Bushfire Management Plan

Flat Rock Wind Farm

July 2022

envision
bushfire protection

LIMITATIONS STATEMENT

This Bushfire Management Plan ('BMP') has been solely prepared for Enel Green Power Australia on behalf of Moonies Hill Energy Pty Ltd for the Stage 1 Flat Rock Wind Farm southeast of Kojonup across a 40 km^2 area within both the Shire of Kojonup and the Shire of Broomehill Tambellup.

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Version Control

Stage 1 Flat Rocks Wind Farm			
Version	**Date**	**Author**	
V1	13 June 2022	Anthony Rowe	Draft
V2	2 July 2022	Anthony Rowe	Client revisions
V3	14 July 2022	Anthony Rowe	Submission

Disclaimer

In undertaking this work, the authors have made every effort to accurately apply the available information at the time of writing following the instructions of the regulatory authorities and applying best practice as described by the Fire Protection Association Australia. Any conclusions drawn or recommendations made in the report are made in good faith, and the consultants take no responsibility for how this information and the report are subsequently used.

Envision Bushfire Protection accepts no liability for a third party's use of, or reliance upon, this specific report.

Envision Bushfire Protection accepts no liability for the inaction of the owner to provide or maintain the bushfire protection measures identified in this report. Vegetation is dynamic, building materials may distort, and the accumulation and the location of flammable materials near the building may affect the potential for damage or loss of a building to occur.

Failure to maintain the property and/or building to these standards may compromise an insurance policy if currently covering any of your assets or those of any third party that may be consequentially affected due such failure. If not insured, and if you are seeking insurance, this report may not influence the decision of any insurer not to offer cover.

Importantly the measures contained in this report cannot guarantee human safety or an absence of harm or that the building will not be damaged or would survive a bushfire event on every occasion. This is due to the unpredictable nature of fire behaviour (knowledge in this field continues to develop) and the unpredictable nature of extreme weather conditions.

Client relationship

I was engaged to provide expert bushfire safety and planning advice. My relationship with the client is a standard commercial contract, and no private, personal, or other matter has influenced the content of the BMP or my findings.

STATEMENT OF CONFORMITY – PLANNING AND DEVELOPMENT ACT 2005

Anthony Rowe Level 3 - BPAD36690

Principal

EXECUTIVE SUMMARY

Preface

This Bushfire Management Plan ('BMP') has been solely prepared for Enel Green Power Australia for the Stage 1 Flat Rocks Wind Farm, to be located south east of Kojonup in an area within the Shire of Kojonup and the Shire of Broomehill Tambellup.

The wind farm at Stage 1 comprises 18 individually sited turbines within a 40 km^2 area.

The site is within a declared bushfire prone area. Accordingly, the proposal is to be assessed for compliance with State Planning Policy 3.7 *Planning in Bushfire Prone Areas* ('SPP 3.7') "*to preserve life and reduce the impact of bushfire on property and infrastructure*" in meeting the supporting elements described in the Guidelines for Planning in Bushfire Prone Areas V1.4 (the Guidelines).

The area in which the turbines are located is pasture, with isolated pockets of remnant forest vegetation. It is gently undulating with slopes of $2.0^0 – 3.0^0$. The windfarm will be hosted by individual landowners and the operation of the windfarm will be managed by Enel Green Power Australia. Agricultural operations will continue around the windfarm assets.

The development of the wind farm comprises a construction phase and an operational phase, the elements of which are described following:

Construction

- Construction compound
  - Construction site office and amenities
  - Concrete batching plant
  - Workshop and vehicle service
  - Fuel stores
- Access roads (making)
- Trenching and installing reticulated power; and
- Turbine assembly compounds at each site

Post construction

- 18 Turbine installations (site assembly compounds removed);
- Substation
- Operations compound (control building and workshop);
- Access roads

The windfarm has been conditionally approved by Shire of Kojonup and the Shire of Broomehill Tambellup. One of the conditions of approval (condition 19) requires the provision of a Bushfire Management Plan addressing the following:

"(a) Identification and clear mapping of firebreaks, emergency ingress and egress points, water points, turnaround areas for fire trucks, water sources, on site fire-fighting equipment;

(b) Identification of on-site tracks for access by emergency fire vehicles, and the requirement for these tracks to be maintained to a trafficable standard at all times;"

"(c) Emergency procedures and personnel contacts;

(d) Consideration of activities on fire ban days;

(e) Notification for other agencies."

