergency response agencies with regards to management of potential project-related traffic impacts. The proponent will also look to establish infrastructure agreements with DTMR and regional councils during that phase of the project.

The route analysis report has identified a number of mitigation measures to be applied at the key locations identified to be potentially impacted along the haulage route TC01D. Different key locations will require different forms of mitigation as determined in the route analysis report. These would include:

- temporary removal/relocation of road signs or posts
- relocation of existing light poles or installation of new ones
- installation of new pavement to create suitable ground conditions and / or widening of pavement
- protection of existing drains or culverts
- creation of a mountable curve
- removal of vegetation.

The route analysis report notes that consultation with relevant stakeholders and authorities would be required to ensure suitability of the above measures.

As noted in the EIS further refinement to the intersection analysis and other road impacts would be undertaken during the detailed design phase of the project.

5.4.5 Coordinator-General's conclusion – traffic and transport

I am satisfied that the EIS has adequately evaluated the impacts of the project on traffic and transport routes and infrastructure. DTMR's submission on the EIS noted the potential difficulty of transporting wind turbines through certain intersections along the proposed transport routes due to the size of the loads. A route analysis report along the most appropriate route (TC01D) for the transport of the wind turbine blades from the Port of Brisbane to the project site has been conducted to address these concerns.

[40] Department of Transport and Main Roads (DTMR), *Manual of Uniform Traffic Control Devices – Part 3 Works on Roads,* DTMR, 2016.
[41] Department of Transport and Main Roads (DTMR), *Transport and Main Roads Specifications – MRTS02 Provision for Traffic,* DTMR, 2016.

Up to five intersections could potentially require upgrades to mitigate impacts from project related traffic, especially vehicles transporting oversize / over-mass loads.

An additional six key locations and intersections were identified during the route analysis assessment. The proponent has met with DTMR since January 2017 to collaboratively manage the potential impacts to roads; and I note the proponent has committed to further consultation with DTMR. I support this collaboration continuing.

I am confident the proponent has the experience to manage impacts to roads—as demonstrated by the successful construction and operation of other wind farms including the Hallett Wind Farms, Macarthur Wind Farm, and the Oaklands Hill Wind Farm.

I have recommended the proponent upgrade any necessary intersections in consultation with DTMR prior to the commencement of significant project-related construction works (Appendix 5).

I have also recommended the proponent update the road impact assessment and the draft road use management plan for each phase of the project (Appendix 5). The road use management plan must be developed in accordance with DTMR's Guide to Preparing a Road-use Management Plan[42] and be approved in writing by DTMR six months prior to commencement of significant construction works.

Furthermore, DTMR and regional councils relevant to the project may require the proponent to enter into infrastructure agreements to formalise arrangements about transport infrastructure works, contributions and road use management strategies.

I note all relevant licenses and permits required under the *Transport Infrastructure Act 1994* for works within the state-controlled road corridor must be obtained no later than three months, or such other period agreed in writing with DTMR, prior to the commencement of significant construction works.

5.5 Hazards and Risks

5.5.1 Introduction

The EIS assessed hazards and risks within and adjacent to the project site. A hazard is defined in the *State Planning Policy – State interest guideline: Natural hazards, risk and resilience*[43] as "a source of potential harm or a situation with a potential to cause loss".

Risk has been defined in the Australia / New Zealand International Organisation for Standardisation - *Risk management - Principles and guidelines* (AS/NZS ISO 31000:2009),[44] as the "effect of uncertainty on objectives".

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[42] Department of Transport and Main Roads (DTMR), *Guideline for preparing a Road Use Management Plan,* DTMR, 2016. Available from DTMR at MDP@tmr.qld.gov.au

[43] Department of Infrastructure, Local Government and Planning (DILGP), *State Planning Policy – State interest guideline – Natural hazards, risk and resilience,* DILGP, 2006.

[44] Standards Australia/Standards New Zealand, *AS/NZS ISO 31000:2009 – Risk management – Principles and guidelines,* Standards Australia, Sydney and Standards New Zealand, Wellington, 2009.

A qualitative hazard and risk assessment, in accordance with the AS/NZS ISO 31000:2009 process, was undertaken as part of the EIS to determine the potential risks to people and property within and adjacent to the project site.

Submissions on the EIS

Submissions on the EIS relating to hazards and risks raised the following issues:

- evacuation planning and procedures in relation to bushfires should be included in a Bushfire Management Plan (BMP)
- nearby landowner concerns regarding increased bushfire risk from wind turbines
- safety management plans and emergency response procedures
- Queensland Fire and Emergency Services (QFES) endorse the risk assessment methodology.

As part of my evaluation I have considered each submission and how further information provided by the proponent has responded to submitter issues.

5.5.2 Hazards

Hazards and risks associated with the project were assessed in the EIS across a broad range of project activities using a risk matrix approach.

The EIS identified 13 potential hazard events. Seven of these were natural hazards that included major rain upstream of the project site, floods, lightning, storm events, cyclones, landslides and bushfires. The remaining hazards include snake bite, unauthorised access to site, accidents involving operation of site machinery/equipment and hazardous substance spills.

An assessment of bushfire hazards was undertaken and presented in the EIS. Bushfire hazard mapping, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and presented as part of the EIS, designates the study area as potentially subject to ‘Medium’, ‘High’ and some small areas of ‘Very High’ potential bushfire intensity. This mapping has been compared to and is consistent with the State SPP Interactive Mapping System for bushfire hazard areas.

Using the AS/NZS ISO 31000:2009 risk assessment procedure, expected consequences are given to each of the risks which were identified. Each expected consequence is then assessed for its likelihood, estimated on the basis of the probability of each consequence occurring.

Bushfire

A desktop assessment of bushfire hazard was undertaken as part of the EIS. The assessment considered the environmental values that may potentially have an impact on, or be impacted by bushfire such as: landform (slope and aspect), vegetation, climate (temperature, relative humidity, wind direction and rainfall) and geology within and adjacent to the project site.

Further information on the environmental values relating to landscape, ecology and geology is presented in Chapter 5 Landscape and Visual Assessment, Chapter 12

Flora and Fauna, and Chapter 16 Topography, Geology and Soils in the EIS. Potential ignition and fuel sources from activities that currently occur or are likely to occur at the project site, were also considered.

5.5.3 Risks

The EIS considered risks involving people and property when addressing natural and man-made hazards related to the project. Potential risks were rated and ranked using a risk matrix (Table 5.5) by taking the combination of the expected consequence and the likelihood of its occurrence and then classifying the significance of the risk (Table 5.6). Consequence was ranked from 'Minor' (rating of 1) to 'Catastrophic' (rating of 5), while likelihood was ranked from 'Rare' (rating of A) to 'Almost Certain' (rating of E).

Table 5.5 Risk matrix

Likelihood	Consequence				
	1	2	3	4	5
E	11	16	20	23	25
D	7	12	17	21	24
C	4	8	13	18	22
B	2	5	9	14	19
A	1	3	6	10	15

Table 5.6 Significance classification

Classification	Colour code
High risk	16-25
Medium risk	7-15
Low risk	1-6

Potential risks to people, classed as medium-risk following the application of mitigation and management measures, include:

- injury or death resulting from bushfires on the project site
- injury or death resulting from accidents involving the operation of site machinery and/or equipment
- death or serious injury from unauthorised access to hazardous areas of the project site (i.e. areas for storage of hazardous goods and substances or where there is risk of a fall from height) which may include the temporary construction compound, substation and turbine sites
- bites to site personnel from venomous snakes
- direct or indirect effects of lightning strikes.

5.5.4 Impacts and mitigation

Mitigation measures are designed to minimise the hazard's significance of impact through a variety of controls, from hazard elimination and substitution to adherence to controls such as use of personal protective equipment (PPE).

Management and mitigation measures for the project are informed by the proponent's health, safety and environment policy as well as relevant statutory and regulatory obligations including:

- *Queensland State Planning Policy – state interest guideline: Natural hazards, risk and resilience*[45]
- *Work Health and Safety Act 2011* (WHS Act)
- *Fire and Emergency Services Act 1990* (FES Act)
- National Standard for the Storage and Handling of Workplace Dangerous Goods[46]
- Australian Dangerous Goods Code[47]
- AS 3959-2009 Construction of buildings in bushfire-prone areas[48]
- AS/NZS ISO 31000:2009 Risk Management[49]
- relevant local planning policies.

The project area may be subject to localised flooding, bushfire and landslide natural hazards. Following the application of mitigation and management measures no extreme or high risks to people or property were identified as a result of the project.

The wind turbines would be located on ridgelines and therefore would not be affected by large-scale flooding. However, the construction of access roads could potentially increase the risk of flooding at waterway crossings. To minimise this risk, all crossings would be designed so that any increase in flow, as a result of the project, would not cause significant impacts to adjoining property owners.

The wind turbines that would be located on ridgelines, would include some areas that would have slopes in excess of 15 per cent. Consequently landslide hazards could exist. All infrastructure including wind turbines and access roads would be designed and constructed to ensure safety and stability in areas of steep slopes.

Bushfire

An increase in occurrence and severity of bushfires within and surrounding the project area has been identified in the EIS. Construction activities on site have the potential to temporarily increase the risk of bushfire.

The events that could lead to this may include: lightning strike, fire as a result of electrical equipment, hot work during construction (i.e. activities that can be a source of ignition such as welding or soldering), and temporary bulk storage of hazardous materials.

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[45] Department of Infrastructure, Local Government and Planning (DILGP), *State Planning Policy – state interest guideline – Natural hazards, risk and resilience,* DILGP, Brisbane, 2016.
[46] National Occupational Health and Safety Commission, *NOHSC:1015 National Standard – Storage and Handling of Workplace Dangerous Goods,* National Occupational Health and Safety Commission, Sydney, 2001.
[47] National Transport Commission, *Australian Code for the Transport of Dangerous Goods by Road & Rail,* 7.4 edition, National Transport Commission, Melbourne, 2016
[48] Standards Australia, *AS 3959-2009 – Construction of buildings in bushfire-prone areas*, SAI Global Limited, Sydney, 2009.
[49] Standards Australia/Standards New Zealand, *AS/NZS ISO 31000:2009 – Risk management – Principles and guidelines,* Standards Australia, Sydney and Standards New Zealand, Wellington, 2009.

There is also a minor level of risk for the potential of bushfires resulting from the operation of the project as the turbines are equipped with electrical components.

In order to assist in reducing the bushfire risk in the project area, the proponent has committed to a number of management objectives during the design, construction and operational phases of the project. These include:

- development of a bushfire management plan that would address matters required by the SDAP state interest for natural hazards
- preparation of emergency provisions for property owners neighbouring and hosting wind turbines
- maintenance of fire breaks around the construction site
- ensuring that buildings meet the specifications and requirements of AS 3959-2009
- maintaining vegetation to remove any potential forest fuels
- providing suitable ingress and egress to the project site and escape routes
- preparing and implementing an emergency evacuation plan for both construction and operation phases in consultation with local emergency management and disaster management groups.

A full list of proponent commitments relating to bushfire risk can be found in Appendix 5 of this report.

5.5.5 Coordinator-General's conclusion – hazard and risk

I am satisfied that the EIS has identified and assessed potential hazards and risks during the construction and operation of the project and that suitable mitigation measures have been proposed.

I have stated a condition for the proponent to develop and submit a bushfire management plan to DILGP prior to commencement of construction. The proponent must ensure that the development is carried out in accordance with the approved plan.

I have also stated a condition for the proponent to submit an emergency evacuation plan for all stages of the project to the chief executive administering SPA three months prior to construction commencing. The plan must be completed in consultation with state and regional emergency services providers, including the Darling Downs Hospital and Health Service. The development must be carried out in accordance with the approved plan.

I have made a recommendation that all buildings in bushfire prone areas should be constructed to comply with AS 3959-2009 Construction of buildings in bushfire-prone areas.

5.6 Social impacts

5.6.1 Introduction

Relevant policies and legislation

The social impact assessment (SIA) for the project included in the EIS was conducted in accordance with the principles of the Coordinator-General's *Social impact assessment guideline: July 2013*. The SIA was also informed by a revised draft of the guideline dated June 2016.

In addition to the requirements of the July 2013 guideline, the proponent was required to:

- define the project's social and cultural area of influence
- define community engagement strategies for all stages of the project, including complaints resolution processes
- present a social baseline study of the people residing in the projects social and cultural area
- develop the following social impact action plans to mitigate the negative impacts of the project:
  - workforce management action plan
  - housing and accommodation action plan
  - social infrastructure, community health and well-being action plan
  - stakeholder and community consultation and engagement action plan
- identify any potential cumulative impacts resulting from other projects in the area.

5.6.2 Submissions received

Key issues raised in submissions on the EIS regarding potential social impacts included:

- support for the project, particularly its economic development opportunities
- potential impacts to mobile phone, television and satellite internet through electromagnetic interference (EMI) generated by the wind farm
- opportunities for residents to discuss operational impacts with the wind farm operator
- concerns about noise impacts on quality of life and human health
- potential negative impacts on land values
- request for the proponent to report on the local and regional benefits of the project, including contributions made to the local economy
- local councils requested engagement on the preparation of community engagement and local industry participation plans
- request for engagement with local Queensland Health providers on the completion of a health management plan relating to potential service delivery impacts

- nuisance created by construction traffic along haulage routes
- visual impacts created by wind turbines dominating the landscape
- potential nuisance generated by shadow flicker
- community consultation not being consistent and biased towards AGL's views
- potential supply impacts on the housing market.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and my assessment is provided below.

5.6.3 Social impact mitigation and management

Community and stakeholder engagement plan

I consider that the proponent has undertaken well-planned and extensive stakeholder consultation and community engagement for the project to date. Consistent with national and international good practice, the proponent commenced community engagement activities at the earliest practicable stage in the project, i.e. upon becoming the project proponent in 2008.

As part of the project's assessment under the now ceased community infrastructure designation (CID) process an initial round of public consultation was undertaken between November 2010 and April 2011. Following the CID community consultation process, the following consultation events and activities were undertaken:

- community information drop-in sessions during the public notification period of the EIS, which were advertised in all local media
- AGL organised and hosted a guided tour to an operational wind farm
- meetings with the local business community regarding tendering requirements for employment opportunities
- regular Community Consultative Committee (CCC) meetings to discuss the latest developments with the project
- regular community newsletters
- individual discussions with nearby landowners (affected and non-affected)
- consultation with Western Downs Regional Council (WDRC) and South Burnett Regional Council (SBRC)
- road pavement assessments with WDRC and SBRC
- consultation with State agencies
- consultation with State and Commonwealth members of parliament.

The purpose of a community and stakeholder engagement plan is to discuss and explain the project to affected members of the community; identify and respond to social impact issues; and to explain the ongoing community engagement strategy throughout the life of the project.

A draft community and stakeholder consultation, collaboration and engagement plan was included in the project's final EIS. The plan commits to inform the community about project schedules and programs, project contacts and communication

procedures, including notification processes, grievance mechanisms, complaints reporting and monitoring protocols.

The plan also focuses on maintaining and building relationships that have been established since AGL purchased the project in 2008.

I have imposed a condition requiring the proponent to provide annual social impact management reports (SIMR) for a period of five years from commencement of construction (Appendix 1). The SIMRs would describe the strategies and actions implemented and the outcomes achieved to inform, engage, consult, collaborate and negotiate with stakeholders and demonstrate that their concerns have been considered. The proponent is required to make to make the reports publicly available on their website during each year of the reporting period.

I have also imposed a condition (Appendix 1) requiring the proponent to update the social impact assessment presented in the EIS, if the project has not commenced construction within three years. This will ensure that the proponents social impact mitigation strategies are based on the latest available information.

The proponent has committed to employ a dedicated community engagement manager for the construction and early operations phases of the project.

The proponent has also committed to the following consultation collaboration and engagement activities for the pre-construction, construction and operational stages of the project:

- consult, collaborate and engage with landowners to determine methods to prevent disruption to current agricultural practices and to avoid areas of high quality agricultural land
- collaborate and engage with the surrounding community about the scheduling of construction activities
- consult with TMR, WDRC, SBRC and stakeholders on preparation and implementation of a road use management plan and a traffic management plan, including investigating alternative routes for deliveries which avoid school bus routes and populated areas
- establish regular community consultation processes regarding noise created by the project
- provide stakeholders with results of compliance noise measurements at sensitive receivers located in proximity to the project to ensure compliance with the wind farm state code and supporting planning guidelines
- implement a complaints procedure for the project and develop appropriate management strategies in consultation with the affected party (possible issues of concern include noise, shadow flicker and EMI impacts)
- establish a dialogue with Traditional Owners and collaborate on the development of a cultural heritage management plan that includes access arrangements for Traditional Owners during construction activities
- investigate, consult and resolve any heritage-related complaints and address accordingly

- provide avenues for consultation with aviation stakeholders to resolve any issues arising during the project with respect to aviation-related factors.

I support these commitments, and require them to be undertaken by the proponent. The commitments are included at Appendix 1 of this report.

The SIA notes that where appropriate, the proponent has committed to coordinating local and/or regional community engagement processes with other nearby project proponents. This will work to minimise 'consultation fatigue' for the local community.

In addition, as further evaluated in other sections of this report, the proponents also committed to incorporate consultation, collaboration and engagement into their construction and operations management plans and implement the consultation commitments they have made with respect to:

- noise (refer to Section 5.3)
- traffic and road conditions (refer to Section 5.4)
- EMI impact management (refer to Section 5.7).

I consider that the information presented in the SIA sufficiently demonstrates the proponent's commitment to implement ongoing consultation collaboration and engagement processes with stakeholders during the pre-construction, construction and operational stages of the wind farm.

Workforce management plan

The proponent has committed to complete a workforce management plan for my approval prior to construction. The plan will ensure the proponent takes into consideration the demand for labour supply in the local and regional area, provides strategies for recruiting workers in areas of high unemployment and commits to appropriate training and development strategies for the recruitment of local workers and the development of workplace employee wellbeing strategies and a code of conduct.

The project would require a peak construction workforce of approximately 350 people over 27 months. The proponent is committed to sourcing the majority of employees locally from within the local and regional study area, with a small proportion of highly specialised workers being sourced from elsewhere in Queensland. The proponent has committed to develop and implement a recruitment plan prior to construction that would detail:

- workforce participation strategies providing employment opportunities and programs for indigenous and minority groups
- recruitment planning—the use of local recruiting agencies and strategies giving preference to maximising opportunities for local employment
- provision of appropriate contractual arrangements with contractors to facilitate local employment opportunities.

Maximising local and regional employment opportunities for the relatively small construction workforce is not expected to have a net negative impact on the existing labour workforce in relation to causing skills shortages or a loss of local workers to the

project. In the context of the regional economy and unemployment, I consider that the project would have positive impacts (further details on economic impacts can be found in Section 5.16).

Housing and accommodation plan

The proponent has committed to complete a housing and accommodation plan for my approval prior to construction. The plan will demonstrate that the impact of the project on the local housing and accommodation market has been appropriately considered, particularly in the areas of rental and purchase costs.

AGL has also committed to reviewing and updating the housing and accommodation plan should there be major impacts from the project on the local housing and accommodation market during the construction of the project.

The SIA states that the project's workforce would be predominantly local therefore a workers accommodation camp would not be required and no fly-in, fly-out arrangement is proposed. With a management strategy focusing on the majority of construction workers being recruited from the local and regional area, it is anticipated that the construction workers would already reside in the region and there would be no additional impact on the housing market.

The management strategy to be implemented in relation to the limited numbers of specialised workers sourced from outside the region is to house them in short-term commercial accommodation. Suitable accommodation for these construction personnel is available in Kingaroy, Dalby, Jandowae, Bell and Kumbria.

The project would require an operational workforce of up to 20 people. It is expected that the project would create both direct and indirect employment opportunities. It is expected that there will be minimal impact on the local housing market during both construction and operations.

Local business and industry content plan

The purpose of a local business and industry content plan is to provide local and regional suppliers with project procurement opportunities.

The proponent has committed to complete a local business and industry content plan for my approval prior to construction.

The proponent has committed to providing opportunities for local and regional business to supply goods and services to the project. The proponent has also informed local councils and organisations such as Toowoomba Surat Basin Enterprise and Advance Western Downs of the proposed project and identified opportunities for local business participation.

Other than the wind turbine components, the services, equipment and materials required for the project are typical for construction projects in the region and it is anticipated that they would be locally available.

The project would benefit the local and regional economies by employing local workers and by offering opportunities for local suppliers to provide resources for the construction phase of the project.

Health and community wellbeing plan

The purpose of a health and community wellbeing plan is to ensure that potential service delivery issues in relation to local health, community services and infrastructure, are mitigated or managed during the construction and operation of the project.

During the consultation processes undertaken for the EIS the community and stakeholders raised community health and safety concerns with regard to:

- the need for traffic management planning and traffic safety arrangements
- increased traffic volumes and increased road safety concerns
- the need for environmental monitoring processes
- potential increases in noise and dust impacts for local residents during construction
- emergency planning processes and protocols
- potential increase in bushfire risk
- potential impacts to general aviation activities
- health impacts from operational wind farm noise.

The proponent has made a commitment to complete a health and community wellbeing plan in conjunction with relevant emergency services providers as well as the Darling Downs Hospital and Health Services. I support this commitment, and require it to be undertaken.

Also, in response to community concerns about project impacts, the proponent has committed to develop and implement a range of mitigation and management strategies including:

- an emergency response plan (including evacuation processes and bushfire management) in consultation with Queensland Fire and Rescue Service, Queensland Police Service, Darling Downs Hospital and Health Services and the Queensland Ambulance Service
- air quality, construction noise and vibration, and water management impacts to be managed through a construction management plan, at the commencement of construction, including processes for managing and monitoring and informing stakeholders of noise and dust impacts and potential bore and water flow issues for local residents
- managing potential nuisance activities, including notifying residents and stakeholders of noise-generating activities, time restrictions on activities, dust suppression and maintaining and operating equipment, plant and machinery in accordance with manufacturers' guidelines
- a weed management plan to prevent the introduction of new weeds species and the spread of declared weeds

- a mosquito management plan to protect the health of local residents and workers
- a designated community engagement manager to be appointed, with responsibility for complaint management processes and procedures
- a social impact monitoring program in order to identify and respond to any unexpected impacts.

In addition to the above committed mitigation and management strategies, the following community concerns, which are further evaluated in other sections of this report, would form part of the proponents' health and community wellbeing commitments for the monitoring of potential impacts including:

- noise monitoring to ensure compliance with approved levels for noise (5.3)
- monitoring of EMI impacts on local communications services (Section 5.7)
- continued consultation with CASA, Airservices Australia and the Department of Defence to mitigate any safety impacts to aviation activities (Section 5.13)
- ongoing consultation with emergency services providers (Section 5.5).

Concerns about community health impacts from the operational noise of the wind farm have been addressed in Section 5.3 of this report.

As a consequence of the above measures and the information presented in the EIS I am satisfied the proponent is committed to managing health and community wellbeing impacts during the construction and operational stages of the wind farm.

All commitments discussed above, included at Appendix 5 of this report, are supported and required by me to be undertaken.

