

9.0 Hazards, health and safety

9.1 Introduction

This chapter describes the conditions and environmental values that may present hazards within and adjacent to the Project Site. Potential impacts from hazards are described and mitigation measures are provided to minimise and manage potential impacts through the design, construction and operational phases of the Project.

9.2 Scope of assessment

A preliminary hazard assessment (PHA) has been undertaken to determine the potential risks to people and property that may be associated with the Project. The PHA also describes potential mitigation and management measures which may be employed to minimise the risk of impacts.

In addition, a detailed assessment of bushfire hazards has been undertaken and considers:

- The local environmental values that may be considered a bushfire hazard
- The Project assets that may be at risk of bushfire and the Project functionality during and after an event
- The potential for the Project to start a bushfire event
- What potential mitigation and management measures can be employed to minimise the risk of impacts from a bushfire.

9.3 Legislation and policy

9.3.1 Queensland State Planning Policy

The Queensland State Planning Policy (SPP) (DSDIP, 2014a) contains state interest and plan making policies that must apply when making or amending a local planning scheme. Safety and resilience to hazards is one of the broad themes around which policies have been established and includes a state interest for natural hazards, risk and resilience.

Natural hazards that can be prepared for through land use planning and development decisions are defined in the SPP as flood, bushfire, landslide, storm tide inundation and coastal erosion. The Project is subject only to potential bushfire hazards due to its location, topography and vegetation.

The SPP is supported by state interest guidelines to assist the implementation of the policy. The relevant guideline that has been considered within this chapter is:

- State Planning Policy – State interest guideline – Natural hazards, risk and resilience (DSDIP, 2014b)

The guideline is supported by the following technical manual:

- A 'fit for purpose' approach in undertaking natural hazard studies and risk assessments (DSDIP, 2014c).

The technical manual describes the approach used to prepare State-wide bushfire hazard maps and how to apply the maps at a local scale.

Further detail on planning for hazards and safety under the SPP is provided in Chapter 11 Land Use and Planning.

9.3.2 Work Health and Safety Act 2011

The *Work Health and Safety Act 2011* (WHS Act) provides a framework to protect the health, safety and welfare of all workers at work. It also protects the health and safety of all other people who might be affected by the work.

All workers are protected by the WHS Act, including:

- Employees
- Contractors
- Subcontractors
- Outworkers

- Apprentices and trainees
- Work experience students
- Volunteers
- Employers who perform work.

The WHS Act also provides protection for the general public so that their health and safety is not placed at risk by work activities. AGL will be required to meet the requirements of the WHS and the supporting Work Health and Safety Regulation 2011 on matters such as incident notification, consultation with workers, issue resolution, inspector powers and functions, offences and penalties.

9.3.3 Fire and Emergency Services Act 1990

The Fire and Emergency Services Act 1990 (FES Act) is the principle legislation in Queensland that deals with lighting fires in the open. The FES Act provides a systematic approach to the authorised use and control of fire in the open and for fire prevention and makes it illegal to light a fire without a 'Permit to Light Fire' by a Fire Warden. Under nuisance provisions of the *Local Government Act 2009* a local government may also have in place a local law restricting or prohibiting the lighting of a fire in part or all of the local government area.

9.3.4 National Standard for the Storage and Handling of Workplace Dangerous Goods

The National Standard for the Storage and Handling of Dangerous Goods (NOHSC:1015 (2001)) sets out requirements to ensure the effective control of the storage and handling of dangerous goods so as to protect the safety and health of workers and the public as well as the protection of property and the environment.

The Standard includes a storage and handling system which covers the risks associated with the premises where any dangerous goods are stored and handled, as well as the risks associated with the use of any container, tank, vehicle or freight container, spill containment system, plant and firefighting and fire protection systems used on premises, in connection with the storage and handling of dangerous goods.

9.3.5 Australian Dangerous Goods Code

The purpose of Australian Dangerous Goods Code (7th Edition) (ADG7) is to provide consistent technical requirements for the land transport of dangerous goods across Australia. ADG7 lists provisions applicable to the transport of dangerous goods for the Project, including:

- Classification
- Packaging and performance testing
- Use of bulk containers, freight containers and unit loads
- Marking and placarding
- Vehicle requirements
- Segregation and stowage
- Transfer of bulk dangerous goods
- Documentation
- Safety equipment
- Procedures during transport
- Emergencies
- Dangerous goods list (with UN numbers).

ADG 7 does not contain all requirements and guidelines relating to the transport of explosives, radioactive materials, waste products and other environmentally hazardous substances unless those products or substances are also dangerous goods within the meaning of ADG7.

9.3.6 Australian Standard 3959-2009

Australian Standard (AS) 3959-2009 *Construction of buildings in bushfire-prone areas* (Standards Australia, 2009) specifies requirements for the construction of buildings in bushfire-prone areas in order to improve their resistance to bushfire attack from burning embers, radiant heat, flame contact and combinations of the three attack forms.

The Standard requires an assessment of the building site based on the vegetation type and effective slope of the ground under the classified vegetation and distance from the vegetation, to determine the Bushfire Attack Level (BAL). The likely BAL then determines what construction methodologies or asset protection mitigations should be in place to provide resistance from attack. Queensland has adopted this Standard and it applies to any buildings to be constructed within the Project Site that are considered within a bushfire-prone area.