Items (a) and (b) have been addressed in the risk register and illustrated spatially on Figures 1a-1g and Items (c), (d) and (e) have been addressed in the Emergency Management Plan contained in this Plan

Risk Assessment

Following the requirements of SPP3.7 a risk assessment has been undertaken as a basis for identifying the risk treatments to satisfy the intent of condition 19.

The intent of SPP3.7 is a risk based arrangement and has been affirmed by the West Australian State Administrative Tribunal.

> *SPP 3.7 is not a prohibition, that risk SPP 3.7 does not require that there be no increase at all in the threat of bushfire to people property or infrastructure. The intention of the policy is to 'implement effective, risk based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure'*[1].

This BMP has applied the risk management methodology described in AS/ISO 31000:2018 and the National Emergency Risk Assessment Guidelines (NERAG 2020) to methodically identify the risks and provide corresponding practical risk treatments.

As Low as Reasonably Practical (ALARP) has been applied to determine the risk treatment measures, for both a fire arriving at the site and for a fire ignited and spreading from the site.

The objective, outcome sought, followed Objective 5.1 from SPP 3.7

> *To avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.*

This assessment of the Flat Rocks Wind farm has involved an extensive literature review on the subject of bushfires affecting wind farms and the ignition of bushfires from wind farms.

The Australian Fire and Emergency Service Authorities Council (AFAC) *wind farms and bushfire operations - Guideline 2018*, found wind farms are not expected to adversely affect bushfire behaviour, including as a hazard to low flying firefighting aircraft, but the turbines should be shut down to reduce turbulence.

International studies find a typical wind farm with 150 turbines may experience one or two fires during 20 years of operation.[2] The nacelle is provided with heat monitoring and fire suppression systems. If these are overwhelmed a nacelle fire is uncontrollable due to its height. The focus therefore is to ensure there is no fire spread or spotting ignitions allowed to develop downwind of the turbine.

A nacelle fire does introduce a different fire dynamic to that of traditional grassland fires. The height of the nacelle creates a potential for downwind spotting and can create dangerous conditions underneath necessitating an exclusion zone. For a grassfire the focus is mostly upon suppressing the fire line; in the event of a nacelle fire resources may need to be split to attend to the fire line as well as addressing any downwind spot fires.

A risk level is a combination of the likelihood and consequence.

The consequence was identified as moderate: if a fire occurs it has the potential to cause loss of a year's earnings due to the destruction of a crop. This is considered in the context of existing controls that should include following the directions of the annual fire break notice to reduce the vulnerability of buildings and assets to grassfire. Establishment of separation areas will reduce the consequence of damage to asset; the consequence is therefore the loss of a crop.

The residual risk after treatments as identified in the attached emergency management plan is 'medium' and comparable to the existing risk level characteristic of pastural activities.

It is acknowledged that the wind farm introduces a new dynamic to firefighting in the locality; a turbine fire has the potential for spotting downwind. Measures have been applied to minimise the occurrence and provision of flexible firefighting equipment will assist to chase down small fires before they can develop.

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[1] HARMANIS HOLDINGS NO. 2 PTY LTD and WESTERN AUSTRALIAN PLANNING COMMISSION [2019] WASAT 43 (25 June 2019)

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[2] Firetrace international 2020 citing studies into the frequency of turbine ignitions https://www.firetrace.com/hubfs/_img/reports/Firetrace-Report-In-The-Line-Of-Fire.pdf

Risk Treatment

This BMP has addressed a condition of a planning authorisation made under the Planning and Development Act 2005. As such it is also subject to the requirements of State planning Policy 3.7 which is a risk management arrangement. It requires the identification of risk and prescribes that the risk treatments should follow four elements identified in the bushfire protection criteria. The four criteria being location, siting and design, vehicle access and water.

Location

The location is predominantly grassland and classed as a moderate bushfire hazard level, a level that is suitable for development. Areas of extreme bushfire hazard (predominantly forest) are to be avoided

Siting and design.