In addition, I have recommended a number of stated conditions to be attached to the project's development permit for a material change of use under the *Sustainable Planning Act 2009* to ensure the health and community wellbeing impacts of the project are appropriately managed. These conditions include demonstrating compliance with the noise requirements of the wind farm state code through the provision of a noise monitoring plan, an emergency management plan, and a construction management plan to manage dust and construction noise impacts. These plans will be submitted to DILGP.

Cumulative impacts

Potential cumulative impacts of the proposed South Burnett Coal Project were considered should there be an overlap of construction schedules of the two projects. AGL have committed (Appendix 5) to work with South Burnett Coal, WDRC and SBRC, DTMR and impacted stakeholders to manage any cumulative impacts.

Cumulative impacts of other existing and future projects have been taken into account with reference to the following nearby projects when assessing the level of housing stock, social service usage and employment in the region. This project is not expected to impose significant impacts to the region's labour force or housing stock when considered in conjunction with the following projects as it is unlikely that all projects would occur at the same time:

- Tarong Northern Land Ash Emplacement Project
- Wetalla Water Pipeline
- Surat Gas Project
- Queensland Curtis LNG Project
- Warrego Highway Upgrades
- the proposed New Acland Coal Mine Stage 3.

The SIA concludes that it would be unlikely for there to be cumulative social impacts as a result of the project.

5.6.5 Coordinator-General's conclusion – social impacts

Overall, I consider the project would generate net social benefits for the region and that commitments made by the proponents will ensure that identified social impacts would be appropriately mitigated or managed and opportunities maximised. All commitments made by the proponent have been included in Appendix 5 of this report, and I require them to be undertaken.

I have imposed a condition for the proponent to produce an annual Social Impact Management Report (SIMR) on the implementation of the commitments and the outcomes achieved to mitigate and manage social impacts. The annual SIMRs must be produced for a period of five years from the commencement of construction of the project. Each SIMR must be made publicly available on the proponents' website during each year of reporting.

Community and stakeholder consultation

I note the proponent's commitment for a structured and integrated approach to consultation activities to ensure that directly impacted landholders have access to information, processes and protocols that provide them with opportunities to participate, collaborate and negotiate on proposed mitigation and management strategies for specific landholder issues and broader community social impacts.

Therefore, I am satisfied that the consultation, engagement, collaboration and negotiation processes proposed for the life of the project are comprehensive and well targeted to identify community and stakeholder issues. The SIMR requires the proponent to publicly report back to me on community and stakeholder engagement activities and I consider that this will ensure that the proponent regularly and appropriately engages with the community.

Workforce and housing

I acknowledge that the proponents have committed to mitigation and management strategies in relation to potential construction workforce and housing impacts. This includes revising the workforce and housing plan should there be major impacts from the project on the local housing and accommodation market during the construction of the project.

I consider that the information presented in the EIS sufficiently demonstrates that minimal impacts from construction workers on the local and regional labour and housing markets are expected. These impacts would be reduced by the proponent's commitment to maximise local employment.

Local business and industry content

I acknowledge that the proponents have committed to mitigation and management strategies in relation to local business and industry content and I note that the proponent has already informed local councils and organisations of the project and identified opportunities for local business participation.

I consider that the information presented in the EIS sufficiently demonstrates the impacts on local businesses during the construction and operation of the project would be minimal. I require the relevant commitments (Appendix 5) to be undertaken.

Health and community wellbeing

The proponent has made a commitment to complete a health and community wellbeing plan in conjunction with relevant emergency services providers as well as the Darling Downs Hospital and Health Services. The project's draft management plans for construction and emergency management would be updated prior to construction and submitted to me for approval.

I have recommended a number of stated conditions to be attached to the projects development approval for a material change of use under SPA to ensure impacts to community safety, health and well-being are appropriately managed.

I note that the proponent has been engaging with the local community since 2008 and AGL is committed to continue this community engagement throughout the life of the project. I consider community engagement is key to the proponent being accepted by the local community to construct and operate the wind farm.

I consider the potential social impacts that may occur as a result of the project can be appropriately managed through the project commitments (Appendix 5), my imposed conditions and my stated conditions. I am satisfied that the project will bring new opportunities for employment and local businesses in the region.

5.7 Electromagnetic interference

5.7.1 Introduction

Electromagnetic interference (EMI) can distort transmissions from digital, radio or television (TV) stations and may arise from many sources, being either man-made or natural. Wind farms have the potential to generate EMI.

The term radio communications is used broadly to encompass all services that rely on electromagnetic or radio waves to transfer information.

The radio communication service most likely to be affected by EMI generated by wind farms are microwave signals. Microwave signals are used for line-of-sight (i.e. the path between two antennas) connections for data, voice and video.

Relevant policies and legislation

EMI as it relates to wind farms is regulated by DILGP through the wind farm state code.

The wind farm state code planning guideline provides guidance for the assessment of EMI potentially generated by wind farms, including advice and methodologies to: identify likely affected parties, assess the EMI impacts, consult with affected parties, and develop mitigation strategies to address potential EMI impacts.

Assessment methodology

Radio communications are licensed and licences are generally described as base-to-mobile style communications which include radio broadcasting, commercial and private telephony. These licence types can be affected by terrain, vegetation and other forms of signal obstruction, as well as the presence of wind turbines.

If not properly designed, wind farms have the potential to interfere with radio communications services. The assessment in the EIS confirmed that the project will be designed and sited to ensure minimal EMI to pre-existing digital, radio or TV reception and other forms of transmission.

Consistent with requirements of the wind farm state code, the EIS presented an assessment of the potential impacts of the project on radio communication services in the vicinity including:

- fixed licenses (point-to-point links, point-to-multipoint links and other links)
- radio communication assets belonging to emergency services
- aircraft navigation systems
- aviation and meteorological radar
- trigonometrical stations
- radio-frequency identification (RFID) tags
- citizens band (CB) radio and mobile phones
- wireless internet
- satellite TV and internet
- broadcast radio
- broadcast TV.

The EIS identified all of the telecommunication towers within 75 km of the project area. The EIS assessed the telecommunication licences attached to these towers by searching the Australian Communications and Media Authority (ACMA) radio communications database.

An ACMA database search was undertaken in March 2016 and identified 428 licences within the nominal 75 km of the wind farm.

In addition, during the EIS process the proponent consulted 15 organisations, including local emergency services providers and Telstra, that operate services that could be impacted by the project. This involved dissemination of basic information on the project, and a request for the organisation to respond regarding whether they foresaw any potential impacts.

Responses were received from six organisations, all of which did not foresee any issues created by potential EMI generated by the wind farm. These responses are discussed later in this chapter.

5.7.2 Existing environment

Australian Communications and Media Authority licence listings

The results from the search of the ACMA database outlined in the EIS provided information about the existing radio communication services in the area and concluded:

- no mobile phone and TV broadcast tower links pass over the project site
- the Telstra exchange terminal at Cooranga North is the closest (approximately 1.8 km) communication (mobile phone) tower to the wind farm
- the Mt Mowbullan station, owned by the Bureau of Meteorology (BoM) is the closest point-to-multipoint base station and is located around 17.5 km east southeast of the project site
- there are five emergency service organisations with licences for operating radio communication assets in the search area:
  - Queensland Police Service
  - Queensland Ambulance Service
  - Queensland Fire and Emergency Services
  - St John Ambulance Australia
  - Moore Linville Bush Fire Brigade
- a company called Aleis International which develops and markets a product for tagging and tracking of livestock (RFID tags) is operating in the vicinity of the project.

Mobile phones

The EIS states that the project study area has:

- small areas of 4G and 3G coverage for Telstra services
- some locations only covered by Telstra 3G when an external antenna is used
- marginal Optus and Vodafone network coverage
- some locations that can only access mobile satellite coverage.

Wireless internet

The EIS confirmed that wireless internet service around the study area is likely to be provided via the 4G or 3G mobile phone network where there is coverage.

Satellite television and internet

In some rural or remote areas, TV and internet access can be provided through satellite only. Satellite TV is delivered via a communication satellite to a satellite dish connected to a set-top box.

In the case of satellite internet, the user's computer is connected to a satellite modem which is in turn linked to a satellite dish/antenna mounted on the building roof. When the user browses a webpage, a request is sent to the operations centre of the satellite internet provider via the satellite antenna. The webpage information is then sent back to the user's computer via the same path.

According to the Australian Internet Service Provider directory, there are at least nine satellite internet providers operating in the vicinity of the project.

The Australian National Broadband Network (NBN) satellite internet service Sky Muster is available to the area surrounding the project.

A number of residents in the vicinity of the project may have access to satellite TV. The main satellite for Pay TV and free-to-air TV in Australia is the Optus C1 satellite.

Terrestrial television broadcasting

Terrestrial TV, also known as broadcast television, is broadcast in digital format by a number of networks. The term "terrestrial" is used to distinguish this type from the newer technologies of satellite television. The main transmitter used by residents in the vicinity of the project is the Darling Downs transmitter located on Mt Mowbullan approximately 18 km south-east of the project site.

5.7.3 Impacts and mitigation

Potential impacts during construction

There is the potential for disruption of TV and radio reception in the area as the turbines are constructed.

Potential impacts during operations

The EIS states that in general, Very High Frequency (VHF) and Ultra High Frequency (UHF) band radio signals, and digital voice-based technologies such as mobile phones with 3G and 4G capabilities are essentially unaffected by wind farm development. This includes land-based mobile repeaters, radio and mobile phones.

Potential impacts to terrestrial television broadcasting

Broadcast towers around the project site were investigated as part of the EIS assessment to determine if TV interference would be an issue. The EIS states that digital TV signal interference is typically limited to around 5 km from the broadcast transmitter.

The EIS states that Digital TV signals are typically more robust in the presence of interference than the phased out analogue TV signals were, and are generally unaffected by interference from wind turbines.

According to the Australian Broadcasting Corporation reception coverage estimator website, the area around the project is likely to be able to receive a digital TV signal from the Darling Downs Mt Mowbullan transmitter.

However, there are some areas around the project where there is variable or no coverage from the Mt Mowbullan transmitter. Therefore some dwellings in the vicinity of the project would be unable to receive a digital TV signal of acceptable quality prior to the installation of the wind turbines.

Furthermore, the EIS notes that the project is located in an area where TV coverage is adversely affected by the Bunya Mountains to the southeast of the project site. As such, there is a risk that some dwellings in the vicinity of the project may be screened from the transmitter, and may receive a reflected signal from the wind turbines that is stronger than the signal from the transmitter. This has potential to impact digital TV reception.

Therefore, although digital TV signals are generally unlikely to be susceptible to interference from wind turbines in areas of adequate signal strength, interference could be encountered in areas where reception is marginal.

Results of AGL's communication with licence holders

As discussed, responses were obtained from six of the communication system licence holders in the area, and none indicated that their services were likely to be impacted.

Aleis International

Aleis advised that strong electromagnetic fields can cause problems for their system and interference problems have been encountered either at Aleis' factory in Jandowae (which is located around 50 metres from electricity distribution lines.

Because Aleis have advised AGL that they do not expect problems from the operation of the wind farm, the EIS concludes that the operation of the wind farm is not expected to affect Aleis International's operations.

Emergency services

Emergency services operating radio communication assets in the vicinity of the project have been identified and contacted to determine if their services are likely to be affected by the project. Other than the Queensland Police Service, none indicated that their services are likely to be impacted.

Queensland Police Service

The Queensland Police Service raised a question regarding potential impacts to UHF mobile communications. The EIS concludes that impacts to UHF mobile communications from the wind farm are very unlikely. The issue was not raised by the Queensland Police Service again during the broader consultation period on the draft EIS.

Aviation radar

Consultation with the Department of Defence, the Civil Aviation Safety Authority (CASA) and Airservices Australia (ASA) has been carried out by AGL to determine the likely impact of the project on radar services. Feedback from this consultation identified that the project would not impact on radar systems.

Bureau of Meteorology (BoM)

The BoM was contacted to provide feedback on the potential impacts of the project on their meteorological radar operations. BoM conducted an analysis to determine interference zones for nearby BoM radar installations and concluded that the project should not cause interference to nearby radar installations.

Satellite television and internet

The satellite internet providers operating in the vicinity of the project were contacted to determine if their services were likely to be impacted. All but three of the providers responded, and none indicated that they foresaw an impact to their services.

Submissions on the EIS

Three property owners near the proposed wind farm made submissions on the draft EIS raising concerns about the potential for EMI to affect mobile phones, TV and satellite internet. As the area around their properties is already considered a 'black spot' for reception, the submissions noted that any reduction in reception quality could have safety implications due to a lack of ability to contact emergency services.

Emergency services agencies did not indicate concerns that EMI generated by the project would have an impact on telecommunication services.

Proposed mitigation measures

Terrestrial television broadcasting

In the event that TV interference is an issue during wind farm construction or operation, there are several mitigation options available such as:

- realigning the householder's TV antenna more directly towards their existing transmitter
- tuning the householder's antenna into alternative sources of the same or more suitable TV signal
- the installation of a more directional and/or higher gain antenna at the affected dwelling
- relocating the antenna to a less affected position
- the installation of satellite TV at the affected dwelling
- installation of a TV relay station.

I have stated a condition requiring the proponent to engage a suitably qualified person to undertake an assessment of television (and radio and radar) reception if a complaint is received. If the assessment establishes an unacceptable increase in interference to

reception as a result of the wind farm, the proponent must undertake measures to restore the affected reception to a reasonable standard.

5.7.4 Coordinator-General's conclusion - EMI

As discussed, due to the concerns raised by a number of nearby landowners about EMI impacts, I have stated a condition that the proponent must undertake measures to restore any TV, radio and/or radar reception to a reasonable standard where it has been demonstrated that the wind farm has interrupted reception strength.

I am satisfied that the proponent has undertaken a thorough assessment of the potential for EMI to be generated by the wind farm during operations. I consider the assessment presented in the EIS to be appropriate for the impacts which are anticipated.

5.8 Shadow flicker

5.8.1 Introduction

Shadow flicker is defined in the wind farm state code as:

> "a shadow that is cast under certain combinations of geographical position and time of day, when the sun passes behind the blades of a wind turbine and as the blades rotate, the shadow flicks on and off. The duration of this effect, which varies according to the time of the year, can be calculated from the machine geometry and latitude of the site".[50]

Other factors which may influence shadow flicker can include:

- the height of the wind turbine and the size of the blades
- topography of the land
- intervening vegetation
- wind direction (and therefore the rotor plane of the wind turbine)
- weather (especially the amount of cloud cover in the sky)
- general visibility (including the presence of any mist, smoke and other particulates).

Relevant policies and legislation

The EIS states that the shadow flicker assessment was developed in line with the requirements wind farm state code and supporting planning guideline.

Performance outcomes within the wind farm state code provide that a proposed wind farm avoids or minimises shadow flicker impacts on existing or approved sensitive land uses.[51] The acceptable outcomes provided in the wind farm state code to meet the performance criteria are:

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[50] Department of Infrastructure, Local Government and Planning (DILGP), *State development assessment provisions – Module 20: Wind farm development,* version 1.9, DILGP, 2016.
[51] See Glossary of this report for a definition.

- modelling of shadow flicker impact on any existing or approved sensitive land use is not to exceed 30 hours per annum and 30 minutes per day within 50 m of a sensitive receptor
- wind turbine blades have a low reflectivity finish.

The associated planning guidelines provide assessment criteria and a set of assumptions for assessing shadow flicker durations within the vicinity of a wind farm. These criteria assist in demonstrating compliance with the wind farm state code.

5.8.2 Assessment methodology

The duration of shadow flicker experienced at a specific location is able to be determined using a geometrical analysis. The analysis takes into account the relative position of the sun throughout the year, location of wind turbines, local topography and the position of the viewer.

This method has been used to determine potential impacts of shadow flicker (i.e. duration) at sensitive receptors surrounding the project. The method is in accordance with the assessment requirements stated in the wind farm state code and planning guideline.

The EIS stated that this method provides a conservative estimation of shadow flicker duration as it may result in an overestimation of actual shadow flicker duration at a sensitive receptor.

The wind farm state code requires shadow flicker impacts not to exceed 30 hours per year and 30 minutes per day at sensitive land uses. The assessment method detailed in the wind farm state code planning guideline requires reporting of the maximum value of shadow flicker duration within 50 m of the centre of a sensitive receptor.

In order to estimate actual shadow flicker duration which may be experienced by a landowner, the EIS incorporated cloud cover because cloud cover has the ability to reduce shadow flicker duration. The wind farm state code planning guideline recommends the annual limit for shadow flicker be reduced to 10 hours per year if cloud cover is included in the assessment.

5.8.3 Existing environment

The wind farm state code planning guideline notes that shadow flicker can be reduced by a number of factors at a specific location including cloud cover, wind, topography, aerosols and vegetation. These factors were considered in the EIS assessment.

Cloud cover

For the EIS assessment, cloud cover data was obtained from five Bureau of Meteorology (BoM) stations surrounding the study area.

Cloud cover is generally measured in okta units (eighths of the sky covered in cloud). The okta level visible across the sky at each of the BoM stations is recorded twice a day, at 9 am and 3 pm, with observations provided as monthly averages by percentage.

The EIS indicates that the average monthly cloud cover in the region ranges between 33 per cent and 58 per cent, and average annual cloud cover is approximately 45 per cent. The EIS conducted an assessment of the likely reduction in shadow flicker duration due to cloud cover on a monthly basis and results indicate that monthly reductions of between 40 per cent and 52 per cent are expected.

Wind

The distribution of wind speed frequency at the site is able to be used to determine probable turbine orientation and to calculate any resulting reduction in shadow flicker duration.

Topography

Assessment of shadow flicker duration experienced at a specific location is determined using a geometrical analysis. This analysis takes into account the relative position of the sun during the year, location of wind turbines, the viewer and the local topography.

The EIS states that the project area is characterised by a number of ridgelines, largely orientated in a north-west to westerly direction. The proposed wind turbines are predominantly located along these ridgelines to ensure maximum exposure to the wind. The ridgelines within the project area range in height from 855 m Australian Height Datum (AHD) in the south-east of the project area, to 470 m AHD in the north-west.

Aerosols

Aerosols present in the atmosphere could include moisture, dust and smoke. Aerosols have an ability to influence shadows cast by a wind turbine. The distance a shadow is cast by a wind turbine is dependent on the strength of the sunlight. The strength of the sunlight is dependent on the amount of humidity, smoke and other aerosols between the sun and the receptor. The more aerosols present in the atmosphere reduces the intensity of the light to cause shadows.

Vegetation

Vegetation may provide a barrier between a sensitive receptor and the turbine. This would reduce the possibility for shadow flicker to be experienced. The EIS notes that the assessment has not made an attempt to account for rotor orientation, vegetation or other shielding effects around each sensitive receptor when calculating shadow flicker duration.

The EIS further states that a site visit could be undertaken during or following detailed design to allow a better understanding of the vegetation coverage in the area, and the potential for shadow flicker shielding at dwellings expected to experience shadow flicker.

5.8.4 Submissions on the EIS

Submissions on the EIS relating to shadow flicker raised issues about potential:

- impacts to human health

- exceedance of shadow flicker limits prescribed in the wind farm state code and associated planning guideline.

I have considered each submission and how the information provided by the proponent has responded to submitter issues as a part of my evaluation.

5.8.5 Impacts and mitigation

Impacts from shadow flicker are caused by wind turbines creating a strobing effect. The most common problem associated with this is annoyance for those affected.

Potential impacts during construction

As shadow flicker is only able to occur from rotating blades of a wind turbine, there are no potential impacts relating to shadow flicker during the construction of the project.

Potential impacts during operations

As stated in the EIS, the impact of shadow flicker could be significant up to a distance of around 800 m to 1325 m. Beyond this distance the shadow is diffused to a level that is not likely to cause annoyance.

For the EIS assessment, a conservative distance of 1500 m from a wind turbine to a sensitive land use was applied to assess the extent of shadows from turbines. This distance meets the separation distance requirements of the wind farm state code.

The EIS assessment considered a wind turbine with a hub height of 110 m and a rotor diameter of 140 m. The EIS calculated shadow flicker at sensitive receptors at heights of two metres to represent ground floor windows and six metres to represent second floor windows.

The EIS assessment was undertaken in accordance with the wind farm state code and planning guideline which recommend that the shadow flicker duration be assessed by calculating the maximum shadow flicker occurring within 50 m of the centre of a sensitive land use.

The EIS identified 14 receptors that would be located within 1500 m distance of the wind turbines, seven are likely to experience shadow flicker. Of these seven, six may be affected by shadow flicker durations higher than the limits provided in the wind farm planning guideline. All seven sensitive receptors that may be affected by shadow flicker belong to landholders who AGL would need to secure agreement with to host wind turbines on their properties.

Proposed mitigation measures

Shadow flicker effects can be reduced by:

- installation of screening structures and/or planting of vegetation to block shadows cast by the turbines
- use of turbine control strategies which shut down turbines when shadow flicker is likely to occur
- painting the wind turbines a non-reflective colour, such as grey.

Where shadow flicker impacts are predicted to be experienced at sensitive receptors on land that would host turbines, the proponent proposes to include shadow flicker provisions in the deed of release and to negotiate where required with landholders on the terms.

5.8.6 Coordinator-General's conclusion – shadow flicker

I am satisfied that the EIS has identified and assessed the potential impacts of shadow flicker during the operation of the wind farm.

To ensure appropriate management of potential impacts, I have stated a condition that the project must meet the performance outcomes for shadow flicker in the wind farm state code.

I have also stated a condition requiring the proponent to ensure that the wind turbine blades have a low reflectivity finish to further minimise the impact of shadow flicker. In considering project commitments I require to be undertaken, and conditions set by me, I am satisfied this matter would not cause significant project impacts.

5.9 Groundwater

5.9.1 Existing environment

The project site is located within the geological Surat Basin region and the hydrogeological Great Artesian Basin (GAB) area. Primary aquifers used for groundwater extraction within the project area include Main Range Volcanics, Marburg Sandstone and the Walloon Coal Measures.

Groundwater within the study area is currently used for domestic, industrial, stock and agricultural purposes.

Legislation and policy

Groundwater management is regulated in Queensland by the *Environmental Protection Act 1994,* Environmental Protection (Water) Policy 2009*, Sustainable Planning Act 2009* and the *Water Act 2000* in conjunction with its subordinate legislation and water resource plans.

Assessment methodology

The groundwater assessment presented in the EIS involved:

- the review of relevant legislation and policy
- an assessment of EVs which may be affected by the project
- a review of information on groundwater quality, use and availability within the project site
- discussions with DNRM on water supply options for the construction and operation phases of the project.

The EIS assessment included a 10 km zone around the project site boundary in order to accurately identify the existing groundwater users, EVs, and potential impacts in relation to the project activities.

Submissions received

The key groundwater issue raised in submissions on the EIS was the potential impact to groundwater through bore extraction.

I have considered these submissions and the response provided by the proponent in my evaluation of the potential impacts of the project on groundwater.

5.9.2 Impacts and mitigation

Construction impacts

Project construction activities have the potential to impact on groundwater quality, quantity and flow characteristics. Over the 27 month construction period, the project proposes to extract around 250 megalitres (ML) to be used for activities including bulk earthworks and materials conditioning, dust suppression and concrete batching.

A submission from South Burnett Regional Council raised concerns regarding the availability of groundwater for the extraction of 250 ML to be used for construction activities. A submission from a private submitter raised concerns about the impacts that the extraction of groundwater for the project would have on their groundwater supply.