9.3.7 ISO 31000:2009 Risk Management

AS/NZS ISO 31000:2009 Risk management provides a generic guide for managing risk and specifies the elements of the risk management process. This standard addresses the management system that supports the design, implementation, maintenance and improvement of the risk management process. The intent of the standard is that it is applied to management systems to formalise and improve risk management processes.

9.3.8 Local planning policies

Kingaroy Shire Planning Scheme

The Kingaroy Shire Planning Scheme identifies high to moderate potential bushfire hazard areas on its Special Management Overlay Areas for Natural Hazard Risk Management Areas mapping (GHD, 2006).

Parts of the Project fall into these designated areas and therefore, Policy No.4 of the Kingaroy Shire Planning Scheme '*Management and Technical Criteria for Development in Potential Bushfire Risk Areas*' is relevant to the Project (Kingaroy Shire Council, 2006).

Policy No.4 sets the requirements in relation to development for making a material change of use or reconfiguring a lot for a dwelling unit. Although not directly applicable to the majority of infrastructure within the Project Site, the management criteria stated within the policy serves as good practice guidance for any new building.

Policy No. 4 also states that for development applications within the areas shown as having potential for bushfire risk, the extent and nature of this risk needs to be determined through a Bushfire Risk Assessment.

Wambo Shire Planning Scheme

Wambo Shire Planning Scheme identifies low, medium and high bushfire hazard area on its Land Characteristics Map – Bushfire Hazard Areas (Campbell Higginson Town Planning, 2005). The Project Site falls into Medium and High hazard areas on this mapping.

'*Planning Scheme Policy 1 – Information Council May Request*' requests that for a development that materially increases the number of people living or working in an area of high bushfire hazard or which includes the storage of hazardous materials in an area of high or medium bushfire hazard, it should be accompanied by a Bushfire Management Plan.

Draft South Burnett Regional Council Planning Scheme

The draft South Burnett Regional Council Planning Scheme identifies medium, high and very high potential bushfire hazard areas on its Bushfire Hazard Overlay map (South Burnett Regional Council, 2016). The majority of the Project Site is mapped as low, medium and high, with a small section mapped as very high.

The draft scheme requires that development is not placed at unacceptable risk from bushfire, does not increase the extent or severity of bushfire and maintains the safety of people and property from bushfire.

9.3.9 Other

The Project will include works and connection to the transmission line, which is to be undertaken in line with current design principles and safeguards, so that the Project satisfies the *Electricity Act 1994* and the *Electrical Safety Act 2002*.

9.4 Methodology

9.4.1 Preliminary hazard assessment

A qualitative risk assessment was undertaken in accordance with the AS/NZS ISO 31000:2009 risk assessment process. The AS/NZS ISO 31000:2009 process was adopted to assess risks qualitatively across a broad range of the Project's activities, encompassing identification, analysis and evaluation of risks including rating and ranking systems.

Expected consequences are assigned to each of the identified risks as per the AS/NZS ISO 31000:2009 risk assessment procedure. The consequence ratings are shown in Table 9.1.

Table 9.1 Consequence rating matrix

Rating	Time	Cost	Safety	Environment
5 (Catastrophic)	6 months+	\$37.5m+	Fatality or permanently impairs person's life (no return to work)	Severe long term damage to environment
4 (Major)	3 – 6 months	\$15m-\$37.5m	Permanently impairs person's life	Significant medium term impact on important environment
3 (Serious)	1 – 3 months	\$3.75m-\$15m	Temporarily impairs person's life	Short to medium term impact beyond operational area
2 (Important)	Up to 1 month	\$750k-\$3.75m	Lost time injury	Small scale and short term impact to localised area
1 (Minor)	Up to 1 week	<\$750k	Isolated incident: Medical treatment injury or near miss	Negligible short term impact to localised area

The qualitative rating of risk requires that each expected consequence is assessed for its likelihood, estimated on the basis of probability of the consequence occurring. The likelihood ratings are shown in Table 9.2.

Table 9.2 Likelihood rating matrix

Category	Criteria
E (Almost certain)	- Probability > 90% - This event is expected to occur in almost all circumstances
D (Likely)	- Probability = 51-90% - This event will occur at regular intervals
C (Possible)	- Probability = 21-50% - This event occurs on an irregular basis but frequently enough to more than a remote possibility
B (Unlikely)	- Probability = 2-20% - This event would not be classified as a common occurrence and would only occur in certain remote circumstances
A (Rare)	- Probability = ≤1% - This event is not known to have occurred or has not occurred in many exposures to the potential risk

The risk matrix in Table 9.3 is used in this assessment to determine the relative magnitude of the risk by taking the combination of expected consequence and its likelihood of occurrence. A supporting table (Table 9.4) further simplifies risks from the broader Consequence-Likelihood matrix (Table 9.3) to hazard events being of Low, Medium or High risk.

Table 9.3 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 9.4 Classification of significance

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

Mitigation and control measures are identified for risk events as part of the evaluation stage in this assessment. The measures are designed to reduce the hazard's significance of impact through a variety of controls, ranging from hazard elimination and substitution to the mandated utilisation of personal protective equipment (PPE). The effectiveness of the mitigation measures and controls placed upon the risk is then considered and the risk re-assessed to indicate the residual risks post mitigation.