Siting and design requires suitable setback from classified vegetation can be established in order to preserve life and reduce the impact upon property and infrastructure. The setback distances are identified as a risk treatment and are based upon a potential separation from grassland that is below a level of serious harm.

The following Asset Protection Zones apply

- Around the site camp (construction compound) a 30 m wide area of grass maintained at less than 100 mm and no grass within the compound.
- Around the turbine construction compound a 30 m wide area of grass maintained at less than 100 mm and no grass within the compound.
- Around the base of the turbine (operational) a 20 m diameter area of compacted limestone or equivalent, and a 40 m diameter area of grass maintained at less than 100 mm.
- Around the substation a 30 m wide area of grass maintained at less than 100 mm and no grass within the substation area
- Around the operations building and maintenance compound a 21 m wide area of grass maintained at less than 100 mm and no grass within the maintenance compound. The operational building is to be constructed and maintained to the BAL 29 standard.
- Access route easements are 20 m wide.

Access

The access roads will be constructed to 21 tonnes with a 20 m reserve to be maintained as low threat. The construction standard is determined by the heavy vehicles that will be used for construction and service of the turbines.

The turbines will provide an area at their base to facilitate the turnaround of service vehicles. The access routes are predominantly through grassland with gentle slopes affording extended view to the location of a fire and the opportunity to take avoidance action.

The windfarm will utilise public roads and access to the turbines will be gated (see figures 1a – 1g).

The gates will be light (with light locks to enable push through), they are not intended as barriers. Each access will have Emergency cannisters (see attached) installed with emergency information inside them, including emergency contact details and maps of the site.

The turbines will be hosted on agricultural production sites. The existing Shire firebreak requirements will apply.

Water supply

The site does not have access to a reticulated water supply. Within the area of the windfarm there are a number of dams, but these may not be a reliable source of water in a period of extended drought. A distribution of water tanks is proposed within the windfarm as a convenient point to replenish firefighting appliances.

Three 50 000 L standalone water tanks ae proposed to be located at the:

- Inside of the access gate to WTGs 13,14,15,17
- Inside of the access gate to WTGs 1,2,3,4,5,6,7,55
- Inside of the access gate to WTGs 8,9,10,11,16

A 50 000 L standalone water tank will be provided at the construction compound and maintained at the operations building maintenance compound during the operation of the windfarm.

A 1 000 litre fire appliance (slip on unit) will accompany each working area during the construction phase and a 1 000 litre fire appliance (slip on unit) will be retained at the operations building and maintenance compound to attend maintenance site works during operation.

All vehicles entering the windfarm area will be required to be equipped with a fire extinguisher, to provide an early response to any grassland ignition.

Additional treatments are identified as management measures in the Emergency Management Plan continued in Appendix 2. It follows an Emergency Management System approach: *Prevention* (*Planning), Preparation, Response and Recovery*. It identifies the emergency procedures and personnel contacts, responsibilities and notification in a bushfire event and operational practices of total fire ban and harvest and vehicle movement restrictions.

In summary the Emergency Management Plan responds to two event types. The event of a turbine nacelle fire, and the event of a grassfire approaching the site.

Nacelle Fire

Report fire

- Shut down turbines, Y position and head to wind if possible
- Alert adjoining residents (SMS contact/WhatsApp)
- Alert the Shire/ Brigade for attendance

Landowner response

- Set up an exclusion zone no closer than 75 m from the base
- Provide the immediate suppression to the fire line outside the exclusion area
- Monitor the area downwind from the turbine for spot fires.
- Monitor the area until the nacelle fire is exhausted and an all clear has been given.

Brigade response

- Attend to the fire line outside the exclusion area.
- Alert areas down wind of the turbine, up to 5 km.
- Monitor for, and attend to, spot fires downwind from the turbine.