The EIS states that DNRM advised groundwater would be the preferred water supply for construction. However, this would be subject to the proponent confirming the need to use groundwater during the detailed design phase and any subsequent approval process to obtain a water permit.

Mitigation measures

The proponent has committed to gauging daily groundwater levels in nearby privately owned bores, where permission has been granted. The will allow the proponent to monitor the bores and if drawdown of landowner bores as a result of the project is identified, the proponent will negotiate mitigation arrangements, which could include compensation measures.

The EIS states that groundwater supply bores will be constructed in accordance with the Minimum Construction Requirements for Bores in Australia[52], and will be installed by a licensed water bore driller.

Groundwater quality could be impacted by spills, surface runoff, seepage and leaks into shallow aquifers, and leakage from incorrect well installation. Measures proposed to manage these risks include:

- maintaining accurate records of all chemicals, fuel and oil stored on-site
- preparing and complying with an erosion and sediment control plan

[52] National Water Commission, *Minimum Construction Requirements for Water Bores in Australia,* 3rd edition, report prepared by the National Uniform Licensing Committee 2011, Canberra, 2012.

- preparing and complying with the emergency spill containment plan which will form part of the projects construction management plan
- complying with the Minimum Construction Requirements for Bores in Australia Operations.

Cumulative impacts

The EIS identified that the cumulative impacts on groundwater from the project are considered to be minor because the proponent will appropriately manage and monitor all groundwater bores in the vicinity of the project.

At the regional scale, the groundwater impacts would be considered negligible and unlikely to contribute to cumulative impacts from other projects such as the Tarong Power Station and the proposed New Acland Coal Mine Expansion: Stage 3 Project and the South Burnett Coal Project.

5.9.3 Coordinator-General's conclusion - groundwater

I am satisfied that the assessment of the potential for groundwater impacts undertaken in the EIS is sufficient. I note the proponent has committed to gauge daily groundwater levels in nearby privately owned and registered bores holes where permission is granted.

I note the proponent has committed to comply with the emergency spill containment plan in the event of a spillage/leak of potentially hazardous substances. For information on project hazards and risk, refer to Section 5.5of this report.

In addition, I note the proponent's commitment to develop and implement a sediment and erosion control plan.

These commitments are included at Appendix 1 and I require the proponent to action them.

I have stated a condition requiring the proponent to develop and submit an erosion and sediment control plan to DILGP three months prior to commencement of construction as well as a construction management plan containing appropriate procedures to mitigate the impacts of a chemical or fuel spill. I am satisfied the proposed mitigation measures, included in commitments at Appendix 5 of this report, will protect groundwater EVs and ensure potential impacts are appropriately managed.

5.10 Surface water

5.10.1 Existing environment

The project site is located within two water catchments; the Burnett River catchment in the north-east and the Condamine River catchment to the south-west.

The existing environment in the Upper Condamine catchment is described as being in a 'moderate to degraded' condition.[53] The existing environment in the Burnett catchment is described as being in a 'good to poor' condition.[54] Mount Jandowae, Downfall, Jingi Jingi and Jambour Creeks and their tributaries are located within the Condamine River catchment and intersect the project site. These creeks are ephemeral in nature and consequently, water quality is highly variable.

Legislation and policy

Surface water quality is regulated in Queensland by the *Environmental Protection Act 1994,* Environmental Protection (Water) Policy 2009*, Sustainable Planning Act 2009, Fisheries Act 1994* and the *Water Act 2000* in conjunction with subordinate legislation and water resource plans.

Methodology

The surface water assessment presented in the EIS involved: the review of relevant legislation and policy; an assessment of environmental values (EVs)[55] which may be affected by the project; a review of information on surface water quality and flooding within the project site; and discussions with the Department of Natural Resources and Mines (DNRM) on water supply options for the construction and operational phases of the project.

5.10.2 Impacts and mitigation

Construction

The DNRM basin flood mapping overlay indicates there is potential for inundation as a result of a 100 year average recurrence interval event.

However, as the project site is located in catchment headwaters at the top of the Great Dividing Range, the EIS states widespread inundation of the project site is not expected, even in extreme rain events.

The project site could be subject to overland flow during significant rain events. Runoff could flow down the range and rapidly recede when the rain event finishes. The runoff on the project site has the potential to impact on surface water EVs. The EIS states there will be no controlled releases of water or wastewater to the environment by the project.

During construction, activities that have potential to impact surface water quality include:

- earthworks associated with vegetation clearance
- earthworks and excavation associated with construction of onsite infrastructure (turbines, access roads and buildings)

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[53] Department of Primary Industries (DPI) (1994) 'The State of the Rivers Report for the Upper Condamine River', Queensland.
[54] Department of Natural Resources (DNR) (1999) 'The State of the Rivers Report for the Burnett River', Queensland.
[55] See Glossary of terms for a definition.

- trenching for underground electrical cables
- construction of waterway crossings
- use and storage of chemicals such as fuel.

These activities increase the potential for the discharge of sediments and chemicals into waterways due to exposed earth, reduced riparian vegetation and chemical spills. The construction of waterway crossings also has the potential to change in-stream geomorphology and aquatic habitat quality due to erosion; restriction of flow due to upstream ponding and restriction of fish movement. The EIS identified no major creeks used for fish movement within the vicinity of the project site.

Mitigation measures for construction

Potential impacts caused by vegetation clearing will be minimised by suitable location of wind turbines and associated infrastructure to avoid remnant vegetation. The final location of the turbines is to be determined during the detailed design phase. The stated aim is to reduce the amount of vegetation clearing required for the project. Removal of vegetation, earthworks and trenching would be undertaken in accordance with an approved erosion and sediment control plan (ESCP) in order to minimise sediment loss from runoff. I have stated a condition for the proponent to submit a sediment and erosion control plan prior to construction to DILGP.

The potential impacts from overland flow would be managed by the ESCP. The proponent has committed to minimise vegetation removal and construction activities within waterways or adjacent to waterways to reduce disturbance to those waterways and potential impacts to water quality. If required, a riverine protection permit would be obtained prior to any excavation work or placement of fill within a waterway.

The proponent commits to design creek crossings in accordance with the Department of Agriculture and Fisheries (DAF) self-assessable codes to minimise impacts to fish passage. The construction of a waterway crossing will require an operational works permit under the *Sustainable Planning Act 2009.* Chemicals will be managed by a materials handling plan contained within the project's construction management plan.

Operation impacts

The construction of impervious wind turbine foundations has the potential to increase stormwater runoff. Increased stormwater runoff has the potential to contribute to downstream flooding; and to affect instream geomorphology and aquatic habitat quality due to stream bank erosion. As in the construction phase, the presence of waterway crossings has the potential to change instream geomorphology and aquatic habitat quality due to erosion; restriction of flow due to upstream ponding, restriction of fish movement and discharge of sediments from erosion.

Mitigation measures for operation

The construction of wind turbine foundations will result in a minor increase in the proportion of impervious area in the catchment. This could proportionally result in a minor increase in the runoff. The EIS concludes this runoff would not significantly

impact the peak flood levels and volume generated. Mitigation measures for stormwater runoff have not been proposed given the small volume of water.

Waterway crossings would be designed, constructed and maintained according to relevant industry practice, guidelines and standards. The proponent commits to design creek crossings in accordance with the DAF self-assessable codes to minimise fish passage impacts.

Decommissioning impacts

The decommissioning of the project would require removal of above ground infrastructure and site rehabilitation. Earthworks associated with decommissioning of onsite infrastructure, and the use and storage of chemicals (i.e. fuel) have the potential to impact on surface water quality. The potential impacts result from the discharge of sediments and chemicals into waterways due to exposed earth and chemical spills.

Mitigation measures for operation

Prior to commencing decommissioning works, a site specific ESCP and a decommissioning and rehabilitation plan will be prepared. Decommissioning activities will be undertaken in accordance with the ESCP to minimise the discharge of sediments. I have stated a condition for the proponent to develop and submit a decommissioning and rehabilitation plan to the DILGP prior to decommissioning. I have stated a condition for the proponent to develop and submit an erosion and sediment control plan to DILGP prior to construction. A material handling plan for chemicals will be included in the decommissioning and rehabilitation plan. The storage and disposal of all hazardous materials would be in accordance with relevant guidelines and Australian standards.

Cumulative impacts

The EIS identified that impacts on surface water from the project would be considered minor, temporary and reversible. At the regional scale, the surface water impacts could be considered negligible and unlikely to contribute to cumulative impacts from other proposed projects such as the proposed New Acland Coal Mine Expansion: Stage 3 Project and the proposed South Burnett Coal Project.

5.10.3 Coordinator-General's conclusion – surface water

The proponent has undertaken an assessment of the potential for surface water quality impacts. No submissions on the EIS were received concerning surface water quality. I note the project area is not subject to riverine flooding but could be subject to overland flow during significant rainfall events. The proponent has committed to minimise vegetation removal and construction activities within waterways or adjacent to waterways to reduce disturbance to those waterways and potential impacts to water quality. I note the proponent has also committed to develop and implement a sediment and erosion control plan to manage impacts from overland flow. To ensure this I have stated a condition for the proponent to submit a sediment and erosion control plan to DIGLP prior to construction.

Furthermore, I have stated a condition for the proponent to develop and submit a decommissioning and rehabilitation plan to DILGP prior to decommissioning. I am satisfied the proposed mitigation measures would protect surface water EVs and ensure potential impacts are appropriately managed.

5.11 Cultural Heritage

5.11.1 Introduction

This section evaluates the potential impacts of the project on Indigenous and non-Indigenous cultural heritage. The EIS included a desktop assessment of known and potential cultural heritage values in the study area and a preliminary archaeological field survey. The desktop assessment involved searches of relevant state and federal registers and databases, and historical literature for the area. The preliminary archaeological field survey, was undertaken to determine potential Indigenous and non-Indigenous archaeological sites within the study area.

No submissions regarding cultural heritage were received during the EIS submission stage.

For information on Indigenous issues in relation to the broader social and economic opportunities and impacts on the local community and region, refer to Sections 5.6 and 5.16 of this report.

5.11.2 Indigenous cultural heritage

Indigenous cultural heritage in Queensland is protected under the *Aboriginal Cultural Heritage Act 2003* (ACH Act). To comply with the duty of care provisions in the ACH Act, proponents of projects requiring an EIS must prepare a Cultural Heritage Management Plan (CHMP) in consultation with the relevant Aboriginal parties for the plan area. The EIS states that the proponent will finalise the CHMP prior to construction.

5.11.3 Non-Indigenous cultural heritage

The region in and around the study area, now known as the Darling Downs and South Burnett regional areas, was first explored in 1827. The study area was opened for selection as part of the New England pastoral district in 1839 and by the 1840s, colonial settlement had occurred in the Darling Downs. The land has been subsequently used largely for pastoral purposes: initially sheep grazing, followed by dairying and then cattle grazing.

5.11.4 Impacts and mitigation

Construction impacts - Indigenous cultural heritage

A search of the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP) Cultural Heritage Database and Register found the Burunggam People,

Western Wakka Wakka People (Team McLeod), Western Wakka Wakka People (Team Beattie) and Wulli Wulli People #2 are the relevant Aboriginal parties for the study area. A CHMP would be developed in consultation with these parties prior to commencement of construction and implemented throughout the project stages in accordance with section 7 of the ACH Act.

The search also found four Indigenous cultural heritage sites were recorded across the study area. These include a stone artefact scatter and three isolated finds.

As the size of the study area (10,000 ha) precluded a full archaeological site survey, the survey targeted areas that are representative of potentially impacted construction areas. Of the areas surveyed, no Indigenous cultural heritage sites were identified. This is likely a result of the study area being extensively cleared for pastoral purposes.

Excavation activities during the construction phase have potential to impact on Indigenous cultural heritage. Excavation is needed for construction of the wind turbine foundations, digging of trenches for underground cables and the grading of roads. When these activities are undertaken along a ridgeline, in a waterway or Basalt outcropping, they have a high risk of harming any extant Indigenous cultural heritage.

These areas are classed as Category 5 under the Duty of Care Guidelines[56]. In Category 5 areas, further Indigenous cultural heritage assessment and consultation with the Aboriginal party for the area must occur prior to the finalisation of the detailed design phase and before construction.

The Duty of Care Guidelines notes that when excavation activities are undertaken in extensively cleared and ploughed areas, it is unlikely that Indigenous cultural heritage items will be found. These areas are classed as Category 4 under the guidelines.[57] If stone tools or other objects of potential Indigenous cultural heritage significance are discovered, the Aboriginal party for the area would be consulted and further Indigenous cultural heritage assessment undertaken.

Further, when activities are undertaken in roads and existing electrical easements, it is unlikely that Indigenous cultural heritage would be harmed. Further Indigenous cultural heritage assessment is not required for these activities.

In order to manage Indigenous cultural heritage, I note the proponent has committed to establishing a dialogue with relevant Aboriginal parties and to developing a CHMP in accordance with the requirements of the ACH Act.

Construction impacts Non-Indigenous cultural heritage

No sites of non-Indigenous cultural heritage are known to occur in the study area. A number of mitigation measures are provided in the EIS to protect identified non-Indigenous cultural heritage artefacts throughout the various stages of the project, should they be discovered.

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[56] Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP), *Aboriginal Cultural Heritage Act 2003 – Duty of Care Guidelines,* DATSIP, 2004.
[57] Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP), *Aboriginal Cultural Heritage Act 2003 – Duty of Care Guidelines,* DATSIP, 2004.

The preferred mitigation measure for known heritage places is to avoid impact where possible. All known heritage places and places of high archaeological potential lie outside of the project area and are considered unlikely to be impacted.

Site inductions would include information for the identification of Indigenous and non-Indigenous cultural heritage and instructions on what to do should artefacts be found. This component of the site induction would be prepared by a qualified heritage specialist.

Mitigation measures

Should Indigenous and non-Indigenous archaeological artefacts be uncovered during construction, a 'stop works' process would be implemented. For example:

- relevant work would cease in the immediate area and the site would be secured
- identified artefacts would not be removed or disturbed further, and barrier or temporary fencing may be erected if required
- DEHP would be informed by the site supervisor or onsite cultural heritage specialist of the artefacts in accordance with sections 88–90 of the *Queensland Heritage Act 1992*
- DEHP would determine the significance and future management of the artefacts.

5.11.5 Coordinator-General's conclusion – cultural heritage

The proponent has undertaken an assessment of the potential for Indigenous and non-Indigenous cultural heritage in the EIS which is appropriate for the level of detail available at this stage in the project.

I note that no submissions raised matters of cultural heritage. In accordance with the requirements of the ACH Act, I note that the proponent has committed to developing a CHMP and to establishing a dialogue with relevant Aboriginal parties. The CHMP would include mitigation strategies to ensure that any cultural heritage finds at the project site during construction are protected. I am confident that the proponent will implement the necessary measures to ensure this outcome.

With respect to non-Indigenous cultural heritage, I am satisfied the proposed mitigation would protect the cultural values and ensure potential impacts are appropriately managed, in line with the requirements of the *Queensland Heritage Act 1992*.

5.12 Greenhouse Gas emissions

5.12.1 Background

Australia has made commitments at the international level under the *United Nations Framework Convention on Climate Change* (UNFCCC) regarding greenhouse gas (GHG) emissions. The UNFCCC objective is to "stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

Within this framework, Australia is a signatory to the *Kyoto Protocol* and the *Paris Agreement.* Australia's national contribution under the *Paris Agreement* is proposed to reduce GHG emissions to 26–28 per cent below 2005 levels by 2030.

GHG is regulated in Australia by the *National Greenhouse and Energy Reporting Act 2007*, the Emissions Reduction Fund and Renewable Energy Targets.

The EIS provided an assessment of GHG emissions from the construction and operational phases of the project.

Submissions on the EIS

One submitter on the EIS raised concern over the requirement for wind power to be supplemented by fossil fuel sources but this is not proposed as part of the Coopers Gap Wind Farm.

A submitter on the EIS also raised concerns about the fossil fuels used to create the components of the wind farm. I concur that such use is unavoidable and do not require mitigation measures for this matter.

I have considered matters raised in submissions on the EIS and further information provided by the proponent in response to submitter issues as a part of my evaluation.

5.12.2 Impacts and mitigation

The EIS states that electricity generated by wind farms is recognised as a clean energy source that can meet a percentage of Australia's electricity requirements with no operational GHG emissions. Potential GHG emissions would only be produced from the construction and maintenance phases of the project.

Construction impacts

GHG emissions during the construction phase would be produced from fuel consumption, electricity consumption, stationary energy use and embodied energy from construction materials.

Fuel consumption can be attributed to:

- transportation of equipment, materials and construction workers
- the establishment of temporary site offices and material lay down areas
- clearing of the site where required
- earthworks for roads and underground cables
- foundation works
- installation of electrical and communications cables and equipment
- erection of towers and turbine structures
- construction of the substation and control room
- site restoration.

GHG emissions from electricity consumption would be from lighting for the project site and temporary site offices. GHG emissions would be generated from stationary energy

sources such as diesel generators used at the project site. GHG emissions would be released from construction materials such as concrete and pre-stressed concrete, aggregate, sand, steel, aluminium, copper, glass, reinforced plastic, wood-epoxy and injection moulded plastic with carbon fibres.

Operation impacts

The EIS states the annual GHG emissions released by non-renewable electricity generation that would be displaced by the project is estimated to be around million tonnes per year of GHG emissions.

When the wind farm is in operation, maintenance of turbines would be required. GHG emissions would be generated from fuel consumption by maintenance vehicles. The EIS states it is anticipated that the substation / switchyard facility, maintenance and operations facility, overhead and underground cabling and access roads would require minimal maintenance. Heavy equipment would be required for rare events such as repair or replacement of major components of the turbines or substation.

Mitigation

Mitigation measures to minimise GHG emissions are proposed for the construction phase activities. These measures include:

- preparation and use of a GHG reduction management plan
- GHG awareness training during site inductions
- developing a set of key performance indicators for emissions to track performance over time
- provision of passive solar design features in the site office
- installation of lights with daylight sensors on constructed paths
- lay down areas located to minimise travel distances
- purchasing materials with lower embodied energy emissions or increased recycled content where possible.

I support the proponent's commitment to use energy efficient lighting and the mitigation measures proposed to be undertaken to address GHG emissions.

5.12.3 Coordinator-General's conclusion – GHG emissions

I am satisfied the proposed mitigation measures that have been included in commitments (Appendix 5) would reduce GHG emissions generated during construction to ensure potential impacts are appropriately managed.

The important part the project itself will play in reducing GHG emissions is significant and is commended.

5.13 Aviation operations

5.13.1 Introduction

An aviation safety assessment was undertaken as part of the EIS to identify if there were any impacts on aircraft that may fly in the vicinity of the project. The assessment investigated locations of local airfields and local aircraft movements to determine potential impacts from the project on aviation operations.

Relevant policies and legislation

The Commonwealth *Civil Aviation Act 1988* (CA Act) establishes the Civil Aviation Safety Authority (CASA) as the aviation safety regulator. The Commonwealth *Airspace Act 2007* confers regulatory responsibility on CASA in relation to the administration and regulation of airspace, with safety as the most important consideration.

Performance Outcome one (PO1) of the wind farm state code ensures aircraft operations are not affected by the location, siting, design and operation of a wind farm. PO2 of the wind farm state code requests lighting of wind turbines to ensure visibility to aircraft.

5.13.2 Assessment methodology

The EIS assessed the potential risks associated with aviation operations in the project area. The aviation assessment involved the review of aviation charts and maps (including prohibited, restricted and danger areas) and the review of aviation operations which occur or are likely to occur within the project area. The assessment approach also considered requirements of the wind farm state code and relevant standards, recommendations and guidelines.

Consultation with CASA, AirServices Australia (ASA) and the Department of Defence (DoD) regarding the project has been undertaken during the EIS process.

5.13.3 Existing environment

Airfields near the project area

The EIS determined there were no licensed or unlicensed aerodromes or airfields located on properties associated with the project. There is a licensed civil aerodrome and five unlicensed aerodromes within the vicinity of the project which are used for general aviation activities.[58] These are:

- Kingaroy Airport (licensed civil)—45 km north east
- Dalby Aerodrome (unlicensed)—50 km south.
- Lyndley Station (unlicensed)—21 km south west
- Jimbour House (unlicensed)—32 km south west
- Trevanna Station (unlicensed)—40 km east

[58] See Glossary of this report for a definition.

- Nanango (Joe Anderson Airfield) (unlicensed)—50 km north-north east

Lightweight flying activities

The EIS investigated the potential for gliding, hang gliding and paragliding operations within the vicinity of the project. Gliding operations occur from Kingaroy Airport and some other airfields south of the project area but are considered too far from the project to have an impact.

The EIS determined that no hang gliding or paragliding occurred within the project area.

Airspace considerations

The EIS noted that the project is below the airspace control zones for Oakey, Amberley, Kingaroy and Brisbane Airports.

The closest danger area is the flying training area for Kingaroy Airport, located around 45 km away. The EIS identified that there was the potential for military jet activities to occur within the vicinity of the project. Military jets fly at low levels and high speeds, and use random routes in the vicinity of the project.

Aerial firefighting activities

Aerial firefighting activities in the region can be conducted by fixed wing aircraft.

Aerial agricultural operations

The EIS stated that agricultural aerial spraying and potentially fertilising may occur in the vicinity of the project using general aviation aircraft.

Rural ambulance services

The EIS identified that no fixed-wing ambulance operations occur within the project area. If required, helicopter ambulance services could occur within the project area.

Submissions received

The aviation issues raised in submissions on the EIS included the following:

- CASA indicated that the proposal is unlikely to be a hazard to civil aviation safety as the location is remote from any licensed aerodromes
- a request for the extremities of the wind farm to be lit with obstacle lighting due to low level military aircraft operations
- potential impacts to aviation activities due to the height of turbines
- ASA noted that the wind turbines will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Kingaroy Airport nor any safe altitudes at the lowest height
- ASA also confirmed that the project would not adversely impact the performance of communication, navigation and surveillance facilities (see Section 5.7).

I have considered the submissions and the responses provided by the proponent in my evaluation of the potential impacts of the project on aviation safety.

5.13.4 Impacts and mitigation

Potential impacts

Potential aviation safety risks from wind farms include (but are not limited to) impacts on flight procedures, aviation communications, navigation and surveillance facilities.

The proposed tip height of the blades of the wind turbines is 180 m above ground level. Most aircraft are required, under the current regulatory framework, to operate at least 152 m above ground level. Therefore the blades of the wind turbine would extend into navigable airspaces. The EIS notes that this has the effect of slightly raising the potential impacts for aviation operations in the vicinity of the project.

The EIS identified potential flying activities present within the vicinity of the project area as:

- general aviation (private flying and ad-hoc charter)
- ultralights and other sports aircraft including gliders
- fire bombing and other firefighting related activities
- helicopter ambulance services
- aerial agriculture
- power line surveying (rotary wing)
- military low flying aircraft.

The take-off and landing airspaces of all the licensed and unlicensed airfields and aerodromes in the vicinity of the project are too distant to be impacted.

The EIS assessment reviewed the air traffic routes which pass over or within ten nautical miles of the project. For all cases the defined lowest safe altitude (LSALT) for the listed routes are more than 305 m higher than the highest proposed turbine, therefore the project has no impact on LSALT for those listed routes.