9.4.2 Health and safety

Following consultation with the community, a number of individuals raised concerns regarding the potential for wind farms to have an adverse impact to human health. In response to the concerns, an independent report by the Long View Group (The Long View Group, 2014) was commissioned to review the scientific evidence on the human health impacts associated with wind farms. A summary of this report is contained in Chapter 10 Socio-Economic Assessment, with a full copy provided in Appendix H, Volume 3.

The report concluded that the general consensus of public health agencies and academic researchers identified in the reviewed literature concludes that there is no scientific evidence of an association between exposure to wind farms and adverse health impacts. This applies to noise (discussed further in Chapter 4), shadow flicker (Chapter 6) and EMI (Chapter 7).

9.4.3 Bushfire hazard

The assessment of bushfire hazard has been undertaken through a review of desktop information only. The assessment considers the environmental values within and adjacent to the Project Site. It also considers the potential ignition sources and fuel sources from known information about activities that currently occur within the Project Site, and are likely to occur as part of the Project.

Desktop resources that have been reviewed for this assessment include:

- The State Planning Policy Interactive Mapping System (Queensland Government, 2016), including bushfire hazard area
- Local Planning Schemes, including overlay maps
- Vegetation community mapping including the Regulated Vegetation Management Map and Vegetation Management Supporting Map (Department of Natural Resources and Mines, 2016)
- Aerial photography (Google, 2016)
- Available fire history information
- Description of the land use and ecology (Chapter 11 and Chapter 12 of this EIS respectively).

9.5 Description of environmental values

9.5.1 People and property

A desktop review undertaken for this assessment identified a number of sensitive receptors and their values within the Study Area. The findings of this review are presented in this section and specifically relate to the hazards concerning two categories of receptors - people and property.

In addressing natural and man-made hazards associated with the Project, consideration was given to risks involving people and their values. Those considered to be most likely at risk include, but aren't limited to, the following groups:

- Residents and workers in surrounding homesteads and nearby townships
- Road users and pedestrians on routes utilised throughout the construction and operation phases of the Project
- The Project workforce
- Surrounding privately leased or owned agricultural and residential land, land resources and infrastructure
- Off-site industrial or public infrastructure within the Study Area; including roads, railways, power and transmission lines, pipelines and other public or privately owned infrastructure.

The location of residential dwellings in close proximity to the Project is shown in Figure 2.2. Townships in the immediate proximity to the Project Site include Bell, Jandowae, Kumbia, Kingaroy, and Dalby which provide accommodation for tourism as well as other industries that support employment in the region.

9.5.2 Bushfire hazard

This section describes the existing environmental values found within and adjacent to the Study Area that may potentially have an impact on, or be impacted by, bushfire. More details on the environmental values relating to landscape, ecology and geology of the Project Site can be found in Chapter 5 Landscape and Visual Assessment, Chapter 12 Flora and Fauna, and Chapter 16 Topography, Geology and Soils of this EIS respectively.

9.5.2.1 Landform

Slope and aspect are the two landform features that have a major influence on bushfire behaviour. The Study Area is located within the Great Dividing Range, which extends along the eastern coast of Australia. The highest point in the vicinity of the Study Area is Mount Kiangarow (1,136 m Australian Height Datum (AHD)) which is located approximately 12 km south-east of the Project Site, in the Bunya Mountains National Park.

The Study Area is characterised by a number of ridgelines, predominantly orientated in a north-west to west direction. Generally, the proposed wind turbines are located along these ridgelines to maximise exposure to the wind resource within the area. These ridgelines range in height from 855 m AHD in the south-east of the Study Area to 470 m AHD in the north-west of the Study Area. Away from these ridgelines, properties within the Study Area are as low as 500 m AHD. The proposed substation is located on flatter land adjacent to Niagara Road.

Land use within the Study Area is predominantly beef cattle grazing as well as sorghum and corn crops. Throughout the area there are a series of minor public roads and numerous private access roads enabling vehicular movement.

9.5.2.2 Vegetation

Most of the Study Area has previously been cleared for grazing, and as a result the vegetation is mostly disturbed paddock comprising a variety of pasture grasses and weeds with scattered eucalypts (*Eucalyptus* spp.) and Bottle Trees (*Brachychiton* spp.). There are some large areas of remnant vegetation, which were generally found to correspond to mapped Regional Ecosystems (REs). The patches of remnant vegetation are in average to good condition with most experiencing edge effects, (including the encroachment of weeds). Those areas that have not been subject to cattle grazing and logging are in particularly good condition and are most likely to provide suitable habitat for threatened flora and fauna species.

There are 12 REs within the Study Area (see Chapter 12 Flora and Fauna). Several areas of High Value Regrowth (HVR) vegetation have also been mapped within the Study Area.

Of particular importance is the Semi-Evergreen Vine Thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions, which are listed as Endangered under the *Environment Protection and Biodiversity*

Conservation Act 1999 (the EPBC Act). This vegetation community corresponds with RE 11.8.3 and RE 11.9.4 and both of these REs are listed as Of Concern under the *Vegetation Management Act 1999*. The SEVT is a fire sensitive community and requires protection from wildfire. Access roads constructed for the Project are likely to improve the ability to protect this community from wildfire.