A fire approaching the site

- Shut down turbines, lock in Y position and head to wind if possible.
- Determine the severity of the fire. If there is potential endangerment to the site:
    - Workers at a turbine (if not safe to evacuate) should park vehicles at the base of the turbine at the lee side of the approaching fire
    - Guide personnel at risk to safety (evacuate or take shelter)
    - All personnel not directly involved in the fire response are to evacuate the site to a safe location as directed by the management team in coordination with public emergency services.
    - The Chief Warden (operations manager), and designated personnel, will ensure the evacuation of personnel has been successfully completed and that all personnel are accounted for.

The risk treatments identified in this BMP have followed the emergency management system approach Prevention (Planning) Preparation, Response and Recovery.

The risk assessment has identified treatments (physical works) as part of Prevention (planning) and Preparation, (described in the Risk Register) and the Response and Recovery described in the Emergency Management Plan (in Appendix 1). Combined these represent an As Low as Reasonably Practical outcome.

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1. PROPOSAL DETAILS

1.1 Introduction

This Bushfire Management Plan ('BMP') has been prepared for Enel Green Power Australia on behalf of Moonies Hill Energy Pty Ltd for the Flat Rocks Stage 1 wind farm to be located within the Shire of Kojonup and the Shire of Broomehill Tambellup.

The site is located in a 40 km^2 area south of the township of Kojonup **(Plate 2)** and is classed as overall being located within a bushfire prone area (OBRM 2021) as shown on **Plate 3.** Some development elements are outside the area shaded as bushfire prone, but the development is comprised of dependent elements within the area shaded as bushfire prone, the development as a whole is treated as within bushfire prone land.

Development, which includes buildings and land use, where located within a bushfire prone area, is required to demonstrate compliance with the requirements of State Planning Policy 3.7.

The policy intent is ***to preserve life and reduce the impact of bushfire on property and infrastructure.*** Compliance is achieved where a proposal incorporates the Acceptable Solutions as described under each Element in the Bushfire Protection Criteria or can satisfy the intent of each Element by performance principle and the Precautionary Principle.

SPP 3.7 is not a prohibition; SPP 3.7 does not require that there be no increase at all in the threat of bushfire to people property or infrastructure. Rather, as is seen in cl 2 of SPP 3.7, the intention of the policy is to 'implement effective, risk based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure'.

Background

The proposed development represents Stage 1 of a wind farm concept for 18 turbines, the site area straddling the Shire of Kojonup and the Shire of Broomehill Tambellup.

The Shire of Kojonup at its meeting 28 September 2021 resolved to conditionally approve Stage 1. Condition 19 of the approval as provided:

> *"Prior to commencing any works, the Applicant is to lodge a Fire Management Plan for approval by the local government. The Fire Management Plan shall be prepared by a suitably qualified consultant and in the context of the construction and operational phases of the development address the following matters -*
>
> *(a) Identification and clear mapping of firebreaks, emergency ingress and egress points, water points, turnaround areas for fire trucks, water sources, on site fire-fighting equipment;*
>
> *(b) Identification of on-site tracks for access by emergency fire vehicles, and the requirement for these tracks to be maintained to a trafficable standard at all times;*
>
> *(c) Emergency procedures and personnel contacts;*
>
> *(d) Consideration of activities on fire ban days;*
>
> *(e) Notification for other agencies."*

This Shire decision follows the conditional approval of the Great Southern Joint Development Assessment Panel made on 27 July 2013 – condition 10.

This (Bushfire Management Plan (contemporary terminology for a Fire Management Plan) has been prepared following condition 19 in the Shire approval.

The Bushfire Management Plan has followed the contemporary procedures for the identification of risk determination and risk management measures as required for a power generating land use.

1.2 Development Proposal

The foundation investigations supporting the approved windfarm were summarised in the Environmental Impact Report 2010, which included:

- Flora, Vegetation and Fauna Assessment: prepared by: Mattiske Consulting Pty Ltd 2010
- Ethnographical Survey Report: prepared by R and E O'Connor Pty Ltd Sept 2010
- Archaeological Survey Report: prepared by John B. Cecchi Sept 2010
- Background Monitoring Report: prepared by Herring Storer Acoustics May 2011
- Noise Impact Assessment: prepared by Herring Storer Acoustics June 2011
- Landscape and Visual Impact Assessment: prepared by William James Landscape Architects July 2011
- Zones of Visual Influence: prepared by GL Garrad Hassan May 2011
- Shadow Flicker Report: prepared by GL Garrad Hassan May 2011

Key components of the wind farm Stage 1 comprise:

- Construction compound (temporary)
- Construction site office building and amenities
- Concrete batching plant
- Workshop and vehicle service
- Fuel stores
- Substation and operations building;
- 18 Turbine installations;
- Access roads and reticulated power; and
- Fire management.