The project will have no impact on any restricted or danger areas airspace as the closest restricted areas are located in the Oakey military control zone. This zone is not within the vicinity of the project.

The EIS investigated potential impacts to navigation aids, communication systems and radar interference. The nearest radar is located at Brisbane, with the project area being outside the potential area of influence. There would be no impact on radar from the project, which has also been confirmed in a submission on the EIS made by ASA.

The EIS identified that the project has the potential to impact low level jet operations in the area. In stakeholder consultation was undertaken as part of the EIS process DoD has raised concerns regarding lighting and recommended that at least the extremities of the wind farm be lit with obstacle lighting.

Seven permanent reference masts for meteorological monitoring (met masts) would be installed at the project site. The height of these masts varies but does not exceed 80 m

above ground level. Although the met masts can be difficult to see in some conditions, they are typically at a height that does not impact aviation operations. However, aerial agriculture and other low-level aviation operations may potentially be impacted by met masts.

The EIS determined that aerial firefighting using fixed wing aircraft within the vicinity of the project area would be hazardous and is not recommended. The EIS determined that aerial agricultural operations on the boundaries of the project may be undertaken satisfactorily as agricultural operators are familiar with operating in constrained areas. Any aerial agricultural operations within the project area would be potentially hazardous and are not recommended to be undertaken.

Helicopter ambulance operations could be restricted in the project area but these impacts would be limited to the area directly around the turbines.

The EIS determined that gliding operations would be subject to the same constraints as general aviation operations and that consultation with the Gliding Federation of Australia will be ongoing to ensure any potential issues are dealt with effectively.

Proposed mitigation measures

The EIS determined the overall risks to aviation operations in the vicinity of the project area are low. However, the wind turbines at a height of 180 m, would enter navigable airspace and therefore could potentially impact aviation activities in the area.

The EIS notes that as there is potential for low-level military jet operations to occur within or near to the project area. The proponent will continue to consult with DoD to determine the specific mitigation measures to be designed and implemented.

Similarly, the proponent has committed to ongoing consultation about met mast design with CASA, AirServices Australia and DoD. I support and require this action to be undertaken.

During the EIS consultation period, the proponent forwarded a copy of the coordinates of the proposed wind turbines to AirServices Australia for assessment. It was noted by CASA that the wind farm meets the requirements for reporting of tall structures.

Upon completion of the construction of the wind turbines, the exact locations of the wind turbines will be reported to AirServices Australia for inclusion in the Enroute Supplement Australia (ERSA), which forms part of the mandatory reference material for pilots[59].

The DoD submission on the EIS recommends that as a minimum the extremities of the wind farm be lit with obstacle lighting. The proponent has committed to consulting with DoD to ensure all safety requirements are met.

[59] See Glossary of this report for a definition.

5.13.5 Coordinator-General's conclusion – aviation operations

AGL has to ensure the turbines do not present a hazard to aircraft operators and the travelling public. I am satisfied that the EIS has identified and assessed the potential impacts of the project on aviation operations in the vicinity of the project.

I have stated conditions to ensure that the proponent will manage the risk to aviation safety from the project including:

- consulting with emergency services providers to develop a bushfire management plan
- providing the final location of wind turbines to entities such as Queensland Fire, Queensland Ambulance Service and Rescue Service, AirServices Australia and Department of Defence.

I note that the proponent has also made commitments (Appendix 5) to work with key stakeholders such as the Department of Defence and CASA to minimise any risk from the project to aviation safety. I consider that the proponent will appropriately manage all aviation risks.

5.14 Topography, Geology and Soils

5.14.1 Introduction

The EIS assessed the topography, geology and soils within the study area. Because the project is located within the Great Dividing Range, the topography within the study area is characterised by a number of ridgelines predominately orientated in a north-west to westerly direction, which is necessary for the requirements of the project. The project site is predominantly comprised of fine textured grey and brown cracking clay soils.

Legislation and policy

Soil erosion and potentially contaminating activities are regulated in Queensland by the *Environmental Protection Act 1994* and the *Soil Conservation Act 1986*. The *Nature Conservation Act 1992* provides for the management of the Bunya Mountains National Park located adjacent to the project site.

Construction impacts on topography, geology and soils are regulated by the wind farm state code and administered by DILGP.

5.14.2 Assessment methodology

The EIS assessment involved undertaking a range of desktop surveys, stakeholder consultations, preliminary site investigations and detailed technical studies.

Topography

Topography of the project site was assessed using available aerial photography. Maps were prepared using Australian Height Datum (AHD) and the Geocentric Datum of Australia 94.[60]

Geology

The preliminary geotechnical assessment undertaken on 21 and 22 May 2008 involved 22 test pits distributed over several ridge lines within the project site. Known mineral, coal, petroleum, natural gas and key resource areas were identified by a desktop study using the MinesOnlineMaps mapping tool.[61]

Soils

The EIS notes that soils found within the project site were identified by an analysis of the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Australian Resource Information System tool,[62] land system maps[63] and Queensland Globe mapping.[64]

Potential contaminated land found within the project site was identified in the EIS by undertaking:

- a desktop study of current and historical land uses of properties within and adjacent to the project site
- a search of the Queensland Environmental Management Register (EMR) and Contaminated Land Register (CLR) administered by the Department of Environment and Heritage Protection
- a desktop study of acid sulphate soil and unexploded ordinance searches.

5.14.3 Existing environment

Topography

The topography of the study area is dominated by a series of north-west to westerly trending ridgelines which rise to 855 m AHD, along which up to 115 wind turbines would be situated. Slopes of ridgelines vary in steepness from shallow to angles steeper than 20 degrees (°).

The EIS states the topography of the site is compatible with the requirements of the project. The study area comprises the land available for development and covers approximately 10,200 ha.

[60] See Glossary of this report for a definition.
[61] Department of Natural Resources and Mines (DNRM), *MinesOnlineMaps,* DNRM, 2016.
[62] Commonwealth Scientific and Industrial Research Organisation's (CSIRO), *Australian Soil Resource Information System,* CSIRO, Canberra, 2013.
[63] Department of Natural Resources and Mines (DNRM), 2016.
[64] Department of Natural Resources and Mines (DNRM), *Queensland Globe,* DNRM, 2016.

Geology

The EIS notes that the project site mainly consists of tertiary basalt bedrock. The north-east of the study area consists of sedimentary rocks. This section of the study area is yet to be ground-truthed due to access restrictions. The proponent proposes to undertake further geotechnical investigations during the detailed design phase to confirm sub-surface conditions within the study area.

Soils

The study area is zoned rural in the Kingaroy and Wambo planning schemes, with the majority of land mapped as Class A and Class B land under the Agricultural Land Classification. Although due to the steep slopes of the project study area, very little cropping occurs. The EIS notes that the project site is predominantly comprised of fine textured grey and brown cracking clay soils. In some parts of the project site, sodic soils have been identified. A desktop survey of the Australian Soil Resource Information System undertaken as part of the EIS indicates there is low to extremely low potential for acid sulphate soil to occur within the study area.

The EIS assessment involved searches of the Queensland Environmental Management Register (EMR), Contaminated Land Register (CLR) and unexploded ordinance mapping. The results indicate that no land within the study area is listed as being contaminated under the *Environmental Protection Act 1994* or contains known unexploded ordinance potential. However, given the historical and current use of the land for agricultural purposes, there is potential for 'notifiable activities' being undertaken. Notifiable activities include (but are not limited to) aerial spraying, livestock dips or spray races. Due to the small scale of these notifiable activities, they are not required to be registered on the EMR or CLR.

The EIS also notes that Exploration Permit for Coal (EPC) 2056 has been granted within the project site and expires on 25 November 2020.

5.14.4 Submissions received

The key issue relating to soils raised in a submission on the EIS was the potential for access tracks to divert the flow of water onto a neighbouring property and create erosion of neighbouring property slopes.

I have considered the submission and the response provided by the proponent in my evaluation of the potential soil erosion impacts and my assessment is provided in the relevant section below.

5.14.5 Impacts and mitigation

Potential impacts during construction

Topography and Geology

It is not anticipated that the project will impact on topographical features or the geology of the project site. Accordingly, no mitigation measures are proposed.

Wind turbines require anchoring in the bedrock for stability. Depending on the suitability of the underlying basalt bedrock, rock anchored foundations or gravity type foundations could be used. Basalt bedrock as a result of weathering processes could have weak material underlying strong rock. This poses difficulties for using rock anchored foundations as they require strong rock up to 10 m below the foundation for anchorage.

The preliminary geotechnical assessment did not find basalt bedrock conditions within the study area, however there is a possibility that these conditions exist. Gravity type foundations could be used as the preliminary geotechnical assessment identified suitable bedrock is likely to be present at most locations between 0.7 m and 1.5 m deep. The proponent proposes to undertake further geotechnical investigations during the detailed design phase to confirm sub-surface conditions and the suitable anchoring.

Quarry materials

To meet project demand, a quarry site located within the study area is being investigated. Fragments of very high strength basalt would be crushed to make road material to be used for road upgrades.

Soils

Excavation work and the removal of vegetation for the construction of wind turbines, substation buildings, other associated infrastructure and access roads have the potential to cause erosion and land instability. The wind turbine foundation footprint will be approximately 10 m x 10 m. The underground cables which connect the wind turbines to a substation require trenches of approximately 0.5 m to 1.5 m in width and 93 km in length. A temporary three metre wide access road will be required during the construction phase. In total, the project would disturb approximately 360 ha of land during construction.

The project will excavate and construct in areas which consist of cracking clay soils and sodic soils. These soils are particularly vulnerable to accelerated rates of erosion and dispersal when the soil is disturbed (i.e. by excavation activities). The rate of erosion is influenced by the topography, the amount of rainfall and wind, soil characteristics and vegetation cover. Construction activities have a relatively high potential to cause land contamination if not managed effectively.

Without appropriate mitigation measures, sediments could potentially be released to surface waters and adversely impact upon surface water quality and aquatic ecosystems. Measures to control impacts on surface water quality are discussed in Section 5.10.

Mitigation measures

In order to mitigate erosion impacts, the proponent commits to develop and implement an erosion and sediment control plan. The results of soil and land stability surveys to be undertaken during the detailed design phase would inform the development of the erosion and sediment control plan. To ensure appropriate erosion and sediment control measures are incorporated into construction practices, I have recommended a stated

condition for the proponent to develop and submit an erosion and sediment control plan to DILGP prior to the commencement of construction.

The EIS notes that construction activities within and adjacent to waterways will be minimised to reduce sediment runoff into the waterway. Upon completion of construction activities, the land will be rehabilitated to provide vegetation cover to reduce the potential for erosion.

Access tracks will be designed to direct water flow away from the track to other vegetated areas. Prior to and immediately after rain events, access tracks and cleared areas will be stabilised to reduce potential for the movement of sediment.

In order to prevent slope instability, the proponent commits to conduct slope stability inspections prior to excavation works commencing. In addition, rock bolting, retaining walls and catch drains are proposed to maintain slope stability and capture run-off.

In order to mitigate contamination impacts, the proponent commits to record the location and quantity of all hazardous materials on-site. The proponent commits to develop and implement an emergency spill containment plan for the containment of chemicals and fuels if spilled. Any soil which has been contaminated with fuel, oils or other chemicals will be disposed of by a waste subcontractor under a disposal permit for contaminated soil. If potentially contaminated soils are discovered on the project site, a site investigation will be undertaken and the area will be recorded in the EMR or CLR.

Potential impacts from operations

Maintenance activities during operation will occur on approximately 100 ha and have potential to create erosion impacts. Maintenance vehicles will to use access roads and cleared areas adjacent to infrastructure. Access roads will be susceptible to accelerated rates of erosion due to lack of cover (either bitumen or vegetation).

The results of soil and land stability surveys undertaken during the detailed design phase will inform the location of the access tracks. The tracks will also be designed to direct water flow away from the track to other vegetated areas. Because access tracks and cleared areas will be stabilised to reduce potential for the movement of sediment caused by rain events, the EIS notes that the potential for impacts from maintenance activities is expected to be minor.

5.14.6 Coordinator-General's conclusion – topography, geology and soils

I am satisfied that no specific mitigation measures are required to mitigate any potential impacts to the topography or geology of the project site. I note that project activities could potentially cause soil erosion and land instability. To minimise these impacts I have stated a condition for the proponent to develop and submit an erosion and sediment control plan to DILGP prior to commencement of construction.

I note that wind farms are a temporary use and reversible, allowing the land to be returned to the former agricultural uses. Rehabilitation of land will be done in

consultation with landowner requirements. I am satisfied the proposed mitigation measures and subsequent rehabilitation of land could ensure potential erosion and contaminated land impacts are appropriately managed. I have stated a condition for the proponent to develop and submit a decommissioning and rehabilitation plan to DILGP prior to the commencement of decommissioning to ensure that rehabilitation activities are appropriately identified and carried out.

5.15 Waste Management

5.15.1 Introduction

The EIS identified the potential waste impacts from the construction, operation, decommissioning and rehabilitation of the project. It noted that the construction phase of the project would generate the most waste and that during the operation of the wind farm, the waste stream would be minimal.

Relevant policies and legislation

The EIS identified the legislative and regulatory framework relevant for waste management, including:

- the *Waste Reduction and Recycling Act 2011* (Qld) (WRR Act)
- the National Waste Policy 2009 (Cwlth)
- Environmental Protection (Waste Management) Regulation 2000
- Queensland Waste Avoidance and Resource Productivity Strategy (2012-2024)
- the Western Downs Regional Council Waste Management Policy (2012)
- the South Burnett Regional Council Waste Management Plan 2015-2022.

5.15.2 Existing environment

The EIS notes that currently in the project area the main waste streams are from domestic, commercial and agricultural sources. The project is likely to generate new waste streams during construction, operations and decommissioning, and the environmental values which may potentially be impacted by these include:

- natural environment (i.e. land, water, air quality, fauna and flora)
- the productive capability of land (i.e. farming practices and forestry)
- health and safety (i.e. local community and project workforce)
- sustainability of natural resources
- available landfill capacity within the region
- visual amenity.

The EIS identified nine waste management facilities within the vicinity of the project area that have the potential to accept waste from the project. These licensed facilities are located in Kingaroy, Chinchilla, Meandarra, Miles, Murgon, Nanango, Tara, Wandoan and Wondai. The EIS notes that consultation with relevant operators would be conducted following detailed design of the project.

5.15.3 Impacts and mitigation

The EIS identified the potential impacts that may result from excessive waste generation, inefficient use of resources or from improper management of wastes generated during construction, operation, decommissioning and rehabilitation of the project.

The potential impacts identified included:

- resource efficiency
  - excessive use of natural resources
- waste generation
  - wastes to be disposed of to landfill (additional to current levels)
  - release of waste (controlled or uncontrolled) causing contamination of air, land, surface or groundwater
  - increase in vermin and pests.

Potential construction impacts

The EIS notes that the highest level of waste generation for the project would likely be during the construction phase. The EIS reported that potential wastes to be generated by the project during construction would include:

- vegetated waste associated with land clearing
- construction building waste (i.e. concrete, metals, glass, plastics)
- material from packaging (i.e. cardboard, paper, metal, plastics)
- regulated wastes / hazardous material (i.e. hydrocarbons, paints, solvents and fertilisers/herbicides)
- sewage effluent and sludge.

The EIS determined that the project is not anticipated to cause significant impacts on environmental values of the nearby landfill sites. Wastes which cannot be reused or recycled would be disposed of at appropriately licensed landfill sites. Waste levels are not expected to be of significant quantity to consume available landfill capacity or shorten landfill life.

Potential operation impacts

The EIS determined that waste is expected to be minimal during operation of the project. During operations the main wastes generated would be minor quantities of hydrocarbons (fuel, oil, lubricants) and hydrocarbon contaminated materials, and used machinery parts.

Potential decommissioning and rehabilitation impacts

A demolition contractor would be employed to decommission wind farm infrastructure.

Infrastructure would be repurposed where possible or removed off site for recycling or disposal at a licensed facility. Infrastructure that is unable to be removed will be buried to a suitable depth to allow agricultural activities to continue.

Submissions on the EIS

Submissions on the EIS relating to waste matters raised the following issues:

- predicted waste streams and disposal options for construction and operation
- disposal of the project waste at council controlled refuse sites
- requirement of the proponent to enter into a waste agreement with council.

I have considered each submission and how the information provided by the proponent has responded to the submitter issues as a part of my evaluation.

Proposed mitigation strategies

The EIS identified a range of mitigation strategies to manage potential impacts from project wastes. The main method proposed is to promote waste avoidance and reduction and to encourage resource recovery and efficiency.

The proponent will use a hierarchical approach to waste management, which prioritises waste management strategies from the most preferable (reduce, reuse or recycle wastes) to the least preferable (disposal). The EIS states where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors.

The EIS states there will be no controlled releases of water or wastewater to the environment from the project and thus no on-site treatment of water is anticipated to be necessary.

The proponent has committed to fully assess waste generation during detailed design to determine information about predicted waste streams and disposal options.

The EIS has identified the nearby waste management facilities in the region and what material they are able to accept.

5.15.4 Coordinator-General's conclusion – waste management

I am satisfied that the potential impacts of waste can be adequately managed through the proponent's commitments. I am satisfied that the proponent will work with the two local councils Western Downs Regional Council and South Burnett Regional Council to enter into a commercial agreement to ensure that the project's waste generation can be properly mitigated.

The proponent has undertaken an overarching assessment of the potential for wastes during construction, operation and decommissioning of the project in the EIS which is appropriate for the level of detail available at this stage of the project. Further assessment is required at the detailed design phase.

I consider that the EIS assessment adequately demonstrates that waste impacts would be effectively managed to avoid any impacts on environmental values and associated ecosystems surrounding the project area.

5.16 Economic impacts

5.16.1 Introduction

The EIS assessed the economic impacts of the project, in particular identifying the anticipated impacts on the local economy and the housing and labour markets.

Baseline data

The socio-economic assessment examined the impacts of the project on the local region, which incorporates the Kingaroy and Wambo Statistical Local Areas (SLA). The region has a well-established agricultural sector incorporating cattle-grazing, cotton, grain growing, peanut and navy bean industries and an expanding wine industry.

Based on the 2011 census data, the Queensland Government Statistician's Office states that the unemployment rate in the Kingaroy SLA is 7.3 per cent. The unemployment rate in the Wambo SLA is 3.2 per cent; which is well below the corresponding State unemployment of 6.1 per cent.

The estimated resident population for the project region was 28,099 at 30 June 2015, with an expected growth rate of 1.6 per cent over 10 years. Queensland is expected to have growth rate of 2.0 per cent over 10 years.

Key economic drivers for the area surrounding the project are agriculture and mining and these industries contribute most to the region's gross value-added products.

Submissions

Submissions on the EIS were largely supportive of the expected positive economic impact of the project, particularly relating to potential positive impact of the project on the local economy and tourism.

One submission requested that the proponent report annually on the localised benefits and contribution the proponent has made to the community, including matters such as local spend on goods and services, contribution to social infrastructure or community groups and events in the project footprint and local government areas.

A number of submitters on the EIS raised concerns about the potential impacts of the wind farm on property values.

I have considered these matters and the responses provided by the proponent in my evaluation of the project and my assessment.

5.16.2 Impacts and mitigation

The EIS reported that the project is expected to have a positive impact on the local economy throughout the construction and operational phases. The project is estimated to contribute approximately $4 million annually to the local economy throughout its lifetime, based on anticipated licence payments, rates, community support and employment salaries.

The capital cost of the project is estimated to be around $500 million, inclusive of turbine components, civil and electrical installation costs, and supply of equipment.

Due to wind turbine components not being manufactured in Australia, the EIS estimated that 25-30 per cent of this would be spent locally with the remainder spent overseas for the import of the turbine equipment. Local expenditure would principally be on labour and civil works.

Employment impacts

The EIS reported that the project is expected to create around 350 full-time jobs during the peak construction phase and an estimated 15-20 full-time jobs throughout the operational life of the wind farm (i.e. one full-time job for every four to six wind turbines). The maintenance jobs would be offered to local people seeking employment and suitable training would be offered as required.

The EIS indicated that there would be sufficient labour supply to meet the needs of the project in the local area and that a fly-in-fly-out (FIFO) or drive-in-drive-out (DIDO) workforce would not be required.

The proponent has committed to maximise local employment during the construction and operational phases and use local contractors wherever feasible for all associated construction work and I am satisfied that these measures would benefit the local economy. To achieve this, the proponent has committed to develop and implement a workforce management action plan.

Local procurement

In order to assist the construction contractor to use local suppliers, contractors, employees and engage with local businesses, AGL is proposing to work with Toowoomba and Surat Basin Enterprise and the Western Downs Alliance, which are independent regional economic development organisations.

AGL would also require the construction contractor to engage with local businesses and the local community to facilitate engagement between the construction contractor and local businesses and wider community. This aims to assist in matching available local skills and resources with opportunities during construction and operation of the project.

AGL have also committed to developing a local procurement plan to ensure that the community gains the maximum economic benefit from the project.

Potential housing market impacts

The EIS reported that market rents and house prices would not be expected to be affected by the project due to the labour force being sourced from and accommodated largely within the local community. No additional housing is predicted to be required and as such, there is expected to be no impact on the rental market.

Should there be changes in local workforce or housing availability, the proponent has committed to monitor the housing market in collaboration with the local councils and amend the Housing and Accommodation Action Plan accordingly.

Potential property value impacts

The EIS incorporated a report assessing the impact of wind farms on surrounding land values in Australia. It reviewed wind farms currently operating in Australia, noting that they have been developed in locations generally removed from densely populated areas. As a result, the small samples of sales transactions available for analysis limited the extent to which conclusions could be drawn.

The EIS notes that studies of property markets would always be influenced by the subjectivity that often accompanies the property purchase decision. Additionally, a very wide range of property features affect the price paid.

It is difficult to form a definitive conclusion about the results of studies into the effects of wind farms on property values as the sample sizes for studies in both Australia and overseas vary greatly. Also as wind farms are reasonably new, there is not a lot of data collected over a suitable time period, especially in Australia.

The most recent study conducted in Australia by the New South Wales Office of Environment and Heritage in 2016 found that wind farms may not significantly impact values of rural properties used for agricultural purposes. This study concludes that there is limited available data to make a conclusive finding relating to value impacts on residential or lifestyle properties located close to a wind farm[65].

A 2012 CSIRO[66] report found that the prices of neighbouring properties have not been found to increase or decrease, although the potential market of buyers may be reduced.

Wind farms provide an additional stream of guaranteed revenue for land owners that host wind turbines, which may be used to help 'drought-proof' their farms. The EIS assessment states agricultural uses, such as cropping and grazing, in the project site will be able to continue in conjunction with the development and operation of the project.

The EIS states that Capital Wind Farm (located 10 km north-east of Bungendore, NSW) has seen land values of properties with wind turbines increase and become attractive to farmers due to the leasehold rental income from the wind turbines on 20 year contracts.[67]

Potential tourism impacts

The EIS reported that the project would be expected to become a tourist attraction, as other major wind farms in other states have. The 2012 CSIRO report indicated that wind farms may work to attract tourists, and this is supported due to the number wind farms across Australia that offer site tours.