The Project Site is predominantly located within existing clearings or in previously disturbed areas and would require the removal of mostly pasture grasses. However, there are some areas where turbines and associated infrastructure may result in the clearing of vegetation mapped as RE and regrowth vegetation. Further consideration of this has been provided in Chapter 12 Flora and Fauna, whilst a detailed assessment of the impacts of clearing on bushfire hazard will be undertaken during the detailed design phase of the Project.

Three weeds declared under the *Biosecurity Act 2014* were observed during the field investigation Velvet pear (*Opuntia tomentosa*); Prickly pear (*Opuntia stricta*); and Lantana (*Lantana camara*). Fires can interact with weeds and pest species by modifying natural environments such that opportunities for the establishment of weeds and pests are promoted.

9.5.2.3 Climate

Weather factors that influence the length, severity of the fire season, and direction of fire spread include temperature, relative humidity, wind direction and rainfall.

In south-east Queensland, fuel accumulates during the hotter summer months (December to February). However, fires are most likely to occur during spring (September to November) following the frost period and before the onset of the rain season.

The Study Area has a sub-tropical climate with warm, wet summers and mild winters. Data collected between 1992 and 2010 at Dalby Airport indicates the likely driest months of the year in the Study Area are from April to September (Bureau of Meteorology, 2016). It is following these dry periods when bushfire risk is likely to be greatest.

9.5.2.4 Infrastructure, community and access

The closest townships to the Project are Bell approximately 30km to the south and Kumbia approximately 30km to the east. The existing land use within and around the Project Site is predominantly rural, characterised largely by cattle grazing within the localities of Cooranga North, Bilboa, Boyneside and Ironpot (see Figure 11.1, Volume 2). The largest nearby townships include Kingaroy to the north-east, Dalby to the south and Jandowae to the south-west. Other land uses in proximity to the Project Site include a cattle tracking equipment research facility; commercial dairies; and industrial feedlots.

The project is predominantly within the South Western Region of the Queensland Fire and Emergency Services department which has a total of 42 permanent and auxiliary urban fire stations. The closest regional fire station is within Dalby (Queensland Fire and Emergency Services, 2016a).

In rural Queensland the use of fire is controlled through the volunteer Fire Warden network. The Study Area falls under four local fire warden districts (FWD) (Queensland Fire and Emergency Services, 2016b). These are:

- Ironpot FWD
- Kumbia No. 2 FWD
- Cooranga North No. 1 FWD
- Cooranga North No. 2 FWD.

The Bunya Highway is the largest State Controlled Road (SCR) in the area, with major connecting roads including Kingaroy-Jandowae Road (also both SCRs), local council roads including Niagara Road, Jarail Road and Cooranga North – Niagara Road distribute traffic to local businesses and properties.

Onsite there is an existing 275 kV transmission line corridor that runs in an east-west direction through the south of the Project, south of Niagara Road, and a 132 kV Ergon Energy corridor that runs to the north of the existing 275 kV Powerlink corridor, before both transmission corridors align in the south-east of the Study Area.

9.5.2.5 Fire history

The Australian Emergency Management Knowledge Hub has a record for a large number of fires occurring throughout Queensland from August to October 2011 (Australian Emergency Management Institute, 2016). This includes within the South Burnett and Western Downs regions. The database does not hold any specific bushfire event information for fire events near the Project Site. There are news reports of large bushfire events in proximity to Dalby and Kingaroy within the past four years (The Chronicle, 2012), (ABC News, 2014), (Queensland Government, 2015).

9.5.2.6 Bushfire hazard mapping

The SPP provides mapping which includes *A new methodology for State-wide mapping of bushfire prone areas in Queensland* with bushfire hazard mapping (DSDIP, 2014a). This mapping has been developed by CSIRO (CSIRO, 2014) and designates the Project Site as potentially subject to 'Medium', 'High' and some small pockets of 'Very High' potential bushfire fire intensity. It also applies a 100 m Potential Impact Buffer to the potential bushfire areas (refer to Figure 9.1, Volume 2).

The Project Site is also identified as being within a natural hazard management area (bushfire) within the former Kingaroy Shire Council and Wambo Shire Council local government Planning Schemes.

Site specific fuel and hazard assessments of the Project Site have not been undertaken at this stage of the Project.

9.6 Potential impacts

9.6.1 Hazardous goods and substance

Minor quantities of hazardous substances will be stored on the Project Site during the construction and operation of the Project. These potential hazardous substances include:

- Solvents
- Paint
- Oil (Transformer)
- Lubricant
- Sealant
- Anti-corrosives
- Gases (oxygen and acetylene)
- Diesel
- Unleaded petrol.

The above hazardous substances may pose an acute risk to people, property and the environment due to their chemical or physical properties. However, the monitoring of hazardous substance use and storage, through the implementation of standard hazard and risk procedures, is expected to adequately address the potential risk posed by the utilisation of these substances. Likely impacts from hazardous substances and mitigation measures to avoid or reduce residual impacts are provided in the PHA in Table 9.5.

9.6.2 Preliminary hazard assessment

The Project activities that could potentially introduce hazards and risks to people and property have been identified and assessed for the purpose of this EIS. The assessment in Table 9.5 considers potential impacts for both on-site and off-site Project activities during all stages of development.