Construction compound

A single construction compound will be established to service the installation of the turbines. It will occupy 4 ha and include site offices, machinery parking, concrete batching plant and laydown/staging areas. The construction compound will also include fuel and oil stores required for the vehicles servicing the construction. On site storage will be in accordance with:

- *Dangerous Goods Safety Act 2004* and Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007 (managed by Department of Mines, Industry Regulation and Safety).
- *Occupational Safety and Health Act 1984*
- *Environmental Protection (Controlled Waste) Regulations 2004* (managed by Department of Water and Environmental Regulation)
- Department of Water and Environment Regulation policy Water Quality Protection Note 58 Tanks for Temporary Elevated Fuels and Chemical Storage 2018.

The site works at the construction compound are expected to provide a base for 100 – 120 persons during the construction phase.

Upon completion of the wind farm the construction compound will be reduced in size and function. An Operations Building / control centre and maintenance centre will be retained to provide supervision of the operating wind farm. The building will include all amenities and a workshop for the storage of tools and spare parts and provide a base for attending technicians and the undertaking of routine maintenance.

Substation

The electrical substation will be constructed to house transformers required to feed the wind farms output into the grid as well as metering, control and circuit protection. The transformers and oil supplies will be bunded to contain any oil spill.

Turbines

The Stage 1 proposal is 18 wind turbine compounds. Each turbine compound will comprise a single turbine (rotor, nacelle, tower, and crane hardstand). The hub height is 125 m with the rotor comprising three blades 73 m each. The tip height from ground is 200 m and a radius of 150 m. (see plate 5)

Plate 1: Typical turbine (photo courtesy of Western Power), a clear base within open land (pasture), retained crane pad and access track.

At construction, each turbine site will have an extended low threat space to be occupied by the laydown for large components, tower sections, nacelle and rotor blades and temporary office, lunchroom, and ablutions buildings to support the assembling workforce. Firefighting facilities will be provided at each construction site to suppress any ignitions that may inadvertently occur at the site. This includes a 50 000 L water tank to support suppression operations from the site.

Each turbine site will consist of a pile anchored foundation for the wind turbine (17 m foundation diameter) and a hardstand pad 20 m x 35 m to support a crane for installation and maintenance.

The turbines incorporate fire risk management systems, which are sealed systems for electrical fires.

The system includes arc detector technology, the lightning protection system, and the smoke/heat detection sensors package that can trigger the fire suppression system.

All high voltage electrical works are contained to, and within, the pylon. The fire hazard zones are as follows:

- Nacelle controller cabinet
- Converter cabinet
- Transformer room

The Fire Suppression System uses a non-conductive 3M Novec 1230 fire protection fluid. The fluid extinguishes principally by the removal of heat from the fire (to break the combustion cycle). Novec 1230 is environmentally safe and has the highest heat capacity of any available Halon alternative; requiring lower extinguishing concentrations for a given fuel.

Novec 1230 also leaves no residue for clean-up in the event of a false suppression event; minimising any wind turbine downtime, and the service cost of an alarm.

Agricultural production can occur up to the Asset Protection Zone (APZ) that is established around the base of the turbine.

At the end of the turbine life, if not replaced, the land will be restored to as close as practical pre-construction condition that will permit a return to broad acre farming. Access tracks will be removed if not retained as a benefit for farming.

Access roads/Power reticulation

The existing road network will be used to access the wind farm site. Within the wind farm area a dedicated network of gravel (all weather roads) will be established to provide access for the construction of the wind farm and year round access to the turbines for servicing and maintenance.

The access ways have been designed to minimise the clearing of any regulated vegetation and minimise disruption to farming operations by siting in cleared paddocks.

The substation will be connected to the turbines by an underground reticulation network (condition of planning approval) that will follow the access roads. The reticulation network will be buried at a depth to permit the continued economic use of the land above.