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[65] NSW Office of the Environment and Heritage, *Review of the Impact of Wind Farms on Property Values,* report prepared by Urbis, 2016.
[66] Nina Hall, Peta Ashworth and Hylton Shaw, *Exploring community acceptance of rural wind farms in Australia: a snapshot.* CSIRO Science into Society Group, 2012.
[67] NSW Office of the Environment and Heritage, *Review of the Impact of Wind Farms on Property Values,* report prepared by Urbis, 2016, page 36.

Submissions on the EIS indicated that the project could generate positive direct and indirect impacts for the local tourism industry. Submissions also indicated that the wind farm would not be visible from existing tracks or lookouts within national parks due to the direction of the view or vegetation cover and would therefore not impact on the visual amenity of tourists visiting the national parks. Further information on this matter is included in the land use and visual impact section (5.2) of this report.

5.16.3 Coordinator-General's conclusion – economic impacts

Once operational, the project would be the largest wind farm in Queensland and one of the largest in Australia. I consider that there would be numerous opportunities for businesses in the South Burnett Regional Council and the Western Downs Regional Council areas arising from the construction and operation of the project.

I am satisfied that the EIS has assessed the potential economic impacts of the project and that the project would have positive economic impacts on the local and state economies. I consider the proponent's commitments to implement workforce and housing management plans and local procurement plans adequate to manage any potential negative impacts that may arise as a result of the project, and I require these commitments to be actioned. I am further satisfied that the project is likely to have an overall positive effect on the local tourism industry.

I note that the project supports the government's commitment to investigating credible pathways to meet a 50 per cent renewable energy target by 2030 and I am encouraged by the fact that the project is estimated to avoid around 1 million tonnes per year of GHG emissions by supplying the wind farm's green power into the electricity grid.

With regards to impacts on property values, I note that delivery of any new infrastructure project is assumed to impact property prices, both positively and negatively. The fact that a property is situated near a potential noise source (in this case the wind farm) is not automatic evidence of a loss in market value. There are other economic factors and variables that impact property prices including the different characteristics of the housing stock, the state of the real estate property market and the timing of when the house is offered for sale. I acknowledge the conflicting views on the evidence about this matter and I have taken this factor into account in my evaluation of economic impacts.

6. Conclusion

In undertaking my evaluation, I have considered the following:

- EIS and clarification material prepared for this project
- submissions on the EIS, including agency advice.

I am satisfied that the requirements of the SDPWO Act have been complied with and that sufficient information has been provided to enable the necessary evaluation of potential impacts, and to inform the conditions of approval.

The environmental assessment commenced with the declaration of this project as a coordinated project on 7 June 2016 and has involved a comprehensive body of work by the proponent. More detailed work will occur in the detailed design phase of the project.

I have assessed and considered the potential impacts identified in the EIS documentation and all submissions. I consider that the mitigation measures and commitments proposed by the proponent together with the conditions and recommendations stated in this report would result in overall acceptable outcomes.

The project has the potential to generate economic benefits throughout the region, including the employment of 350 people during construction, 20 people during operation and a capital expenditure of $500 M.

Accordingly, I recommend that the Coopers Gap Wind Farm proceed subject to the conditions in Appendices 1 and 2 and the recommendations in Appendix 3. In addition, I require the proponent's commitments to be fully implemented as presented in the EIS documentation and summarised in Appendix 5 of this report.

Copies of this report will be issued to:

- DILGP
- DTMR
- DEHP
- DNRM

A copy of this report will also be available on the DSD website at:

www.statedevelopment.qld.gov.au/coopers-gap

If there are any inconsistencies between the project (as described in the EIS documentation) and the conditions in this report, the conditions shall prevail. The proponent must implement all the conditions of this report.

Appendix 1. Imposed conditions

This appendix includes conditions imposed by the Coordinator-General under section 54B of the SDPWO Act.

All of the conditions imposed in this appendix take effect from the date of this Coordinator-General's report.

These conditions do not relieve the proponent of the obligation to obtain all approvals and licences from all relevant authorities required under any other Act.

In accordance with section 54D of the SDPWO Act, these conditions apply to anyone who undertakes the project, such as the proponent and an agent, contractor, subcontractor or licensee of the proponent.

Schedule 1. Social impacts

The entity with jurisdiction for the conditions in this schedule is the Coordinator-General.

Condition 1. Social Impact Management Reports

(a) The proponent must provide an annual Social Impact Management Report (SIMR) for approval by the Coordinator General for a period of five years on each anniversary of the commencement of construction.

(b) The SIMR must describe the strategies and actions implemented and the outcomes achieved:

  (i) to inform, engage, consult, collaborate and negotiate with stakeholders and the community and to demonstrate that stakeholder and community concerns have been considered in making decisions to avoid, mitigate and manage social impacts

  (ii) to provide, local and regional employment, training and development opportunities and to mitigate and manage any project related impacts on the local labour markets

  (iii) to mitigate and manage project related impacts on the local and regional housing markets

  (iv) to mitigate and manage project related impacts on community health, safety and wellbeing.

  The proponent must make the reports publically available on its website promptly following approval by the Coordinator General.

Condition 2. Social Impact Assessment Review

(a) If construction has not commenced within 3 years of this Coordinator-General's report, 6 months prior to the commencement of construction, the proponent must undertake a review of the social impact assessment for the project to reflect the social and economic environment at that time.

(b) A copy of the report must be provided to the Coordinator-General for review and approval. The review must be made publically available by the proponent on its website.

Appendix 2. Stated conditions

This appendix contains conditions stated by the Coordinator-General under section 39(1)(a) of the *State Development and Public Works Organisation Act 1971*.

Schedule 1. Development permit for a material change of use

This schedule applies to decisions for a development permit for a material change of use under the *Sustainable Planning Act 2009*.

Condition 1. Location

(a) Prior to commencement of construction, the proponent must submit to DILGP a revised wind farm layout plan identifying the final position of all proposed turbines and supporting infrastructure.

(b) The wind farm development must be carried out generally in accordance with the plan required by part (a) of this condition.

Condition 2. Design

(a) The wind farm must be designed and constructed in accordance with the following:

  (i) the maximum number of turbines must not exceed 115

  (ii) all turbines must be setback a minimum of 1500 metres (m) from any existing or approved sensitive land use on a non-host lot (as at the date of the Coordinator-General's report), or alternatively, the setback agreed between the non-host lot owner and proponent via a deed of release

  (iii) the overall maximum height of any turbine (measured to the tip of the rotor blade at the highest point above ground level) must not exceed 180 m.

(b) Prior to the commencement of use, the proponent must submit certification to DILGP from a Registered Professional Engineer Queensland (RPEQ) that the wind farm as constructed complies with the design specifications indicated in part (a) of this condition.

Condition 3. Updated noise impact assessment

(a) Prior to commencement of construction, the proponent must submit to DILGP an updated noise impact assessment that reflects final turbine model selection and siting in accordance with the wind farm layout plan required by Part A. Condition 1 of this approval.

(b) The updated noise impact assessment must be prepared by a suitably qualified acoustic consultant, and be in accordance with the acoustic criteria of the Wind farm state code and Wind farm state code – planning guideline.

Condition 4. Noise monitoring plan

(a) Prior to construction, the proponent must submit to DILGP a noise monitoring plan prepared by a suitably qualified acoustic consultant.

(b) The noise monitoring plan must be consistent with the noise impact assessment required by Part B. Condition 3 of this approval, and prepared in consultation with DILGP.

Condition 5. Operational noise monitoring

(a) No later than 12 months of the wind farm commencing operation, and as agreed with DILGP, the proponent must submit to DILGP a noise monitoring report prepared by a suitably qualified acoustic consultant outlining the results of the operational noise monitoring under Part B. Condition 5(a).

(b) At 12 months following the wind farm being fully operational the proponent must submit to DILGP an operational strategy outlining any necessary operating measures / regime to ensure the wind farm complies with the criteria of the Wind farm state code.

Condition 6. Operational noise levels

(a) The wind farm must be operated in accordance with any operational strategy under Part B. Condition 5 of this approval to ensure that resulting noise meets the acoustic level requirements of the Wind farm state code and Wind farm state code – planning guideline.

Condition 7. Shadow flicker

(a) Blade shadow flicker impacting on any existing or approved sensitive land use(s) (as at the date of the Coordinator-General's report) must meet the performance outcomes of the Wind farm state code having regard to any agreements with owner of the relevant land.

Condition 8. Material or coating of turbine blades

(a) The wind turbine blades must have a low reflectivity finish/treatment.

Condition 9. External lighting

(a) During wind farm operation, external lighting of infrastructure associated with the wind farm is not permitted other than:

(i) low-level, low-intensity security lighting

(ii) aviation obstacle lighting required by the Department of Defence

(iii) lighting necessary in the case of an emergency or for operational call-outs.

Condition 10. Television, radio and radar

(a) Within one month of receiving any complaint that the operation of the wind farm is having an adverse effect on television, radio or radar transmission or reception at any existing or approved sensitive land use (as at the date of the Coordinator-General's report) within 5 km of a wind turbine, unless otherwise agreed with DILGP; the proponent must engage a suitably qualified person to undertake an assessment of the television, radio and radar transmission or reception at the relevant sensitive land use.

(b) If the assessment establishes an unacceptable increase in interference to television, radio or radar transmission or reception at the relevant sensitive land use as a result of the wind farm, the proponent must undertake measures to restore the affected transmission or reception to a reasonable standard, within two months of undertaking the assessment required by part (a) of this condition.

(c) On request, the proponent must provide to DILGP the results of any assessment carried out in response to a complaint under Part D, Condition 10 (a), and evidence that any restoration measures required by Part D. Condition 10(b) have been undertaken.

Condition 11. Ecological assessment

(a) The proponent must submit to DILGP, an ecological assessment in accordance with the methodology outlined in the wind farm state code planning guideline.

Condition 12. Notice of construction

(a) The proponent must provide written notice to DILGP of the start date of the construction works subject of this approval. The notice must be provided at least one week prior to the construction works commencing unless otherwise agreed by DILGP.

(b) The proponent must provide written notice to DILGP of the completion of the construction works subject of this approval. The notice must be provided within one week following completion of the construction works.

Condition 13. Construction management plan

(a) Prior to the commencement of construction, the proponent must submit to DILGP a construction management plan reflecting the wind farm layout required by Part A. Condition 1 of this approval.

(b) The construction management plan must be prepared in accordance with the Wind farm state code planning guideline.

(c) The wind farm development must be carried out generally in accordance with the construction management plan(s).

Condition 14. Erosion and sediment control plan

(a) Prior to the commencement of construction, the proponent must submit to DILGP an updated erosion and sediment control plan reflecting the wind farm layout required by Part A. Condition 1 of this approval.

(b) The erosion and sediment control plan must be certified by a RPEQ.

(c) The wind farm development must be carried out in accordance with the updated erosion and sediment control plan.

Condition 15. Bushfire management

(a) Prior to commencement of construction, the proponent must submit to DILGP a bushfire management plan which has been completed in consultation with State Assessment and Referral Agency and the Queensland Fire and Emergency Services.

(b) The bushfire management plan must detail the mitigation strategies used to achieve the outcomes of Part E of the *State Planning Policy (April 2016) - Natural Hazards, risk and resilience*; along with any other strategies to minimise bushfire risk.

(c) The bushfire management plan must outline how an adequate level of training will be provided to staff that will be tasked with emergency management activities.

(d) The wind farm development must be carried out in accordance with the bushfire management plan.

Condition 16. Emergency evacuation plan

(a) Prior to commencement of construction, the proponent must submit to DILGP a copy of the wind farm's emergency evacuation plan for the wind farm construction and operations.

(b) The emergency evacuation plan must be completed in consultation with State and regional emergency services providers, including the Darling Downs Hospital and Health Service.

(c) The wind farm development must be carried out in accordance with the emergency evacuation plan.

Condition 17. Notification of turbine locations

(a) Prior to the commencement of use, the proponent must send a copy of the coordinates of the each turbine location and a map of the locations of any associated roads or tracks to the following entities:

  (i) Queensland Fire and Emergency Services

  (ii) Queensland Ambulance Service

  (iii) CASA and local aerodromes

  (iv) Airservices Australia

  (v) Department of Defence

(vi) South Burnett Regional Council and Western Downs Regional Council.

Condition 18. Decommissioning and rehabilitation plan

(a) Six months prior to decommissioning of the wind farm, the proponent must submit to DILGP a decommissioning and rehabilitation plan prepared by a suitably qualified person.

(b) The decommissioning and rehabilitation plan must address the actions to be undertaken where any or all turbines will permanently cease to generate electricity. The plan must outline potential impacts of the decommissioning stage and proposed mitigation measures. The plan must also include a program for:

(i) removal of all wind turbines and supporting infrastructure except where agreed with the land owner

(ii) removal and clean-up of any residual contamination resulting from the wind farm

(iii) rehabilitation / revegetation of storage areas, access tracks and other areas affected by the decommissioning of turbines, if those areas will not otherwise form part of the ongoing use of the land.

(c) Decommissioning and rehabilitation must be carried out in accordance with the decommissioning and rehabilitation plan.

(d) No later than two months after the turbines cease operation, the proponent must notify the following entities that the wind farm operations have ceased and the proposed timing of removal:

(i) Queensland Fire and Emergency Services

(ii) Queensland Ambulance Service

(iii) CASA and local aerodromes

(iv) Airservices Australia

(v) Department of Defence

(vi) South Burnett Regional Council and Western Downs Regional Council.

Definitions

Construction: any construction activities associated with the project other than:

(e) installation of wind monitoring masts

(f) building / road dilapidation surveys

(g) investigative drilling and geotechnical investigations

(h) establishing temporary site offices and construction compounds

(i) installation of environmental impact mitigation measures, fencing and enabling works

(j) minor access tracks

Appendix 3. Coordinator-General's recommendations

This appendix includes the Coordinator-General's recommendations. The recommendations relate to the applications for development approvals for the project.

While the recommendations guide the assessment managers in assessing the development applications, they do not limit their ability to seek additional information nor their power to impose conditions on any development approval required for the project.

Schedule 1. Transport Infrastructure Act 1994

This part is relevant to applications for which the *Transport Infrastructure Act 1994* is applicable.

Recommendation 1. Road impact assessment

(a) In consultation with DTMR, WDRC and SBRC the proponent must prepare a road impact assessment (RIA) in accordance with GARID and other relevant standards for each stage of the project (construction, operation and decommissioning stages) to describe impacts on the safety, efficiency and condition of state-controlled and local roads, and describe any impact mitigation proposals, including any proposed road works, and summarise key road-use management strategies.

Recommendation 2. Prepare a road-use management plan for each stage of the project.

(b) In consultation with DTMR, WDRC and SBRC the proponent must prepare a road-use management plan in accordance with DTMR's Guide to Preparing a Road-use Management Plan, and have it approved by DTMR, WDRC and SBRC prior to the commencement of significant project traffic, or as otherwise agreed between the proponent and DTMR, WDRC and SBRC.

Recommendation 3. Road and intersection upgrades

(c) Prior to the commencement of significant project traffic, the proponent must:

(i) carry out road and intersection upgrades as required under the RIA

(ii) obtain all relevant licenses and permits, for example, under the *Transport Infrastructure Act (Qld) 1994* for any such works.

Recommendation 4. Infrastructure agreements

(d) Where an infrastructure agreement is entered into, the proponent must ensure compliance with the infrastructure agreement.

Recommendation 5. Permits, approvals and traffic management plans

(e) To ensure efficient processing of the project's required transport-related permits and approvals, the proponent should, prior to the commencement of significant construction works or project traffic:

(f) submit detailed drawings of any works required to mitigate the impacts of project-related traffic for DTMR, WDRC and SBRC to review and approve.

(g) obtain all relevant licenses and permits required under the *Transport Infrastructure Act 1994* for works within the state-controlled road corridor.

(h) prepare a Heavy Vehicle Haulage Management Plan for any excess mass or over-dimensional loads for all phases of the project in consultation with DTMR's Heavy

Vehicles Road Operation Program Office, the Queensland Police Service and WDRC and SBRC.

(i) prepare and implement a TMP in accordance with DTMR's *Guide to preparing a Traffic Management Plan.*

Definitions

Significant project traffic: is an increase in traffic associated with the project which is equal to or greater than five per cent in either traffic numbers (annual average daily traffic) or axle loadings (equivalent standard axles); or the transport of oversized and overweight vehicles requiring a permit from DTMR.

Schedule 2. Nature Conservation Act 1992

This part is relevant to applications for which the *Nature Conservation Act 1992* is applicable.

Recommendation 6. Significant residual impacts

(a) The proponent must submit with any application under the *Nature Conservation Act 1992* an assessment of the significant residual impacts (SRI) of the project prepared by a suitably qualified person in accordance with the Significant Residual Impact Guideline.

(b) The SRI assessment report must specify the extent of the significant residual impact and clearly identify any offset requirements in accordance with the *Environmental Offsets Act 2014*.

(c) If offsets are required, the proponent must provide the environmental offsets in accordance with the *Environmental Offsets Act 2014* and the Environmental Offsets Strategy.

Schedule 3. Vegetation Management Act 1999

This part is relevant to applications for which the *Vegetation Management Act 1992* is applicable.

Recommendation 7. Significant residual impacts

(a) The proponent must submit with any application under the *Vegetation Management Act 1999* an assessment of the significant residual impacts (SRI) of the project prepared by a suitably qualified person in accordance with the Significant Residual Impact Guideline.

(b) The SRI assessment report must specify the extent of the significant residual impact and clearly identify any offset requirements in accordance with the *Environmental Offsets Act 2014*.

(c) If offsets are required, the proponent must provide the environmental offsets in accordance with the *Environmental Offsets Act 2014* and the Environmental Offsets Strategy.

Schedule 4. Sustainable Planning Act 2009

This part is relevant to applications for which the *Sustainable Planning Act 2009* is applicable.

Recommendation 8. Construction of buildings in bushfire-prone areas

(a) All buildings in bushfire prone areas should be constructed to comply with *Australian Standard AS 3959-2009 Construction of buildings in bushfire-prone areas.*

Appendix 4. Detailed noise information

Introduction

To help the reader to better understand the impacts of noise and how it is measured, this Appendix has been included to complement the noise impact assessment included in this report. This Appendix also contains information about the variety of noise regulations used in Australia and internationally

Definitions of noise terminology

Sound

Sound is produced by vibrations which cause pressure changes in air. The resulting waves of pressure travel in all directions away from their source. Sound is a sensory perception while hearing is fluctuations in air pressure detected by the ear.

Decibels

Air or sound pressure is measured in Pascals (Pa) but is expressed as a sound pressure level (L_p) in decibels (dB)—which is a logarithmic scale used to compress the range of audible sound pressure. A decibel is the relationship or ratio between two sound levels, for example the measured sound pressure level and the minimum sound pressure level a person with good hearing can detect. The relationship between sound pressure and L_p is as follows:

$$Lp\ (dB) = 10\ log(\ p^2/p_{ref}^2\ ) = 10\ log(\ p\ /\ p_{ref}\ )^2 = 20\ log\ (\ p\ /\ p_{ref})$$

Where: *Lp = sound pressure level (dB)*

p = sound pressure (Pa)

pref = 2 x 10^{-5} – reference sound pressure (Pa)[68]

Many noise measurement situations require calculating the combined sound pressure level of multiple noise sources. When the word “level” is added to the word that describes a physical quantity, decibels are implied. Because sound pressure levels are expressed in a logarithmic scale they cannot be arithmetically added. For example, 40 dB plus 40 dB does not equal 80 dB. In fact 40 dB + 40 dB = 43 dB.

Table 6.1 outlines the effects of how changes in noise levels may sound to people while 0 outlines the expected community response to increases in noise.

Table 6.1 Subjective effect of changes in noise levels

Change in level of dB	Subjective effect
3	just perceptible
5	clearly perceptible
10	twice as loud

[68] Department of Environment and Heritage Protection, *Noise Measurement Manual*. Brisbane, The State of Queensland, 2013

Table 6.2 Estimated community response[69]

Amount in dB(A) by which the rating level exceeds the noise criterion	Estimated community response	
	Category	**Description**
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action

Sound pressure level

"Sound Power Level" and "Sound Pressure Level" are different quantities. Sound power is the quantity of sound that is generated and released at the source of sound. The Sound Pressure Level at some location away from the source is the result of the radiation of that sound and depends on the surrounding environment and the distance from the source.

Sound pressure level does not change according to who is listening to the sound; it is therefore an objective property, which can be measured by an acoustician.

Frequencies

It is very difficult to compare the loudness of sounds when they are of different frequencies. Knowing that a sound has a pressure level of 40 dB, for example, does not tell us how loud it will be. This is because the loudness of the sound depends on its frequency as well as its pressure level.

In general terms, the noise we hear in any environment is a combination of energy at different frequencies. There are noise sources that have their dominant content of energy present in the higher frequencies, such as a whistle, and noise sources that have their dominant content in the low frequencies, such as a diesel locomotive engine. Most noise sources are "broadband" in nature—that is they possess energy in all frequencies.

Frequency is also referred to as pitch and is the rate of repetition of the pressure wave. Frequency is measured in hertz (Hz) or cycles per second. Higher frequencies have a greater number of sound waves (or cycles) per second than lower frequencies as illustrated in Figure 6.2.

[69] Department of Environment and Heritage Protection, *Noise Measurement Manual*. Brisbane, The State of Queensland, 2013.

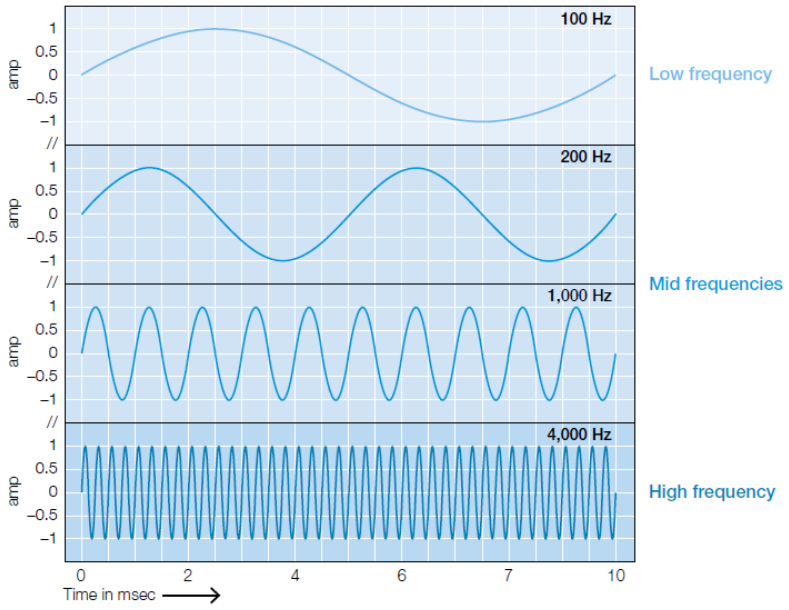

Figure 6.2 Sound waves of different frequencies[70]

As an example, bass instruments, such as the tuba or double bass, produce sounds of a lower frequency (or pitch) than smaller instruments such as the flute or violin. Sounds with mostly low frequencies often sound like a rumble, for example, thunder. Sounds with mostly high frequencies often sound like a buzz or whine, for example, mosquitoes.