Table 9.5 Preliminary hazard assessment

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
1	Tanker crash (with rupture - single or multiple vehicle)	<p>Release of diesel, lubricant or waste oil, resulting in soil contamination, vegetation health impacts and downstream waterway impacts.</p> <p>Death or injury to occupants of vehicle.</p> <p>Loss or damage of property (private vehicle, public or private infrastructure, loss of fluid).</p>	4	The route roads are sealed with intersections and signage adequate for traffic volumes and types. Overall, the route possesses few outstanding hazards, with the exception of wet weather events.	B	M	<ul style="list-style-type: none"> Requirements for vehicles to comply with ADG code. Trucks to be equipped to respond to rupture event, including first aid, firefighting and spill response. 	2	B	L
2	Spills or leaks of sewerage (during collection/ operation of portable toilets, piping, storage, treatment)	<p>Spills and leaks of sewerage, of localised and limited size and location, polluting soil and surface water with pathogens and untreated waste.</p> <p>Effects on the functionality of the sewerage network, including possible outages.</p> <p>Nuisance odour.</p>	2	<p>Likelihood of significant impact event occurring is quite low, assuming appropriate design and construction of sewerage infrastructure and effective operation and maintenance schedules.</p> <p>Minor spills and leaks may occur, however it is not anticipated that these events would occur more than once in a given year.</p>	B	L	<ul style="list-style-type: none"> Spill kits readily available Contractors and operators to be appropriately licensed and trained. Maintenance and monitoring of sewerage network to be scheduled to sufficiently reduce the likelihood of events occurring. 	2	A	L
3	Site storage tank containing diesel ruptures, leaks or	Contamination of environment compromising the integrity	4	Storage tanks holding diesel comply with AS 1940. These standards are in place to	B	M	<ul style="list-style-type: none"> Storage of relatively small amounts of hazardous 	2	B	L

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
	spills.	of values relating to soil, groundwater and surface water systems. Subsequently this affects the receiving terrestrial and aquatic flora and fauna.		minimise the likelihood of ruptures or leaks resulting in a contaminating release to the environment. Spills unlikely to significantly affect persons or property due to localised potential of a spill and low quantity stored on site.			<ul style="list-style-type: none"> substances, oil and chemicals bunded chemical storage areas Storage where low risk of damage to containers. Containment if spill occurs. Oil and lubricants and other regulated waste will be removed from site and disposed of using a licensed specialist contractor 			
		Health risk to persons as a result of inhalation.								
4	Major rain/flood event occurs upstream or on-site	Major rain and flood events naturally mobilise sediment from within a catchment which degrades surface water quality downstream by increasing turbidity and ultimately depositing sediment within deposition zones (which may be external to streams).	3	The Project Site and its infrastructure will be designed to withstand predicted flood events. However, although not probable, it is possible for an event to occur that exceeds the Project's design specifications. Very unlikely for any injuries or fatalities to occur to workforce or persons downstream.	B	M	<ul style="list-style-type: none"> Ensure drains are lined to reduce flow velocity and prevent scouring of drain. Stabilise batters. Implementation of an Erosion and Sediment Control Plan Temporary and permanent drainage control through the Project Site Plan to limit land disturbance during periods of known high rainfall, where 	3	A	L
		Damage to property both within the Project Site and downstream, such as local government controlled roads and								

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
		private property.					practicable and possible.			
5	Bushfire in Project Site and/or Study Area	Risk of death, injury to persons and loss of property (vehicles, equipment, infrastructure) to inhabitants immediately surrounding the Project Site and local roads	4	Bushfire hazard mapping designates the Project Site as potentially subject to 'Medium', 'High' and some small pockets of 'Very High' potential bushfire fire intensity.	C	H	<ul style="list-style-type: none"> - Develop a bushfire management plan - The substation and construction offices will be designed and constructed to comply with AS3959 to protect employees - Fire warnings and notices will be observed, including evacuation notices 	4	B	M
		Loss of flora and fauna both within and outside the Project Site, potentially including forests and recreational areas.								
6	Accident involving operation of site machinery / equipment	Risk of death, injury to persons operating in the vicinity of the accident.	5	Likelihood of occurrence, without maintenance and appropriate operator and safety training is possible.	C	H	<ul style="list-style-type: none"> - All staff to be suitably trained for the task they are undertaking. - Adherence to strict incident management and emergency response plans, as appropriate in site health and safety systems and protocols. 	5	A	M
		If working at height, significant risk of injury or death to person due to fall injury.								
		If working with or in the vicinity of electrical hazards, significant risk to person and potentially others using or in vicinity of electrical hazard.								
7	Unauthorised access to site	Death or serious injury to intruder gaining access to hazardous areas.	4	Unit operations or facilities presenting high risks i.e. deep excavations, fuel	B	M	<ul style="list-style-type: none"> - Security and warning signs at all access points and 	4	A	M

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
		Environmental incident or production losses due to intruder's deliberate or accidental interference.		storage are fenced. It is considered unlikely that an unauthorised access to the Project Site would occur.			tracks/roads that intersect the Project Site. - Sensitive areas to be secured with fencing and gates where required, i.e. substation			
8	Snake bite	Snakes in the area range from highly venomous to non-venomous. Potential for bites from venomous snakes can be fatal if untreated or cause serious harm to persons	4	Likelihood of bite occurrence in cleared areas is low, while likelihood in vegetated or rocky/escarped areas is slightly higher.	B	M	- All site personnel to be trained in safe work practises limiting the risk of snake bite, as well as instructing basic first aid and response procedures. - Appropriate PPE is to be worn when carrying out work in areas likely to contain snakes.	4	A	M
9	Cyclone	Damage to people (death/injury) and property due to effects of high wind, rain and dust events.	4	The inland location of the Project Site reduces the likelihood of a cyclone of significant magnitude causing material damage or harm to persons.	A	M	- Infrastructure to be designed and constructed according to the appropriate standards protecting against the risk of high wind events. - In the event of an approaching	3	A	L

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
							cyclone or high wind weather system, infrastructure and equipment on site would be secured. Turbines to be locked down facing into the wind			
10	Storm	Damage to people (injury) and property due to wind, hail, rain and dust.	2	A storm event that causes serious bodily injury and results in Lost Time is considered to be possible without any mitigation applied.	C	M	<ul style="list-style-type: none"> - Infrastructure to be designed and constructed according to the appropriate standards protecting against the risks associated with storm events. - In the event of an approaching storm, infrastructure and equipment on site would be secured appropriately. 	2	A	L
11	Flood	Fast flowing and potentially deep overland flows, swollen rivers and creeks, scour, erosion and sedimentation causing risk to people, property and the environment. Impervious infrastructure on-site may	3	The proposed infrastructure will result in only a very small increase in the proportion of impervious area in the catchment and therefore there will be a very small increase in the runoff volume.	B	M	<ul style="list-style-type: none"> - In the event of a likely flood event approaching the Project Site, infrastructure and equipment on site would be secured and prepared for the influx of water 	3	A	L

Hazard no.	Hazard event	Potential Impact					Mitigation	Residual Impact		
		Consequence	C	Likelihood	L	Risk		C	L	R
		increase downstream flooding.					from the upstream catchment.			
12	Lightning	Damage to people (death/injury) and property due to direct or indirect effects of lightning strike.	5	Lightning storms are known to occur in the area. However, strikes to people and equipment are unlikely.	B	H	<ul style="list-style-type: none"> - Design mitigation of risk into infrastructure elements – such appropriate surge protectors and lightning protection for turbines and masts. - Suspend outdoor activities during storm activity. 	4	A	M
13	Landslide	Damage to people (death/injury) and property due to direct or indirect effects of landslide.	4	Landside risk in the Project Site is considered to be low, with the region not recognised as generally posing geological, morphological or physical conditions conducive to causing natural landslides (Geoscience Australia, 2016)	B	M	<ul style="list-style-type: none"> - Ensure drains are lined to reduce flow velocity and prevent scouring of drain. Stabilise batters. - Plan to limit land disturbance during periods of known high rainfall, where practicable and possible. 	3	A	L

9.6.3 Bushfire

The Project is located within a bushfire hazard area and may be subject to a bushfire event of high potential intensity (refer to Section 9.5.2.6).

Although the Project is not inherently susceptible to fire, there will also be some level of risk of a fire starting as electrical equipment will be on site during construction, operation and decommissioning. Wind farms can also be struck by lightning, but they are equipped with comprehensive lightning protection systems that transfer high voltages and currents safely to the ground. The flammable parts of the turbine are located within the nacelle (high above the ground) and potential fuels from the surrounding vegetation.

Construction activities on site have the potential to temporarily increase the risk of bushfires (from hot work and temporary bulk storage of hazardous materials). The potential impacts from a bushfire without mitigation or control measures in place are presented in Table 9.6.

Table 9.6 Potential impacts from bushfire

Project phase	Project activity or event	Potential impacts
Construction	Unsafe hot work activities start a bushfire event	- Risk of harm to construction workers, visitors and local community
	An uncontrolled bushfire event passes through the Project Site	- Risk of the bushfire damaging adjacent properties - Damage to the construction site and materials - Delay to the construction program - Risk of harm to sensitive vegetation communities and fauna habitat - Increasing the intensity of a bushfire through provision of additional fuels (e.g. construction materials)
Operation	Turbines are hit by lightning and start a bushfire event	- Risk of harm to construction workers, visitors and local community
	Turbines malfunction and start a bushfire event	- Risk of the bushfire damaging adjacent properties
	Unsafe hot work activities start a bushfire event	- The wind farm is unable to function effectively following the event
	An uncontrolled bushfire event passes through the Project Site	- Supporting infrastructure on site is damaged (e.g. transmission lines) - Risk of harm to sensitive vegetation communities and fauna habitat
Decommissioning	Unsafe hot work activities start a bushfire event	- Risk of harm to construction workers, visitors and local community
	An uncontrolled bushfire event passes through the Project Site	- Risk of harm to sensitive vegetation communities and fauna habitat

9.7 Mitigation measures

AGL's Health, Safety and Environment (HSE) Policy sets out overarching objectives for HSE, and the strategies by which those objectives will be achieved. The policy applies to all employees, contractors, products and services, and joint ventures under AGL's operational control. AGL's health, safety and environment management system is based on the requirements in Australian Standards AS/NZS 4801 (2001) Occupational Health and Safety Management Systems and AS/NZS ISO 14001 (2004) Environmental Management Systems.

AGL is committed to providing employees with a safe and healthy place to work, to measuring and publishing safety performance, and high standards of accountability.