Low frequency noise

Low frequency sounds have a narrow audible range and need to be at higher sound levels than mid and high frequencies to be audible. The hearing threshold increases as the frequency decreases, particularly below 200 Hz. This is because we are less sensitive to low frequencies than mid and high frequencies.

Once a low frequency sound is audible, the level only needs to increase by a small amount (relative to the increase required at mid and high frequencies) to be considered loud, and only a small amount further again before the loudness increases significantly. Further, annoyance increases more rapidly for low frequency sounds, compared to sounds of higher frequencies[71].

All sounds decrease in pressure as they travel away from their source, due to dissipation of sound into the environment. Lower frequencies travel more efficiently and their sound level decreases less than higher frequencies.

This means that at a certain distance away from its source, the low frequency content of a sound becomes more prominent than the mid and high frequency content. The larger the distance travelled by the sound, the greater this effect. For example, when standing next to a road, the higher frequency sounds of the tyre against the road are most obvious. At a distance, the sound which remains from the road is the rumbling low frequency content of the engines[72].

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[70] Department of Health, *Wind farms, sound and health: Technical information*. Melbourne: State Government of Victoria, 2013.
[71] G. Leventhall. Low frequency noise: what we know, what we do not know and what we would like to know. *Low Frequency Noise, Vibration and Active Control*, 2009, 25(2): 79-104.
[72] Sonus. Wind farms technical paper: environmental noise. Southbank: Clean Energy Council, 2010.

Wind turbines can produce broadband noise across the frequency spectrum. With large separation distances, higher frequency noise is attenuated at a greater rate, resulting in a higher concentration of lower frequency noise at residences. A normal acoustic environment contains many other sources of low frequency sound, such as the sound of diesel engines, aircraft fly-overs, blasting, mechanical plant (including pumps, compressors, air-conditioners and gas turbines), surf waves breaking on a beach, waterfalls, thunder, wind blowing foliage of trees and shrubs, etc.

Infrasound

Infrasound is generally considered to be sound at frequencies less than 20 Hz. There is no sudden drop in audibility as the frequency drops below 20 Hz. Instead, there is a smooth decrease in audibility from low frequency sound to infrasound. Infrasound is perceived by the ear like other frequencies, so it has to be above the hearing threshold to be detected. It is also harder to locate the source of infrasound than that of higher frequency sound[73].

There are many sources of infrasound, as shown in Table 6.3. Most infrasound is accompanied by sounds at other frequencies so it is unusual to experience pure infrasound.

Table 6.3 Examples of sources of infrasound

Natural environment	Household and industry	Human body
• Waves	• Air conditioning	• Breathing
• Wind	• Rail traffic	• Chewing
• Waterfalls	• Power plants	• Heart beat

Infrasound from wind farms has been found to be well below the hearing threshold of 85 dB(G), and therefore inaudible, even as close as 185 m from the turbines[74].

Infrasound levels have been measured at close proximity to wind farms in a number of settings (for example, Australia, Japan and Europe) and the measured sound has been found to be in the range of 50–70 dB(G)[75].

This is significantly below the internationally recognised audibility threshold of 85 dB(G). A recent study measuring infrasound near wind farms in South Australia found that infrasound associated with the turbines was insignificant compared to the background levels in the environment. Local wind conditions were identified as the main source of infrasound in a rural environment, regardless of the presence of wind turbines[76].

This supports the findings of an earlier study, which found that the level of infrasound emitted by wind farms is approximately equivalent to that produced by waves at a beach or background infrasound in an urban environment[77].

Whilst the aerodynamic noise from a rotating turbine blade produces energy in the infrasound range, measurements of infrasound noise emissions from modern upwind turbines at sensitive receptors indicates that at distances of 200 m, infrasound is in the order of 25 dB below the

[73] Bellhouse G. *Low frequency noise and infrasound from wind turbine generators: a literature review*. Wellington NZ: Energy Efficiency and Conservation Authority, 2004.
[74] Turnbull C, Turner J, Walsh D. Measurement and level of infrasound from wind farms and other sources. Acoustics Australia 2012; 40(1): 45–50.
[75] Department of Health, *Wind farms, sound and health: Technical information*. Melbourne: State Government of Victoria, 2013.
[76] Evans T, Cooper J, Lenchine V. Infrasound levels near wind farms and in other environments: Environment Protection Authority, South Australia, 2013.
[77] Sonus. Wind farms technical paper: environmental noise. Southbank: Clean Energy Council, 2010.

recognised perception threshold of 85 dB(G). A 25 dB difference is significant and represents at least a 100 fold difference in energy content. Infrasound also reduces in level when moving away from the source, and separation distances between wind farms and dwellings in Queensland are regulated at 1.5 km[78], therefore impacts can be considered to be minor.

Weighting networks

Human hearing systems are not equally sensitive to all sound frequencies, and to compensate for this, various types of filters or frequency rating networks have been used to determine the relative strengths of frequency components making up a particular environmental noise.

A-weighting (dB(A))

The most common weighting used in environmental noise measurement is A-weighting. The A-weighting represents the way the human ear is more sensitive to mid-range frequencies and less sensitive to high and low frequencies. A-weighted measurements are expressed as dB(A). The dB(A) measure gives a mathematical representation of the perceived loudness of any noise, as heard by people.

Table 6.4 Typical A-weighted sound levels for different sources[79]

Noise source	Sound level (dBA)
Quiet bedroom	20–25
Rural night-time background	20–40
Typical wind farm (at moderate wind speed 7 m/s)	35–45*
Car at 64 km/h at 100 m	55
Busy general office	60
Pneumatic drill at 15 m	95
Jet aircraft at 50 m	105
Threshold of pain	130

* Based on sound level measurements taken from multiple resident locations near two Victorian wind farms, at distances of 500–1,000 m from the nearest turbine.

C-weighting (dB(C))

C-weighting is often used for peak measurements and low frequency noise. It is often used in entertainment noise measurement, where high pressure low frequency noise is common. The C-weighting is also commonly used for sounds with impulsive characteristics such as fire-arms; shooting ranges; and pile driving. C-weighted measurements are expressed as dB(C) and C-weighting is available on many Sound Level Meters (SLMs).

The C-weighting characteristic gives the meter a flat response characteristic over a wide range of frequencies, from approximately 50 Hz to 4,000 Hz. The response falls at the higher and lower frequencies. C-weighting may be used together with A-weighting to assess the broad frequency content of a particular sound, particularly whether low frequencies are present at a significant level.

[78] Sonus. Wind farms technical paper: environmental noise. Southbank: Clean Energy Council, 2010.
[79] Department of Health, *Wind farms, sound and health: Technical information*, State Government Victoria, Melbourne, April 2013

G-weighting (dB(G))

The G- weighting, specifically designed for infrasound, falls off rapidly above 20 Hz, whilst below 20 Hz it follows assumed hearing contours down to 2 Hz. This slope is intended to give a subjective assessment to noise in the infrasonic range. A G-weighted level of 95 – 100 dB(G) is close to the perception level. G-weighted levels below 85 – 90 dB(G) are not normally perceived by humans.

Measuring sound levels over time

Time weighting

Sometimes sound must be measured using a noise descriptor that gives an accurate representation of the sound level over time. L_{90} and L_{eq} are examples of such noise descriptors, and are described below.

Sound level measurements using any grade of SLM can be fast, slow, or impulse time weighted. The impulse time weighting is about four times faster than fast, with a short rising time constant but a slow falling one. “Fast” corresponds to a 125 m/s time constant.

Steady noise

In cases where constant noise is present e.g. constant machine noise, the L_{A90} can be used—as it provides the noise level equalled or exceeded for 90 percent of the measurement period. This generally has the advantage of removing extraneous ambient effects from the measurement. For example, noise from occasional traffic and birds won’t be captured by L_{A90}. The descriptor is commonly used to assess noise emissions from sources including fan noise, domestic air-conditioners and pool pumps and is commonly referred to as the background noise level.

L_{eq} / L_{Aeq}

Measuring sound in the environment can be difficult because there are often different sources of sound and the levels may fluctuate over a wide area and over time. However, it is sometimes useful to convert the measurement of varying noise to an equivalent continuous noise level for a given period of time. This is called Equivalent Continuous Sound Level or $L_{eq.}$ When measured in decibels, the descriptor is written as L_{Aeq}. It is often used to determine the noise level over a 24 hour period but it can be calculated over any time period, such as night time between 10.00 pm and 6.00 am.

L_{Aeq} is generally not used for measuring wind farm noise because it takes account of all sounds in the environment, including wind gusts, and other sounds that do not come from the wind turbines themselves.

L_{Amax}

Short duration/non-steady noise: impact, impulse and transient noise is measured with L_{Amax}. The maximum A-weighted sound pressure level is the highest level of sound present over the measurement period. It is normally used in the case of short duration and transient sound and is a measure of how high the sound was in level for a short period of time. This noise descriptor is also used to assess sleep disturbance and awakening criteria (such as those used in the WHO guidelines on noise). The averaging time of this measurement parameter is normally of the order of 1/8 of a second.

Free field measurements

Free field measurements are generally used to assess noise conditions set at property boundary or to assess a noise model calibration/validation point. A free field environment is one in which there are no reflective surfaces within the frequency region of interest.

Wind turbine noise characteristics

Wind turbines emit noise, including low frequency noise, which decreases incrementally the further you are away from the wind turbines. As noted in the wind farm state code planning guideline, the noise generating characteristics of wind farms include output that varies with wind speed and turbine location.

The wind farm state code states that noise characteristics associated with wind farms generally fit within two categories—mechanical noise and aerodynamic noise.

Mechanical sounds come from the internal machinery and have decreased significantly over time as turbine design has improved. Mechanical sounds from modern wind turbines are not generally a dominant source of emitted noise.

Aerodynamic noise which is produced from air passing over the blades of the wind turbine is typically the dominant source of noise from wind turbines. Aerodynamic noise can be divided into four generation mechanisms: inflow turbulence, tip noise, trailing edge noise and blade tower interaction. Aerodynamic sound is generated by the rotation of turbine blades through the air, and contains many different frequencies typically within the 200–1,000 Hz range.

Tonality

Tonality occurs when there is a dominant frequency associated with the noise. It can sound like a hum or whine. Examples of tonal noise include, reversing beepers, alarms, bells, buzzers, the screeching of mechanical plant, grinding metal. High frequency tones can be just as annoying as low frequency tones.

A tonal characteristic can be identified objectively in accordance with the method in *Australian Standard AS1055.1−1997 Acoustics - Description and measurement of environmental noise*. The method involves comparing noise levels in adjacent one-third octave bands.

The wind farm state code planning guideline states wind farm developers should avoid installation of wind turbines which exhibit sound with tonal characteristics by specifying the supply of wind turbines from a manufacturer which guarantees that the supplied wind turbines will not exhibit tonal characteristics at residences.

Impulse noise

The EHP Noise Measurement Manual defines impulse noise as a high peak of short duration or a sequence of such peaks (bangs, clicks, clatters, or thumps). Examples of impulse noises include a metal press and hammering. It is not a normal characteristic of wind turbine noise but may occur infrequently as a result of mechanical or aerodynamic problems.

Legislation, guidelines and policies

This section is incorporated in this evaluation report in response to submitters who raised concerns about which noise limits with which the Coopers Gap Wind Farm would be required to comply.

It is important to note that wind farm noise standards and guidelines are not established to ensure inaudibility. The ability to hear a wind farm, designed and operated in accordance with

the standards and guidelines in Australia, will vary according to a range of variables such as the influence of the ambient environment, the local topography, the distances involved and the weather conditions at the time[80].

World Health Organisation guidelines

The WHO *Guidelines for Community Noise* indicate a noise level of 30 dB(A) inside a typical bedroom correlates to an external noise level with the windows open of the order of 45 dB(A). The baseline limit criterion of 35 dB(A) (for non-host lots) to 45 dB(A) (for host lots) found in the state wind farm code is therefore equal to or more stringent than the WHO guidelines recommendation of 45 dB(A).

The acoustic levels prescribed by the wind farm state code were established to ensure the health and safety of individuals and the community, regardless of whether the landowner is receiving a financial benefit.

For comparison purposes, a wind farm that complies with a 40 dB(A) baseline limit could introduce twice as many turbines again onto the site, or move of the order of half as close to the nearest dwelling, and still achieve the WHO recommendations to prevent the potential onset of sleep disturbance[81].

World Health Organisation guidelines

The World Health Organisation's (WHO) *Guidelines for Community Noise*[82] is the internationally recognised standard to achieve a minimum level of protection from noise for community health and safety.

The WHO guidelines state noise levels of 45 dB(A) outside bedrooms with open windows over an eight-hour period would protect community health from sleep disturbance; however the code does acknowledge that a 60 dB L_{Amax} may occur.

Night time indoor noise levels for sleep protection are recommended to be 30 dB(A) over an eight-hour period, with an L_{Amax} of 45 dB is included.

To protect against hearing impairment, the guideline recommends noise levels less than 70 dB(A) over a 24 hour period, with an L_{Amax} of 110 dB.

Environmental Protection Policy - noise

The acoustic criteria prescribed by the wind farm state code ensures proposals suitably achieve the EPP (Noise) acoustic quality objectives identified in Table 6.5, which has been extracted from the EPP (Noise).

Table 6.5 Acoustic quality objectives in EPP Noise

Column 1	Column 2	Column 3			Column 4
Sensitive receptor	Time of day	Acoustic quality objectives (measured at the receptor) dB(A)			Environmental value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	

[80] Sonus. Wind farms technical paper: environmental noise. Southbank: Clean Energy Council, 2010.
[81] Sonus. Wind farms technical paper: environmental noise. Southbank: Clean Energy Council, 2010.
[82] Birgitta Berglund , Thomas Lindvall, Dietrich H Schwela, *Guidelines for Community Noise*, World Health Organisation, 1999.

dwelling (for outdoors)	daytime and evening	50	55	65	health and wellbeing
dwelling (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing, in relation to the ability to sleep

The contents of the wind farm state code and planning guideline are consistent with the State Planning Policy April 2016, the Environmental Protection (Noise) Policy 2008 (EPP Noise), WHO guidelines on noise and NHMRC advice on wind farms.

One of the complexities in directly applying the EPP Noise acoustic quality objectives as assessment criteria for the wind farm state code is the difficulty in utilising internal acoustic levels in a development assessment framework. Applying internal acoustic levels to neighbouring or surrounding properties would ultimately require property and building access by the proponent for both attenuation measuring and compliance activities. DILGP, owner of the wind farm state code consider that this is not a reasonable requirement for the applicant or the neighbouring property owner.

In accordance with the WHO guidelines, the wind farm state code planning guideline assumes that the noise reduction from outside to inside, with a window partly open for ventilation, is 15 dB(A). An independent expert acoustic consultant commissioned by DILGP has confirmed that a 15 dB(A) facade reduction is a reasonable and accurate assumption for Queensland.

National Health and Medical Research Council (NHMRC)

The main source of official advice on the health impact of wind turbines is the NHMRC. The current legislative basis of the Council is the *National Health and Medical Research Council Act 1992* (the NHMRC Act). The NHMRC is responsible to the Commonwealth Minister for Health.

The NHMRC commenced its contribution to advising on health and wind farm issues in 2009. On the request of Chief Health Officers, the Office of the NHMRC conducted a 'Rapid Review' of the published scientific literature on the issue of wind turbines and potential impacts on human health. The Rapid Review covered the available evidence on the potential health impacts of infrasound, noise, electromagnetic energy, shadow flicker and blade glint produced by wind turbines.

The Rapid Review paper concluded that following the review of the available evidence, including journal articles, surveys, literature reviews and government reports, –"*there are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines"*.[83]

In June 2010, the NHMRC released a Public Statement on Wind Turbines and Health in which the conclusion was that 'there is currently no consistent evidence that wind farms cause adverse health effects in humans'.[84]

[83] https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh53_evidence_review_wind_turbines_health_0.pdf

[84] https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh53_public_statement_wind%20turbines_and_health_150225.pdf

In 2011, the NHMRC commissioned an 'independent systematic review' ('the review') of the human health effects of wind turbines. The outcomes of the systematic review were finalised in late 2013 and the outcomes informed the development of a draft Information Paper on wind farms and human health. The independent review also identified gaps in the current evidence base to inform recommendations for research.

A final version of the document was formally released in February 2015. Prior to publication, the NHMRC sought input from state and territory planning and environment departments through chief health officers.

The findings of the review informed the development of the NHMRC Statement: Evidence on Wind Farms and Human Health and the NHMRC Information Paper: Evidence on Wind Farms and Human Health released in February 2015.

The final NHMRC Statement: Evidence on Wind Farms and Human Health notes:

There is no direct evidence that exposure to wind farm noise affects physical or mental health. While exposure to environmental noise is associated with health effects, these effects occur at much higher levels of noise than are likely to be perceived by people living in close proximity to wind farms in Australia. The parallel evidence assessed suggests that there are unlikely to be any significant effects on physical or mental health at distances greater than 1,500 m from wind farms.

However, the NHMRC recognised that the body of direct evidence on wind farms and human health is 'small and of poor quality'. It added that given reported experiences of health effects and the 'limited reliable evidence', 'further high quality research is warranted'.

In February 2015 the NHMRC announced that there will be a Targeted Call for Research to stimulate applications for research that addresses the gaps in the evidence base. The process will 'encourage Australia's best researchers to undertake independent, high quality research investigating possible health effects and their causes, particularly within 1500 m from a wind farm'.

In March 2016, the NHMRC awarded two grants to study the effects of wind farms on human health. The University of NSW was awarded $1.94m, to study the health impacts of infrasound and Flinders University secured $1.36m to investigate whether wind farms disturb sleep compared with traffic noise. No results of either study have been released.

Managing noise and preventing hearing loss at work – Code of practice[85]

One of the submitters on the EIS requested that the acoustic levels for the wind farm be consistent with the levels prescribed in the Managing noise and preventing hearing loss at work – Code of practice. The code is based on a national model code of practice developed by Safe Work Australia and approved by the Workplace Relations Ministers' Council on 10 August 2011 as part of the harmonisation of work health and safety laws.

The code of practice applies to all types of work and all workplaces covered by the *Work Health and Safety Act 2011* where there is the potential for exposure to noise that can contribute to hearing loss. Therefore the code of practice is not applicable to noise generated by wind farms. Table 6.6 is extracted from the code of practice and it demonstrates the length of time a person without hearing protectors can be exposed before the standard is exceeded.

[85] https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0009/58176/managing-noise-preventing-hearing-loss-cop-2011.pdf

Table 6.6 Equivalent Noise Exposures

Noise Level dB(A)	Exposure Time
80	16 hours
82	12 hours
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	7.5 minutes
106	3.8 minutes
109	1.9 minutes
112	57 seconds
115	28.8 seconds
118	14.4 seconds
121	7.2 seconds
124	3.6 seconds
127	1.8 seconds
130	0.9 seconds

The wind farm state code has more stringent noise criterion than the Managing noise and preventing hearing loss at work – Code of practice.

ISO 9613-2:1996 Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation

ISO 9613-2:1996 Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation (ISO 9613) is one of the methods prescribed by the wind farm state code for predicting and measuring the expected noise generated by wind farms.

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission.

The method specified ISO 9613 consists of octave-band algorithms (with nominal midband frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound which originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Specific terms are provided in the algorithms for the following physical effects:

- geometrical divergence
- atmospheric absorption
- ground effect
- reflection from surfaces
- screening by obstacles.

ISO 9613 is supported by a significant amount of research confirming that with a suitable level of safety factors and consideration of ground topography, the predicted noise levels agree well with measured noise levels during operations of the wind farm after construction. A 1998 validation study known as the European Union Joule Project[86], found that the accuracy of the ISO 9613 in relation to wind farms was impressive. As with any model, the accuracy is subject to its inputs, such as temperature and humidity, to be used, how hard or soft the ground should be taken to be, the relative height of the receiver and the amount of "barrier" attenuation that should be applied to the ground contours.

International noise standards for wind farms

The analysis of noise generated by wind turbines is an important aspect of the planning process and was an issue raised in EIS submissions.

Some countries have implemented national legislation governing wind farm noise, whereas other countries defer the jurisdiction to the local state, province or county. A number of jurisdictions have more stringent noise limits for rural areas with relatively low background noise levels than for residential areas. The majority of jurisdictions use the L_{Aeq} metric for regulating wind farm noise. Other jurisdictions have used a metric that is derived from the L_{Aeq} metric.

To give the reader a sense of the disparity of wind turbine noise regulations, an overview is presented in Table 6.7.

[86] Bass, J. H., A. J. Bullmore, and E. Sloth. "Development of a wind farm noise propagation prediction model." Contract JOR3-CT95-0051, Final report (1996).