9.7.1 Hazardous goods and substance

Storage locations will include the temporary construction compound, substation and turbine sites. All chemicals and hazardous substances will be stored in bunded areas with Safety Data Sheets (SDS) made available. Due to the minor quantities of hazardous substances on site, a dangerous good store will not be required. Further details

of the storage of hazardous substances during construction will be provided in the Project's Construction Environmental Management Plan.

9.7.2 Bushfire

The medium to very high bushfire hazard severity rating indicates that bushfire protection and mitigation strategies are required to protect the infrastructure and people within the Project Site. Both the risk of a bushfire starting and the impacts from a bushfire event can be reduced through the employment of mitigation measures including appropriate design and construction; provisions for emergency services; personal protective measures; and maintenance and monitoring programs. Mitigation measures that may be adopted for the Project are provided within Table 9.7.

Table 9.7 Potential bushfire impact mitigation measures

Mitigation measure	Detailed discussion
Appropriate design and construction	<ul style="list-style-type: none"> - A Bushfire Management Plan (BMP) will be developed by a suitably qualified professional that informs the final design and bushfire management provisions required - Buildings (including the substation) will meet the specifications and requirements of AS 3959 of buildings in bushfire-prone areas in order to improve their performance when subjected to burning debris, radiant heat or flame contact generated from a bushfire - Equipment and machinery (including turbines) will provide high safety standards - Fire breaks will be maintained around the construction site - Designated smoking areas for construction and operations workers will be appropriately placed to minimise the risk fire ignition - A Construction Environmental Management Plan (CEMP) will be developed and implemented, incorporating provisions outlined in a BMP, including clearing an appropriate corridor for the alignment - Ignition sources and hazardous materials will be controlled in accordance with the CEMP - The infrastructure constructed will have minimum safety clearance requirements for vegetation in proximity to the turbines, substation and transmission lines. This will ensure that the risk of impact on the proposed infrastructure in the event of a bushfire is minimised - Fire Danger Index (FDI) will be monitored daily and construction works scheduled accordingly, as identified in the BMP - Lightning protection devices will be installed within turbines - Where practicable, services will be kept underground, particularly electricity (reticulation between turbines) - Adequate access will be provided at the proposed substations and along the access roads for emergency services - The substation and construction offices will be designed and constructed to comply with AS3959 to protect employees - Careful management and control of the hazardous materials will be implemented during construction and operation - Connection to the transmission line will be undertaken to standards that satisfy the <i>Work Place Health and Safety Act 2011</i>, the <i>Electricity Act 1994</i> and the <i>Electrical Safety Act 2002</i>.
Provision for emergency services	<ul style="list-style-type: none"> - Consultation will be undertaken with property owners that contain or are neighbouring to wind turbines, to help develop the emergency provisions within the BMP - Suitable ingress and egress will be provided to site and escape routes. Access roads will have the capacity and design to carry fully loaded fire fighting and emergency vehicles. Roads will be clearly signposted and buildings clearly identified - Appropriate water supply will be provided in the form of either water storage or access points for fire-fighting purposes

Mitigation measure	Detailed discussion
	<ul style="list-style-type: none"> - Consultation will be undertaken with the local fire wards and Queensland Fire and Emergency Services (QFES) - Adequate road access will be provided for fire-fighting/other emergency vehicles and safe evacuation.
Employee protection measures	<ul style="list-style-type: none"> - Fire warnings and notices will be observed, including evacuation notices - Emergency Response Procedures will be prepared and implemented, this includes developing and implementing Fire Evacuation Plans, Stay or Go policy and drills; and developing and implementing Coordinated Operations Plans to improve efficiency of response and allow deployment of out of area resources - Adequate communication plan and communication equipment will be provided within the substations - Employee activity will be limited during Heightened Fire Danger Periods - Buildings will be fitted with fire detection systems in accordance with AS 1670 – Fire detection, warning, control and intercom systems – Control and indicating equipment - Remote deactivation of turbines will be available - Appropriate fire protection equipment/systems will be maintained at site offices and vehicles, with appropriate training provided as required.
Maintenance and monitoring programs	<ul style="list-style-type: none"> - Maintenance of vegetation will be undertaken to remove any potential forest fuels in accordance with the BMP, including within asset protection zones (setbacks between buildings/structures and hazardous vegetation) - A Weed Management Strategy will be developed - Fuel management methods will be implemented to mitigate fire hazards, including planned fuel reduction burns - Causes of fire will be investigated and, where necessary, facilities or procedures will be updated to prevent further incidents - Daily FDI will be monitored and maintenance works scheduled accordingly, as identified in the BMP - Visual inspections will be conducted for smoke or fire during construction - Visual inspections will be conducted around construction areas for presence of dry fuel - Regular maintenance and servicing of equipment and turbines will be carried out.

A detailed risk assessment and BMP will further determine the hazards and risks of the Project and provide appropriate site specific mitigation measures. A BMP will be completed prior to construction and will detail the design, appropriate emergency responses, and mitigation measures required to enable the Project to function effectively during and immediately after bushfire events. The BMP will further specify appropriate clearance distances and emergency service access requirements during construction and operation.

The development of the BMP will be undertaken in consultation with relevant authorities, stakeholders, property owners and neighbours and will include site assessments of fuel loads as well as determining where asset protection zones may be required to protect infrastructure and/or people. This will be undertaken during the detailed design stage.