Table 6.7 Comparison of noise threshold limits in different jurisdictions

Country / Jurisdiction	Standard	Noise limits Rural area	Noise limits Residential area
Australia (Queensland)	No national legislation for wind turbine noise. Each State has differing regulations. Australian Standard 4959-2010 Acoustics – Measurement, prediction and assessment of noise from wind turbine generators	Host lot (with wind turbines) Whichever is greater: **Night** 45 dB(A) or background noise plus 5 dB(A) Non-host lot (without wind turbines) Whichever is greater: **Night** 35 dB(A) or background noise plus 5 dB(A)	Host lot (with wind turbines) Whichever is greater: **Night** 45 dB(A) or background noise plus 5 dB(A) Non-host lot (without wind turbines) Whichever is greater: **Night** 35 dB(A) or background noise plus 5 dB(A)
Belgium (Flanders)		At 95 per cent rated power: **Day** 48 dB(A) **Evening/night** 43 dB(A)	At 95 per cent rated power: **Day** 44 dB(A) **Evening/night** 39 dB(A)
Belgium (Wallonia)		**Day** 45 dB(A) at all wind speeds **Night in Summer** 40 dB(A) at all wind speeds **Night not in Summer** 43 dB(A) at all wind speeds	**Day** 45 dB(A) at all wind speeds **Night in Summer** 40 dB(A) at all wind speeds **Night not in Summer** 43 dB(A) at all wind speeds
Canada (Alberta)		40 dB(A)	40 dB(A)
Canada (Ontario)		40 dB(A) at 4 m/s wind speed 45 dB(A) at 8 m/s wind speed 51 dB(A) at 10 m/s wind speed	45 dB(A) at 4 m/s wind speed 45 dB(A) at 4 m/s wind speed 21 dB(A) at 10 m/s wind speed
Denmark		42 dB(A) at 6 m/s wind speed 44 dB(A) at 8 m/s wind speed	37 dB(A) at 6 m/s wind speed 39 dB(A) at 8 m/s wind speed
Finland		**Day** 45 dB(A) **Night** 40 dB(A)	**Day** 45 dB(A) **Night** 40 dB(A)
France		**Day** background noise plus 5 dB(A) at all wind	**Day** background noise plus 5 dB(A) at all wind

		speeds **Night** background noise plus 3 dB(A) at all wind speeds	speeds **Night** background noise plus 3 dB(A) at all wind speeds
Germany		**Day** 60 dB(A) at all wind speeds **Night** 45 dB(A) at all wind speeds	**Day** 50-55 dB(A) at all wind speeds **Night** 35-40 dB(A) at all wind speeds
Netherlands		**Day** 47 dB(A) **Night** 41 dB(A)	**Day** 47 dB(A) **Night** 41 dB(A)
New Zealand	New Zealand Standard 6808:2010 Acoustics – Wind farm noise	Whichever is greater: 35 dB(A) or background noise plus 5 dB(A)	Whichever is greater: 40 dB(A) or background noise plus 5 dB(A)
Norway		45 dB	45 dB
Sweden		35 dB(A) at 8 m/s wind speed	40 dB(A) at 8 m/s wind speed
United Kingdom		**Day** background noise plus 5 dB(A), with a lower limit of 35 go 40 dB(A) **Night** background noise plus 5 dB(A), with a lower limit of 43 dB(A)	**Day** background noise plus 5 dB(A), with a lower limit of 35 go 40 dB(A) **Night** background noise plus 5 dB(A), with a lower limit of 43 dB(A)
United States of America	No national legislation for wind turbine noise. Each State has differing regulations.	Ranges from **Day** 45-55 dB(A) **Night** 45-55 dB(A)	Ranges from **Day** 45-55 dB(A) **Night** 45-55 dB(A)s

Appendix 5. Proponent commitments

#	Proponent commitment
	Noise and vibration – design commitments
1.	Ensure that any wind turbine layout within the Project Site is compliant with the applicable noise criteria
2.	Use of low-noise plant and equipment model.
	Noise and vibration – construction commitments
3.	Preparation of a CEMP
4.	Scheduling of construction activities
5.	Maintenance of construction equipment
6.	Use of low-impact construction methods, where practicable
7.	Appropriate consultation with surrounding community about scheduling of construction activities
8.	Regular community consultation regarding noise created by the Project
9.	Limitation of construction hours to Monday to Saturday where practicable. Construction work on Sunday to be specifically addressed in CEMP.
10.	Noise monitoring in accordance with the CEMP
	Noise and vibration – operation commitments
11.	Prepare a noise complaints procedure and register, and investigate any construction noise complaints appropriately.
11.	Vibration complaints are not expected, but will be appropriately investigated.
12.	Investigate any operational noise complaints appropriately
13.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guidelines
	Landscape and visual amenity – design commitments
14.	Minimise vegetation removal, where possible
15.	Design of facilities to minimise visual impact on surrounds, such as semi-matt finishes on turbines to reduce glint
16.	Natural line of the existing landscape will be used wherever practicable
17.	Use the natural line of the landscape to reduce visibility and assist integration of the wind farm infrastructure
18.	Wind turbines should be white or off-white, with a semi-matt surface to reduce the reflection of light
	Landscape and Visual amenity – construction commitments
19.	Limit works compounds and restrict to areas of lower visual sensitivity and/or lesser visibility where possible to avoid unnecessary visual impact
20.	Control after-dark construction lighting to minimise effects on sensitive visual receptors
21.	Use of spoil from excavation sites for incorporation into bunding for buffer planting zones
22.	Construct overhead electrical reticulation below the ridgeline, where possible

23.	Consider new native planting to assist in visual screen, where necessary
24.	Ensure the screening consists of mixed plants of local provenance including some fast-growing species, as appropriate to the landscape character
25.	CEMP to control landscape and visual effects
26.	Site waste management plan will be enacted to ensure waste is minimised and reduces impacts to landscape character
27.	Weekly visual inspection of construction areas for new infestations of weeds
28.	Weekly inspections of weed treatment areas to determine efficacy of measures
	Landscape and Visual amenity – operation commitments
29.	Maintain access roads in a tidy manner
30.	Regular visual inspections of rehabilitation areas for 12 months or until established for weed invasion
31.	Inspection of the Project Site during scheduled maintenance for weed infestation
32.	A post-decommissioning rehabilitation plan will be prepared to reinstate the Project Site to its pre-existing (or enhanced) conditions
	Shadow Flicker – design commitments
33.	Detailed design to be informed by further shadow flicker modelling if turbine layout is altered
34.	Site visit to investigate the dwellings expected to experience some shadow flicker to determine site-specific conditions. This will enable further modelling of the detailed design layout to incorporate site conditions at these locations, and will identify the need for mitigation measures at these locations
35.	Relocate turbines if shadow flicker impacts are determined to be extreme and unable to be mitigated through other means
	Shadow Flicker – operation commitments
36.	If determined to be necessary, implement control strategies to shut down certain turbines when shadow flicker is likely to occur at particular dwellings.
37.	Enable landowners with concerns about shadow flicker to contact the wind farm operator. Any complaints to be investigated appropriately.
38.	Install screening structures or plant trees to block shadows cast by turbines during operation, where required
	Electromagnetic interference – design commitments
39.	Educate landowners and stakeholders about potential interference to CB radio and mobile phone signals
40.	Ensure that any changes during detailed design to the wind farm layout are investigated for potential disruption to satellite or digital television
	Electromagnetic Interference – construction commitments
41.	Encourage CB radio and mobile phone users to move a short distance when experiencing signal interference
42.	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with AGL.

43.	Investigate complaints accordingly and where mitigation measures are necessary, consider undertaking one or more of the following: • Tune the householder's antenna into alternative sources of the same or suitable TV signal • Install a more directional and/or higher gain antenna at the affected dwelling • Relocate the antenna to a less-affected position • Install satellite TV at the affected dwelling • Install a TV relay station
Electromagnetic Interference – operation commitments	
44.	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator.
45.	Investigate these complaints appropriately.
46.	Encourage CB radio and mobile phone users to move a short distance when experiencing signal interference.
47.	Educate residents experiencing interference issues on how to tune household antennas to alternative sources
48.	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator.
49.	Investigate these complaints appropriately and employ the appropriate mitigation measures as necessary
Aviation – design commitments	
50.	Consultation with appropriate authorities, including CASA, Airservices Australia, RAAF, AAAA, GFA and Hang Gliding Federation of Australia regarding the Project
51.	Liaise with RAAF about the low-level operations in the region, and the implications that this may have on the Project.
52.	Consider inclusion of obstacle lighting on wind turbines if they penetrate navigable airspace in accordance with International Civil Aviation Organisation requirements.
Aviation – construction commitments	
53.	Notify Airservices Australia, CASA and RAAF when construction commences.
54.	Have the Project included on aeronautical charts.
55.	Operate obstacle lighting in accordance with International Civil Aviation Organisation requirements if required.
Aviation – operation commitments	
56.	Wind farm operator to provide avenues for consultation with aviation stakeholders if any issues arise during the operation of the Project with respect to aviation-related factors.
57.	Operate obstacle lighting in accordance with International Civil Aviation Organisation requirements if required.
Bushfire risk management – proponent design commitments	
58.	Preparation of a Bushfire Management Plan in consultation with the QFRS
59.	Keep electricity services underground where possible (e.g. between turbines)
60.	Equipment and machinery (including the turbines) to provide high safety standards
61.	Develop emergency provisions for property owners neighbouring and containing wind turbines

62.	The Queensland Department of Community Safety (DCS) will be consulted prior to construction of the Project. The Project detailed design will be in accordance with relevant standards, including requirements for emergency vehicle access.
63.	Provide suitable ingress and egress to the Project Site and escape routes
64.	Roads should be designed to carry fully-loaded fire fighting vehicles
65.	Ensure appropriate water supply
	Bushfire risk management – construction commitments
66.	Maintain fire breaks around construction site
67.	Visual inspection of construction areas for presence of dry fuel
68.	Incorporate Bushfire Risk Plan into the CEMP
69.	Avoid higher risk areas when siting buildings or other infrastructure
70.	Ensure buildings meet specifications and requirements of AS 3959
71.	Install lightning protection devices in wind turbines
72.	Observe fire warnings and notices
73.	Fit buildings with fire detection systems in accordance with AS1670
74.	Maintain fire extinguishers at site offices and construction vehicles
75.	Prepare and implement an Emergency Response Plan for construction
76.	Investigate the cause of any fire, and update facilities or procedures to prevent further incidents
77.	Fire Danger Index (FDI) will be monitored daily.
	Bushfire risk management – operation commitments
78.	Observe fire warnings and notices
79.	Maintain vegetation to remove any potential forest fuels
80.	Prepare and implement an Emergency Response Plan for operation
81.	Investigate the cause of any fire, and update facilities or procedures to prevent further incidents
82.	Maintenance of vegetation to remove forest fuels
83.	Fuel management strategy to mitigate fire hazards, including planned fuel reduction burns
84.	Regular maintenance and serving of equipment and turbines
	Mosquito management – design commitments
85.	Provide a mosquito management component in the Weed and Pest Management plan
	Mosquito management – construction commitments
86.	A Pest Management Technician, licensed under the *Pest Management Act 2001*, will be engaged when pest control activities are required to be undertaken during construction
87.	Maintain activities as set out in the Weed and Pest Management Plan
88.	Visual inspections in accordance with the requirements set out in the Weed and Pest Management Plan
	Mosquito management – operation commitments
89.	A Pest Management Technician, licensed under the Pest Management Act 2001, will be engaged when pest control activities are required to be undertaken during operation
90.	Maintain activities as set out in the Weed and Pest Management Plan

91.	Visual inspections in accordance with the requirements set out in the Weed and Pest Management Plan
Socio-Economic (Noise) – design commitments	
92.	Final turbine layout within the Project Site is to ensure compliance with operational noise criteria
93.	Application of operational noise criteria and setbacks from sensitive receptors
Socio-Economic (Noise) – operation commitments	
94.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guidelines
Socio-Economic (Local employment and contractor opportunities) – design commitments	
95.	Develop workforce management arrangement and a Local procurement and Content Plan.
96.	Update and implement revised Stakeholder Consultation and Engagement Plan
97.	Early engagement with TSBE and the community to increase awareness of employment opportunities for the construction and operation of the wind farm
98.	Incorporate draft agreement terms for utilisation of local quarry in EPC Contract.
Socio-Economic (Local employment and contractor opportunities) – construction commitments	
99.	Implement workforce management arrangement and a Local procurement and Content Plan
100.	Implement and revise where necessary the Stakeholder Consultation and Engagement Plan
101.	Use of local contractors wherever feasible for all associated construction work
102.	Maximise local employment during construction phase
Socio-Economic (Local employment and contractor opportunities) – operation commitments	
103.	Maximise local employment during operational phase
104.	Implement and revise where necessary the Stakeholder Consultation and Engagement Plan
Socio-Economic (housing market) –design commitments	
105.	Prepare a Housing and Accommodation Action Plan in consultation with the local councils
Socio-Economic (housing market) – proponent construction commitments	
106.	Implement Housing and Accommodation Action Plan
107.	Should there be changes in local workforce or housing availability, Housing and Accommodation Action Plan should be amended accordingly
108.	Monitor housing market in collaboration with the local councils
Socio-Economic (safety and nuisance) – design commitments	
109.	Ensure that the final turbine layout is compliant with noise guidelines, shadow flicker guidelines and minimises EMI impacts and bushfire risk
110.	Prepare a Community Health and Wellbeing Plan

	Socio-Economic (safety and nuisance) – construction commitments
111.	CEMP to control noise and bushfire risk appropriately
112.	Implement a Community Health and Wellbeing Plan
113.	Implement a complaint recording, investigation and reporting system for construction
114.	Investigate source of complaint and address the issue appropriately
	Socio-Economic (safety and nuisance) – operation commitments
115.	Implement a complaint recording, investigation and reporting system for operation
116.	Investigate source of complaint and address the issue appropriately
117.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guidelines.
	Land Use and Planning (minimal impacts to agriculture) – design commitments
118.	Consult with landowners to determine methods to prevent disruption to current agricultural practices
119.	Avoid areas of Class A and B ALC where possible
120.	Where some disruption cannot be avoided, consult with landowners to identify ways to minimise impacts to agricultural practices
	Land Use and Planning (minimal impacts to agriculture) – construction commitments
121.	Develop and implement a CEMP, outlining how disruption of agricultural practices will be minimised during construction, based on discussions with landowners during the design phase
122.	Where disruption cannot be avoided, liaise with landowners to reduce potential impacts
123.	Investigate the cause of complaints of disrupted activities and address the issue appropriately
	Land Use and Planning (minimal impacts to agriculture) – operation commitments
124.	Operate the wind farm in accordance with measures identified during the design phase
125.	Investigate the cause of complaints of disrupted activities and address the issue appropriately
126.	Implement a complaint recording, investigation and reporting system for construction and operation
	Flora Conservation (maintain endangered SEVT vegetation community) – design commitments
127.	Avoid all SEVT for wind turbines and other infrastructure unless there is no suitable alternative
128.	Co-locate access roads and underground electrical reticulation to reduce area of vegetation clearing required
129.	Prior to clearing, collection of seeds from local trees for propagation and use in seed mixes
	Flora Conservation (maintain endangered SEVT vegetation community) – construction commitments
130.	Minimise construction activities within remnant vegetation

131.	Locate all construction sites, such as site office, soil stockpiles, machinery/ equipment storage within existing cleared areas or disturbed area
132.	Impose strict no-go zones for construction workers and machinery within endangered vegetation
133.	Micro-siting will be used to minimise impacts on the areas of remnant vegetation and regrowth vegetation.
134.	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements
135.	Educate all contractors on the importance of the vegetation and ensure no encroachment on surrounding vegetation
136.	Implement the SEVT management and rehabilitation plan in accordance with the SEVT Recovery Plan (McDonald, 2007)
137.	Daily visual inspection of vegetation clearing boundaries
	Flora Conservation (maintain extent of 'Of Concern' vegetation communities) – design commitments
138.	Avoid all areas Of Concern RE unless there is no suitable alternative
139.	Detailed design of the Project to promote the retention of remnant vegetation within the Study Area
140.	Co-locate infrastructure to reduce area of vegetation clearing required
141.	Research viability of compensatory planting
142.	Develop a management and rehabilitation plan
	Flora Conservation (maintain extent of 'Of Concern' vegetation communities) – construction commitments
143.	Minimise construction activities within remnant vegetation
144.	Locate all construction sites, such as site office, soil stockpiles, machinery/ equipment storage within existing cleared areas or disturbed area
145.	Impose strict no-go zones for construction workers and machinery within remnant vegetation
146.	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements
147.	Educate all contractors on the importance of the vegetation and ensure no encroachment on surrounding vegetation
148.	Implement the management and rehabilitation plan
149.	Daily visual inspection of vegetation clearing boundaries
	Flora Conservation (maintain extent of regrowth vegetation) – design commitments
150.	Avoid all regrowth vegetation unless there is no suitable alternative
151.	Detailed design of the Project to promote the retention of regrowth vegetation within the Study Area
152.	Co-locate infrastructure to reduce area of vegetation clearing required
153.	Research viability of compensatory planting
154.	Develop a management and rehabilitation plan
	Flora Conservation (maintain extent of regrowth vegetation) – design commitments
155.	Minimise construction activities within regrowth vegetation

156.	Locate all construction sites, such as site office, soil stockpiles, machinery/ equipment storage within existing cleared areas or disturbed area
157.	Impose strict no-go zones for construction workers and machinery within regrowth vegetation
158.	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements
159.	Educate all contractors on the importance of the vegetation and ensure no encroachment on surrounding vegetation
160.	Implement the management and rehabilitation plan
161.	Daily visual inspection of vegetation clearing boundaries
	Flora Conservation (no new infestations of weeds or pests) - design commitments
162.	Avoid further fragmentation of existing small patches (<5 ha)
163.	Maintain, as far as practicable, existing surface drainage paths
	Flora Conservation (no new infestations of weeds or pests) – construction commitments
164.	Minimise construction activities within remnant vegetation
165.	Install washdown facilities at main site entry/exit points to remove soil and weeds
166.	Develop and implement a Weed Management Plan that includes specific controls for environmental and noxious weeds
167.	Maintain activities as set out in the Weed Management Plan
168.	Imported topsoils/mulches to be weed-free prior to material arriving onsite
169.	Visual inspections in accordance with the requirements set out in the Weed Management Plan
	Flora Conservation (no new infestations of weeds or pests) – operation commitments
170.	Revegetate disturbed areas as soon as practicable after works with appropriate native and locally endemic species that have high habitat value
171.	Maintain activities as set out in the Weed Management Plan
172.	Visual inspections in accordance with the requirements set out in the Weed Management Plan
	Flora Conservation (protection of regulated vegetation communities) – design commitments
173.	Determination of offsets (if required)
174.	Confirmation on delivery of offsets
175.	Delivery of financial offset (if appropriate)
	Fauna Conservation (No significant impact on a native fauna population) – design commitments
176.	Avoid the removal of large hollow-bearing trees or dead trees wherever possible Develop a pre-construction and post-construction monitoring plan for bats and birds
177.	
	Fauna Conservation (No significant impact on a native fauna population) – construction commitments
178.	Speed limits will be clearly signed on access roads and roads during construction and known fauna crossing points highlighted with signage

179.	Avoid travelling on roads during dusk and dawn, where possible.
180.	Removal and translocation of hollows containing wildlife from habitat trees shall be conducted using a cherry picker, arborist and spotter/catcher
181.	All nests and dreys shall be safely removed from trees prior to any trees being felled
182.	All native fauna are protected (including snakes) and shall not be intentionally harmed as a result of the works or workers actions
183.	All site personnel shall be made aware of sensitive fauna/habitat areas and the requirements for the protection of these areas
184.	Fauna exclusion devices shall be implemented where practical to discourage fauna from entering the construction site
185.	In accordance with statutory obligations/policies, construction activities to be monitored in accordance with a standardised Flora and Fauna Monitoring Program
186.	Avoid disturbing, removing or breaking up fallen timber (especially larger logs) wherever possible
187.	Wherever it is unavoidable to disturb fallen timber, relocate them adjacent to the turbine footprint or road
188.	Investigate the cause of any fauna injury or death
189.	Information gained through investigations to be applied in adaptive management to prevent or minimise further losses or injuries where possible and practical and/or implement compensatory actions
190.	Prepare a Flora and Fauna Monitoring Program that includes assessment of mortality of native fauna and adaptive management processes to prevent or minimise further losses or injuries and/or identifies measures to be implemented as compensatory actions
191.	Visual inspections in accordance with the Flora and Fauna Monitoring Program
	Fauna Conservation (No significant impact on a native fauna population) – operation commitments
192.	Maintenance of fauna exclusion systems and structures designed for safe fauna passage to enable these systems to function effectively
193.	Continued visual inspection of Project Site for fauna mortality in conjunction with scheduled maintenance works and according to the requirements established in the Flora and Fauna Monitoring Program
194.	Flora and Fauna Monitoring Program to include targeted monitoring of bats and birds
195.	Records of all mortalities should be kept to ensure that mortality rates are kept to an acceptable level
	Flora Conservation (prevent impediments to movement of at risk wildlife) – design commitments
196.	Any turbine lighting is to be minimised, and red lights used to prevent the attraction of insects
	Flora Conservation (prevent impediments to movement of at risk wildlife) – construction commitments
197.	Where possible, construction, and clearing of vegetation, should be staged to allow for continued wildlife movement outside the immediate danger of the construction site
198.	All construction activities, e.g. site offices, stockpiles etc should be located in existing disturbed or cleared areas to minimise disruption of wildlife habitat

199.	In accordance with statutory obligations, spotter/catchers will be present at all vegetation clearing to ensure minimal disturbance to onsite fauna and recover and rescue any injured or orphaned fauna during construction
200.	In accordance with statutory obligations, spotter/catchers will be present at all vegetation clearing to ensure minimal disturbance to onsite fauna and recover and rescue any injured or orphaned fauna during construction Visual inspections in accordance with the Flora and Fauna Monitoring Program
	Flora Conservation (prevent impediments to movement of at risk wildlife) – operation commitments
201.	Continued visual inspection of wind farm for fauna mortality in conjunction with scheduled maintenance works and according to the requirements established in the Flora and Fauna Monitoring Program with input from QPWS
	Traffic (Delays to traffic on SCRs and local roads) – design commitments
202.	Preparation of a Road Use Management Plan or Traffic Management Plan in consultation with TMR, SBRC and WDRC
203.	Investigate opportunities to use alternative routes for deliveries avoiding school bus routes and populated areas
204.	Specific traffic planning elements to be considered will include road diversions, construction route options and scheduling of deliveries, services and shift patterns
	Traffic (Delays to traffic on SCRs and local roads) – construction commitments
205.	Implementation of the Road Use Management Plan or Traffic Management Plan for construction traffic
206.	Any necessary road closures will be described within the Road Use Management Plan or Traffic Management Plan and necessary approval obtained from TMR and Councils
207.	Access points to be located with adequate sight lines and advance warning signs provided
	Traffic (Delays to traffic on SCRs and local roads) – operation commitments
208.	Implementation of the Road Use Management Plan or Traffic Management Plan for operational traffic
	Stock routes - design commitments
209.	Investigate detailed design solutions to minimise impact on existing roads and stock routes.
	Stock routes - construction commitments
210.	Ensure all stock routes remain open during construction phase, and any works or improvements to the road infrastructure must consider potential stock movement
	Stock routes - proponent operation commitments
211.	Ensure all stock routes remain open throughout the operational period where possible
	Water quality (sediment impacts) – construction commitments
212.	Develop and implement of a Sediment and Erosion Control Plan in accordance with Engineers Australia's *Soil Erosion and Sediment Guidelines for Queensland Construction Sites*
213.	Works within riparian zones to be scheduled outside the wetter months (November–February) as far as practicably possible
214.	Maintain, repair or reinstate damaged erosion and sediment control infrastructure
215.	Investigate cause of increased turbidity or released sediment and address accordingly
216.	Daily visual inspections of sediment control infrastructure

217.	Weekly visual inspections of discharge water and receiving water bodies
218.	Visual inspections of discharge water and receiving water bodies after rainfall
219.	Turbidity monitoring in the event of turbid plumes from construction activities
	Water quality (sediment impacts) – operation commitments
220.	Maintain vegetation along easements to prevent soil erosion
221.	Implement erosion and sediment control measures if areas are causing high sediment loads or turbidity in nearby waterways
	Riparian zone (no net degradation of riparian areas) – design commitments
222.	Design to avoid structures within riparian areas where practicable
223.	Design to include rehabilitation of riparian areas
224.	Design to minimise scour and erosion of riparian areas
225.	CEMP to clarify guidelines on construction activities around riparian areas in the project construction zone.
	Riparian zone (no net degradation of riparian areas) – construction commitments
226.	Minimise vegetation removal and construction activities within waterways
227.	Rehabilitate riparian areas as soon as practicable after construction
228.	Rehabilitate disturbed areas
229.	Daily visual inspection of construction site for clearing or construction activities beyond designated areas
230.	Weekly visual inspection of rehabilitated areas until construction period is complete
	Riparian zone (no net degradation of riparian areas) – operation commitments
231.	If vegetation in rehabilitation areas dies due to the operation of the Project, investigate and address the cause and rehabilitate.
	Riparian zone (no interference with stream flow) – design commitments
232.	Design to avoid construction within riparian areas where practicable
233.	Assess construction water supply requirements as part of design
234.	Department of Agriculture and Fisheries self-assessable codes for low-impact development activities will be used to design waterway barrier developments within the Project Site during construction.
	Riparian zone (no interference with stream flow) – construction commitments
235.	Obtain construction water from sources other than local waterways
	Riparian zone (no interference with stream flow) – operation commitments
236.	Obtain water for irrigation of revegetated areas from a source other than local waterways
	Riparian zones (no introduction of weeds or pests into riparian areas) - design commitments
237.	Design to avoid construction within riparian areas where practicable
238.	Design to include rehabilitation of riparian areas to prevent establishment of new weed and pest species
	Riparian zones (no introduction of weeds or pests into riparian areas) - construction commitments