The BMP will contain (but is not exclusively limited to) information on:

- Accessible water supply
- Fuel reduction programs
- Fuel load assessments, ignition source assessments, and exposure assessments
- Protection zones
- FDI actions
- Stay or Go policy
- Wildlife mitigation zones

- Exclusion zones
- Emergency response planning, evacuation and relevant emergency contact details
- Fire management advantages – including access roads and water points
- Hazard reduction methods (e.g. prescribed burning, mowing and/or slashing)
- Monitoring provisions
- Signage requirements
- Consultation with local fire wardens, QFES, stakeholders, property owners and neighbours.

The BMP will be prepared to satisfy the requirements of the SPP, Kingaroy Shire Planning Scheme Policy - 4 and Wambo Shire Planning Scheme Policy - 1.

9.7.3 Consultation

The Queensland Department of Community Safety (DCS) will be consulted prior to construction of the Project, and notified of likely timeframes for construction. The Project detailed design will be in accordance with relevant standards, including requirements for emergency vehicle access. A CEMP will be prepared that comprehensively deals with any issues raised by DCS (refer to Chapter 20 Project Commitments).

9.8 Residual impacts

The Project is not considered to present a significant hazard or risk to people or property following the application of practical mitigation, control and management measures as outlined in in this chapter.

In terms of bushfire hazard, despite the mitigation measures and treatments to be put in place, it is not possible to completely eliminate the likelihood of a bushfire event occurring. The Project is unable to mitigate the risk of a bushfire event starting from natural causes such as lightning or activities from neighbouring properties.

Wind turbines are designed and manufactured to incorporate quality and safety standards (including Australian and international standards) that minimise the risk of fire to an absolute minimum (NSW Department of Environment, Climate Change and Water, 2010). Control systems, monitoring systems and regular maintenance during operation of the Project ensure that the operational parts of the turbines do not wear or fail and become a fire hazard. Wind turbines are fully automated, with fail-to-safe mechanisms to bring the machine to a safe condition should something go wrong or when the turbine is experiencing extreme conditions (e.g. extreme wind or heat).

Despite this, it is recognised that the risk of fire always exists when electronics, electrical equipment and flammable oils and hydraulic fluids exist in the same enclosure. The detailed design of the Project and the implementation of a BMP will minimise the likelihood of a bushfire event from occurring.

It is not anticipated that the Project will increase the effects of a bushfire that passes through the site and hence heighten the risk to people or property. The Project Site allows for the provision of access and maintenance roads from the local road network that can act as fire breaks and facilitate emergency access. Any final layout will incorporate access from the local road network which improves firefighting access for fires that originate outside the Project Site.

Should the Project be operationally impaired by a bushfire event, this will have minimal impact on the community and natural environment as they are not dependent on the Project's operation.

9.9 Cumulative impacts

Cumulative impacts to bushfire hazard can be identified as a potential change in the surrounding environment from a project or development that may then increase or decrease the risk of a bushfire event to the Project or to other properties. The predominant risk of additional projects and proposals is the increase of ignition sources and changes in fuel distribution.

Coordinated projects, State government projects and local development applications will require approval in line with State legislation and planning requirements. This approval process will ensure that adequate design and assessment is undertaken to manage the risks of fire ignition and protection of the projects/developments during a bushfire event. However, increased development within a local area can strain local firefighting resources, which may impact on the Project's ability to withstand a bushfire event and function effectively following an event.

A review of the current and proposed projects (including coordinated projects, Department of Transport and Main Roads projects and regional council projects) has identified that there are not any large projects within the local area that may increase the risk of a bushfire event at the Project Site, or constrain fire services in the event of a bushfire. The distance that a bushfire can spread is dependent on the wind, topography and fuel loads of the environment. However, the likelihood of a fire event that has started as the result of another project or development reaching the Project Site is extremely low. Roads (as fire breaks), vegetation clearance and slope changes are likely to prohibit the spread to the Project Site from these other areas.

Unknown small scale developments and activities within the local area that involve hot works may still pose a bushfire risk to the development.

9.10 Summary and conclusions

The level and nature of hazards associated with the Project have been described in this chapter. The Project is not considered to present a significant hazard or risk to people or property following the application of practical mitigation, control and management measures as outlined in this chapter.

The Project Site is situated within land identified to have a medium to very high level of potential bushfire hazard due to the nature of the surrounding environment.

Bushfire events can start from natural causes like lightning or from human activity. Consideration of appropriate design and construction measures; provisions for emergency services; personal protective measures; and maintenance and monitoring programs will mitigate both the impact of a bushfire event to the Project and the risk of a fire starting at the Project Site.

Prior to construction, a BMP will be prepared for the Project following a detailed risk assessment (using the appropriate risk management and bushfire risk standards including AS/NZSISO 21000 Risk Management) to guide the mitigation requirements and site specific controls.

There will always be a low risk of a bushfire event occurring. The Project is located in a sparsely populated, rural area, however there are ignition sources present (including hot work activities as part of farming practices and maintenance of farming plant and machinery) that may start a bushfire event. Additionally, there is always a risk of fire when electronics, combustible oils and hydraulic fluids are present.

With the appropriate design and mitigation measure in place, the impacts to the Project following a bushfire event are considered to be low and the Project should have the ability to function after it (some minor repairs and maintenance may be necessary). The local community will not be impacted by any temporary downtime following an event, as they are not directly dependant on the electricity supply from the Project.

9.11 References

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