239.	Develop and implement a Weed and Pest Control Plan, detailing procedures for cleaning and checking construction vehicles entering the construction site
240.	Minimise vegetation removal and construction activities within waterways
241.	Rehabilitate riparian areas as soon as practicable after construction
242.	Manually remove weed species within and adjacent construction areas
243.	Remove overabundant or notifiable pest species in accordance with advice from the Department of Agriculture and Fisheries
244.	Weekly visual inspection of construction areas for new infestations of weeds or pests
245.	Weekly inspections of weed or pest treatment areas to determine efficacy of measures
	Riparian zones (no introduction of weeds or pests into riparian areas) - operation commitments
246.	Maintain vegetation within the Project Site to prevent the establishment of weed species
247.	Manually remove weed species within and adjacent to wind farm infrastructure in riparian areas
248.	Inspection of Project Site during maintenance activities for weed infestation
	Groundwater (no significant variation/contamination to local groundwater levels, no contamination of local groundwater system) – design commitments
249.	Determine water requirements for construction and identify suitable water sources
250.	Identify surface water bodies sensitive to groundwater movement (i.e. dams)
251.	Identify all local users of groundwater resources within a 1 km radius of the Study Area
	Groundwater (no significant variation/contamination to local groundwater levels, no contamination of local groundwater system) - construction commitments
252.	Comply with Emergency Spill Containment Plan in the event of a spillage/leak of potentially hazardous substances
253.	Contain poor quality discharge water and treat prior to disposal, subject to achieving water quality guidelines
254.	Investigate the nature of any spilled/leaked potentially hazardous/contaminating substances
255.	Investigate the extent of any spillage/leakage of potentially hazardous/contaminating substances
256.	Gauge daily groundwater levels in nearby privately owned (with permission) and registered bore holes
257.	Should groundwater quality in the immediate vicinity degrade as a result of the Project's construction activities, monitor down-gradient groundwater quality and downstream surface water quality
	Groundwater – (no significant variation/contamination to local groundwater levels, no contamination of local groundwater system) - Operation commitments
258.	No specific mitigation measures are considered necessary due to low potential risk
259.	Conduct groundwater quality sampling, using the existing registered bore hole network, following a major spillage/leakage event
260.	All chemicals, fuel and oil will be stored in above ground tanks in bunded areas, with accurate records maintained of volumes purchased and stored, to ensure any contamination of land or water is prevented, and any spill is detected quickly.
	Topography, Geology & Soils (Effective erosion and sediment control measures implemented and maintained) – Design commitments

261.	Incorporation of stable embankments and cuts, with catch drains to minimise longer term erosion
Topography, Geology & Soils (Effective erosion and sediment control measures implemented and maintained) – Construction commitments	
262.	Prepare and maintain a project-specific Erosion and Sediment Control Plan
263.	Keep land clearance to a minimum
264.	Avoid wherever possible clearing areas of highly erodible soils which are prone to water and wind erosion
265.	Where appropriate, revegetate and mulch progressively as each section of works is completed. The interval between clearing and revegetation should be kept to an absolute minimum
266.	Coordinate work schedules, if more than one contractor is working on a site, so that there are no delays in construction activities resulting in disturbed land remaining destabilised
267.	Program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example during Summer when intense rainstorms are common
268.	Stabilise the site and install and maintain erosion controls in accordance with the project-specific Erosion and Sediment Control Plan
269.	Keep vehicles to well-defined access roads, and keep access roads off sloping terrain wherever practical
270.	Identify and investigate the site of erosion and address in accordance with the project-specific Erosion and Sediment Control Plan
271.	Maintenance of road surfaces and cleared footprints will be conducted prior to and immediately following rainfall events during the construction phase and throughout the life of the Project, reducing the potential of mass movement of sediment.
272.	Erosion and sediment control measures documented
273.	Daily visual inspection and check sheets maintained
274.	In-situ turbidity (NTU) monitoring of local receiving surface waters, in accordance with the requirements of the project-specific Erosion and Sediment Control Plan
Topography, Geology & Soils (Effective erosion and sediment control measures implemented and maintained) – Operation commitments	
275.	Identify and investigate the site of erosion and provide suitable erosion controls, in accordance with the Erosion and Sediment Control Plan
276.	A land rehabilitation program will be established progressively, to reinstate a suitable soil profile.
Topography, Geology & Soils (No mass wasting/landslip events) – Design commitments	
277.	Geological and geotechnical investigations in areas requiring cuts – areas for turbine foundations and hardstand, and access roads
278.	Geological profile of slopes, with slope stability reports issued prior to undertaking earthworks
279.	Incorporate rock bolting, retaining walls and stable cuts with associated catch drains as required to maintain slope stability
Topography, Geology & Soils (No mass wasting/landslip events) – Construction commitments	
280.	Construction activities undertaken in accordance with relevant work method statements

281.	Identify and investigate the site of mass wasting and provide suitable remediation
282.	Mass wasting and landslip control measures documented
283.	Daily visual inspection and check sheets maintained
	Topography, Geology & Soils (No mass wasting/landslip events) – Operation commitments
284.	Visual inspection of susceptible areas following heavy rainfall/landslip inducing event
285.	Identify and investigate the site of mass wasting and provide suitable remediation
	Topography, Geology & Soils (No generation of acidic waste water, No generation of acidic material) – Design commitments
286.	Inspection of intrusive igneous rock bodies for disseminated sulphides will be conducted as part of the geotechnical investigation
	Topography, Geology & Soils (No generation of acidic waste water, No generation of acidic material) – Construction commitments
287.	Any exposed acid producing material will need to be neutralized and contained according to the Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines
288.	Divert potentially acidic surface run-off away from local waterways, into established sedimentation basins
289.	Neutralise the contained surface run-off by chemical/biological means, in accordance with the Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines
290.	Submission of samples of suspected acidic material to a NATA accredited laboratory for characterisation
291.	pH monitoring of surface run-off generated from operational construction sites, at times and in locations where generation of acidic runoff is likely
292.	pH monitoring of local surface waters receiving surface run-off from construction sites, at times and in locations where generation of acidic runoff is likely
	Topography, Geology & Soils (No generation of acidic waste water, No generation of acidic material) – Operation commitments
293.	No specific mitigation measures are considered necessary due to low potential risk
	Contaminated Land (No contamination of land) – Design commitments
294.	Investigate the presence of any Notifiable Activities on properties within the Study Area
295.	An Emergency Spill Containment Plan to be produced
	Contaminated Land (No contamination of land) – Construction commitments
296.	Nature, quantity and location of all hazardous materials on-site recorded in a manifest
297.	Storage areas to consist of a compacted base, bunding to contain spillages and roofing to prevent contamination and infiltration of stormwater (as per AS1940 and AS3780)
298.	Residual hazardous materials will be removed from the construction site and returned to an appropriate storage area or a suitable waste facility
299.	Spillages of all dangerous goods and contaminated materials will be rendered harmless through investigation, collection and disposal at a suitable disposal facility
300.	Fill material imported from off-site to be procured from a licensed quarrying facility and accompanied by relevant documentation to verify it is contaminant/ASS free
301.	Contaminated fill material exported from site will be disposed at a facility licensed for disposal of such material
302.	If potentially contaminated soils are encountered, a preliminary site investigation should be undertaken

303.	Visual and olfactory observation of all in-situ material excavated during construction
304.	Submission of samples of suspected contaminated material to a NATA accredited laboratory for characterisation
	Contaminated Land (No contamination of land) – Operation commitments
305.	The application of good practice in the storage and handling of dangerous and hazardous goods will provide appropriate practical responses to manage impacts on occupational health and safety and minimise the risk of a spill occurring
306.	Preliminary site investigation of land exposed to leaked or spilled potentially hazardous substances/material
307.	Submission of samples of suspected contaminated material, generated from operational activities, to a NATA accredited laboratory for characterisation
	Waste management (minimal waste generation) – Design commitments
308.	Detailed design for infrastructure to carefully specify material needs to avoid over estimating requirements.
	Waste management (minimal waste generation) – Construction commitments
309.	AGL will use a hierarchical approach to waste management, from the most preferable (reduce, reuse or recycle wastes) to the least preferable (disposal), and prioritise waste management strategies to avoid waste generation.
310.	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors.
	Waste management (minimal waste generation) – Operation commitments
311.	The waste stream generated from a wind farm during operation is minimal. AGL will use a hierarchical approach to waste management during operation.
312.	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors.
	Cultural Heritage (Minimal reduction of cultural heritage values) – Design commitments
313.	Establish a dialogue between AGL and Traditional Owners
314.	Development of a Cultural Heritage Management Plan
	Cultural Heritage (Minimal reduction of cultural heritage values) – Construction commitments
315.	Include construction phase within the Cultural Heritage Management Plan
316.	If items of potential cultural heritage significance are discovered during construction, work is to cease immediately in the vicinity of the construction works and a cultural heritage professional is to be invited to investigate prior to works recommencing in that area
317.	Cultural Heritage Management Plan to potentially include recommendations for Traditional Owners on site during construction activities
	Cultural Heritage (Minimal reduction of cultural heritage values) – Operation commitments
318.	Include operation phase within the Cultural Heritage Management Plan
319.	Investigate any heritage-related complaints and address accordingly
320.	Implement a complaint recording, investigation and reporting system for construction and operation
321.	Visual inspection of items of cultural heritage value in the event of a complaint

	Sustainability and Climate Change (Reduce carbon footprint of the Project) – Design commitments
322.	Energy efficient lighting to be used, whilst satisfying the safety requirements of the Project
323.	Use of sustainably sourced or recycled materials for temporary structures and drainage where possible
	Sustainability and Climate Change (Reduce carbon footprint of the Project) – Construction commitments
324.	Water efficiencies used wherever available, including minimising potable water during construction, and using construction waste water for dust suppression
325.	Avoidance of clearing vegetation where possible

Acronyms and abbreviations

Acronym	Definition
AADT	Annual Average Daily Traffic
ACH Act	*Aboriginal Cultural Heritage Act 2003* (Qld)
ACMA	Australian Communications and Media Authority
AGL	AGL Energy Limited
AHD	Australian Height Datum
ALC	Agricultural Land Classification
Aleis	Aleis Pty Ltd
AM	Adaptive Management
AS	Australian Standard
ASA	AirServices Australia
AusWEA	Australian Wind Energy Association
BMP	Bushfire Management Plan
BoM	Bureau of Meteorology
CA Act	*Civil Aviation Act 1988*
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
CB	Citizen's Band Radio
CCC	Community Consultative Committee
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CID	Community Infrastructure Designation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Department of Agriculture and Fisheries
DATSIP	Department of Aboriginal and Torres Strait Islander Partnerships
dB	Decibel
dB(A)	Decibel A-weighted network
dB(C)	Decibel C-weighted network
dB(G)	Decibel G-weighted network
DEHP	Department of Environment and Heritage Protection
DEWS	Department of Energy and Water Supply
DIDO	Drive-in drive-out
DILGP	Department of Infrastructure, Local Government and Planning
DNRM	Department of Natural Resources and Mines
DoD	Department of Defence
DSD	Department of State Development
DTMR	Department of Transport and Main Roads
EIS	Environmental Impact Statement
EMI	Electromagnetic Interference

EO Act	*Environmental Offsets Act 2014*
EP Act	*Environmental Protection Act 1994* (Qld)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPC	Engineering, Procurement and Construction
EPHC	Environment Protection and Heritage Council
EPP (Noise)	*Environmental Protection (Noise) Policy 2008 (Qld)*
ERA	Environmentally Relevant Activity
ERSA	En Route Supplement Australia
ESA	Equivalent Standard Axles
EV	Environmental Values
FDI	Fire Danger Index
FES	*Fire and Emergency Services Act 1990*
FIFO	Fly-in fly-out
GAB	Great Artesian Basin
GARID	Guidelines for Assessment of Road Impacts of Development
GDA	Geocentric Datum of Australia
GFA	Gliding Federation of Australia
GHG	Greenhouse Gas
GPS	Geographic Positioning System
GWh	Gigawatt Hours
ha	Hectare
Hz	Hertz
IAR	Initial Assessment Report
IAS	Initial Advice Statement
km	Kilometres
kV	Kilovolt
LGA	Local Government Areas
LGC	Large-scale Generation Certificate
LNG	Liquefied Natural Gas
LRET	Large-scale Renewable Energy Target
LSALT	Lowest Safe Altitude
m	Metres
MCU	Material Change of Use
ML	Mega litre
mm	Millimetres
MSES	Matters of State Environmental Significance
MW	Megawatt
NATA	National Association of Testing Authorities
NBN	National Broadband Network
NC Act	*Nature Conservation Act 1992* (Qld)
NEM	National Electricity Market
NHMRC	National Health and Medical Research Council
NSW	New South Wales

PO	Performance Outcome
PPE	Personal Protective Equipment
QFES	Queensland Fire and Emergency Service
Qld	Queensland
QPWS	Queensland Parks and Wildlife Service
QR	Queensland Rail
RAAF	Royal Australian Air Force
RCR	Regional Council Roads
RE	Regional Ecosystem
RET	Renewable Energy Target
RFID	Radio-Frequency Identification
RIA	Road Impact Assessment
RPEQ	Registered Professional Engineer Queensland
SARA	State Assessment and Referral Agency
SBRC	South Burnett Regional Council
SCR	State-Controlled Road
SDAP	State Development Assessment Provisions
SDPWO Act	*State Development and Public Works Organisation Act 1971* (Qld)
SEVT	Semi-evergreen Vine Thicket
SIA	Social Impact Assessment
SIMR	Social Impact Management Report
SLA	Statistical Local Area
SMP	Species Management Plan
SPA	*Sustainable Planning Act 2009* (Qld)
SPP	State Planning Policy
SRI	Significant Residual Impact
TC	Transport Corridor
TI Act	*Transport Infrastructure Act 1994* (Qld)
TI Regulation	Transport Infrastructure (State Controlled Roads) Regulation 2006
TMP	Traffic Management Plan
TOR	Terms of Reference
TSBE	Toowoomba and Surat Basin Enterprise
TV	Television
UHF	Ultra-High Frequency
UNFCCC	United Nations Framework Convention on Climate Change
VFR	Visual Flight Rules
VHF	Very High Frequency
Water Act	*Water Act 2000*
WDRC	Western Downs Regional Council
WHO	World Health Organisation
WHS Act	*Work Health and Safety Act 2011* (Qld)
WRR Act	*Waste Reduction and Recycling Act 2011*

Glossary

Term	Definition
assessment manager	For an application for a development approval, means the assessment manager under the Sustainable Planning Act 2009 (Qld).
blade chord	The thickest part of the turbine blade which is around 800 m to 1,325 m for modern wind turbines, which typically have maximum blade chord lengths of three to five metres.
bunding	A constructed retaining wall around potentially polluting substances
certified aerodrome	A certified aerodrome as specified under the Civil Aviation Safety Regulations 1998 (CASR) part 139.
Class A and Class B land	Agricultural land and soil is mapped according to the suitability for agriculture classified using the Agricultural Land Class approach. Class A land is arable through to Class D land which is unsuitable for agriculture. Formerly known as Good Quality Agricultural Land.
concrete batching plant	Equipment that combines various ingredients to create concrete.
construction areas	The construction worksites, construction car parks, and any areas licensed for construction or on which construction works are carried out.
controlled action	A proposed action that is likely to have a significant impact on a matter of national environmental significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth). Controlled actions must be approved under the controlling provisions of the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).
controlling provision	The matters of national environmental significance, under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth), that the proposed action may have a significant impact on.
coordinated project	A project declared as a ' coordinated project' under section 26 of the SDPWO Act. Formerly referred to as a ‘significant project’.
Coordinator-General	The corporation sole constituted under section 8A of the State Development and Public Works Organisation Act 1938 and preserved, continued in existence and constituted under section 8 of the SDPWO Act.
cut-in	The wind speed at which a wind turbine starts power production.
decommissioning	The wind turbines and any other above-ground infrastructure is removed from the site, and roads, parking areas and foundation pads are covered and revegetated to return the ground to its former state.

Deed of release	A written agreement between proponent and landowner accepting the following: a reduced setback between wind turbines and the landowner's existing or approved sensitive land use(s), and/or an increased acoustic level at the landowner's existing or approved noise affected sensitive land use(s). See the Property Law Act 1974, section 45 for the formal requirements for deeds executed by individuals.
electrical reticulation works	A network of wires for electricity transfer.
electromagnetic interference	means disturbance or degradation of telecommunications signals currently in operation over the land use area. Includes signals transmitted via microwave, very high frequency and ultra-high frequency systems.
Enoute Supplement Australia (ERSA)	A publication which contains information vital for planning a flight and for the pilot in flight. It includes pictorial presentations of all licenced aerodromes and is amended every 12 weeks. Other information includes aerodrome physical characteristics, hours of operation, visual ground aids, air traffic services, navaids, lighting, aerodrome operators' details and any changes applicable.
environment	As defined in Schedule 2 of the SDPWO Act, includes: ecosystems and their constituent parts, including people and communities all natural and physical resources the qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community the social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs (a) to (c).
environmental values (EVs)	The qualities that make surface water suitable for supporting aquatic ecosystems and human use. These EVs need to be protected from the effects of habitat alteration; waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways are safe for community use.
Equivalent Standard Axels (ESA)	A unit of measurement which converts the wheel loads of traffic to an equivalent number of standard loads which is usually expressed in terms of the equivalent number of 80 kilonewtons (kN) single axel load.
Geocentric Datum of Australia 94	The Geocentric Datum of Australia is a coordinate system of latitudes and longitudes for Australia. GDA94 is based on a global framework, the IERS Terrestrial Reference Frame (ITRF), but is fixed to a number of reference points in Australia. GDA94 is compatible with modern positioning techniques such as the Global Positioning System (GPS). The GDA94 does not affect the heights.
ground level	The level of the natural ground, or, where the level of the natural ground has been changed, the level as lawfully changed.
guy wire	A tensioned cable designed to add stability to a free-standing structure, such as wind turbines and wind monitoring towers. One end of the guy wire is attached to the structure, and the other is anchored to the ground at some distance from the mast or tower base.

host lot	means a parcel of land (lot/s) that accommodates any part of a wind farm development.
hub	The section where wind turbine blades are attached to. The hub is fixed to a rotor shaft.
imposed condition	A condition imposed by the Queensland Coordinator-General under section 54B of the SDPWO Act. The Coordinator-General may nominate an entity that is to have jurisdiction for the condition.
initial advice statement (IAS)	A scoping document, prepared by a proponent, that the Coordinator-General considers in declaring a coordinated project under Part 4 of the SDPWO Act. An IAS provides information about: the proposed development the current environment in the vicinity of the proposed project location the anticipated effects of the proposed development on the existing environment possible measures to mitigate adverse effects.
mast	The tower on which the wind turbine sits.
matters of national environmental significance	The matters of national environmental significance protected under the Environment Protection and Biodiversity Conservation Act 1999. The eight matters are: world heritage properties national heritage places wetlands of international importance (listed under the Ramsar Convention) listed threatened species and ecological communities migratory species protected under international agreements Commonwealth marine areas the Great Barrier Reef Marine Park nuclear actions (including uranium mines).
Matters of state environmental significance	The matters of state environmental significance means the following natural values and areas: protected areas under the Nature Conservation Act 1992 marine parks and land protected under the Marine Parks Act 2004 areas within declared fish habitat areas (management A and management B) under the Fisheries Regulation 2008 threatened wildlife under the Nature Conservation Act 1992 regulated vegetation under the Vegetation Management Act 1999 wetlands under the Environmental Protection Regulation 2008 legally secured offset areas under the Environmental Offsets Act 2014
micro-siting	Micro-siting is a process through which the specific location of the wind turbines is determined. Each turbine must be located to maximise the wind resource and comply with the wind farm state code such as setback distance and noise criteria.
non-host lot	means a lot no part of which is used for wind farm or part of a wind farm. See the Sustainable Planning Regulation 2009, schedule 26.
okta	A measure of cloud cover or eighths of the sky covered with cloud.

the project	Coopers Gap Wind Farm
project site	Land which the Project infrastructure will be located, which is approximately 2,048 hectares. This sits within the study area.
proponent	The entity or person who proposes a coordinated project. It includes a person who, under an agreement or other arrangement with the person who is the existing proponent of the project, later proposes the project.
Queensland Wind Farm State Code and supporting Planning Guideline 2016	A code and guideline to facilitate renewable energy outcomes whilst protecting communities from any adverse impacts as a result of wind farm development.
Regional Ecosystem	Regional Ecosystems are vegetation communities in a bioregion that are consistently associated with a particular combination of topography, geology and soil.
remnant vegetation	Native vegetation which still remain.
renewable energy	Energy from a source (such as solar, wind, tidal) that occurs naturally and is not depleted when used.
scenic amenity	The measure of a landscape's scenic qualities, reflecting the psychological benefit that the community derives from viewing the region's wide variety of landscapes.
sensitive land uses	See the State Planning Policy 2016. Sensitive land use means any of the following as defined in the standard planning scheme provisions: caretakers accommodation child care centre community care centre community residence detention facility dual occupancy dwelling house dwelling unit educational establishment health care services hospital hotel multiple dwelling non-resident workforce accommodation relocatable home park residential care facility resort complex retirement facility rooming accommodation rural workers' accommodation short-term accommodation tourist park.
sensitive receptor	A place where noise (or dust, odour, light, smoke) is measured to investigate whether impacts are occurring.

Significant residual impact	A significant residual impact is defined under the Environmental Offsets Act 2014. A significant residual impact is determined by the use of the Significant Residual Impact Guideline and is generally an adverse impact, whether direct or indirect, to an environmental matter that remains despite implementation of mitigation measures.
shadow flicker	Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind rotating blades of a wind turbine and casts a moving shadow over neighbouring areas. When viewed from a stationary position, the moving shadows cause periodic flickering of the light from the sun, giving rise to the phenomenon of 'shadow flicker'.
stated condition	Conditions stated (but not enforced by) the Coordinator-General under sections 39, 45, 47C, 49, 49B and 49E of the SDPWO Act. The Coordinator-General may state conditions that must be attached to a: development approval under the Sustainable Planning Act 2009 proposed mining lease under the Mineral Resources Act 1989 draft environmental authority (mining lease) under Chapter 5 of the Environmental Protection Act 1994 (EPA) proposed petroleum lease, pipeline licence or petroleum facility licence under the Petroleum and Gas (Production and Safety) Act 2004 non-code compliant environmental authority (petroleum activities) under Chapter 4A of the EPA.
study area	The land available for development, consisting of participating properties. The study area is approximately 10,200 hectares.
substation building	Substation buildings are part of an electrical distribution system. Substation buildings transform voltage from high to low, or the reverse.
wind farm	A wind farm is a group of two or more wind turbines in the same location, which are collectively used to generate electrical power.
wind turbine	A tall structure that has large blades which rotate in the wind to produce electricity.

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