Fire Management

Each turbine is provided with a fire suppression system in the nacelle for electrical fires, and each turbine is monitored. The base of each turbine, pylon, is non combustible

Plate 2: Site Locality, and state road network

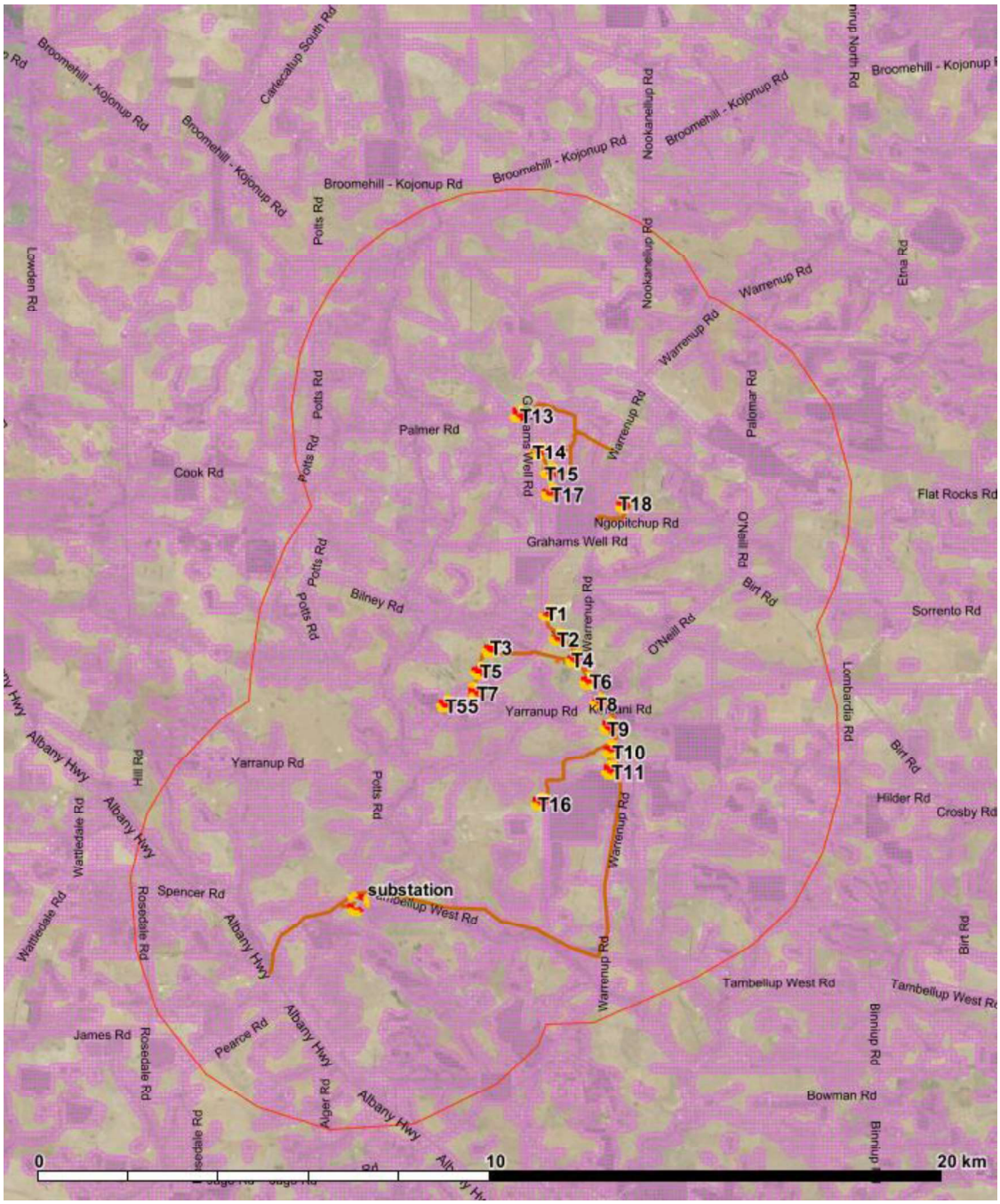
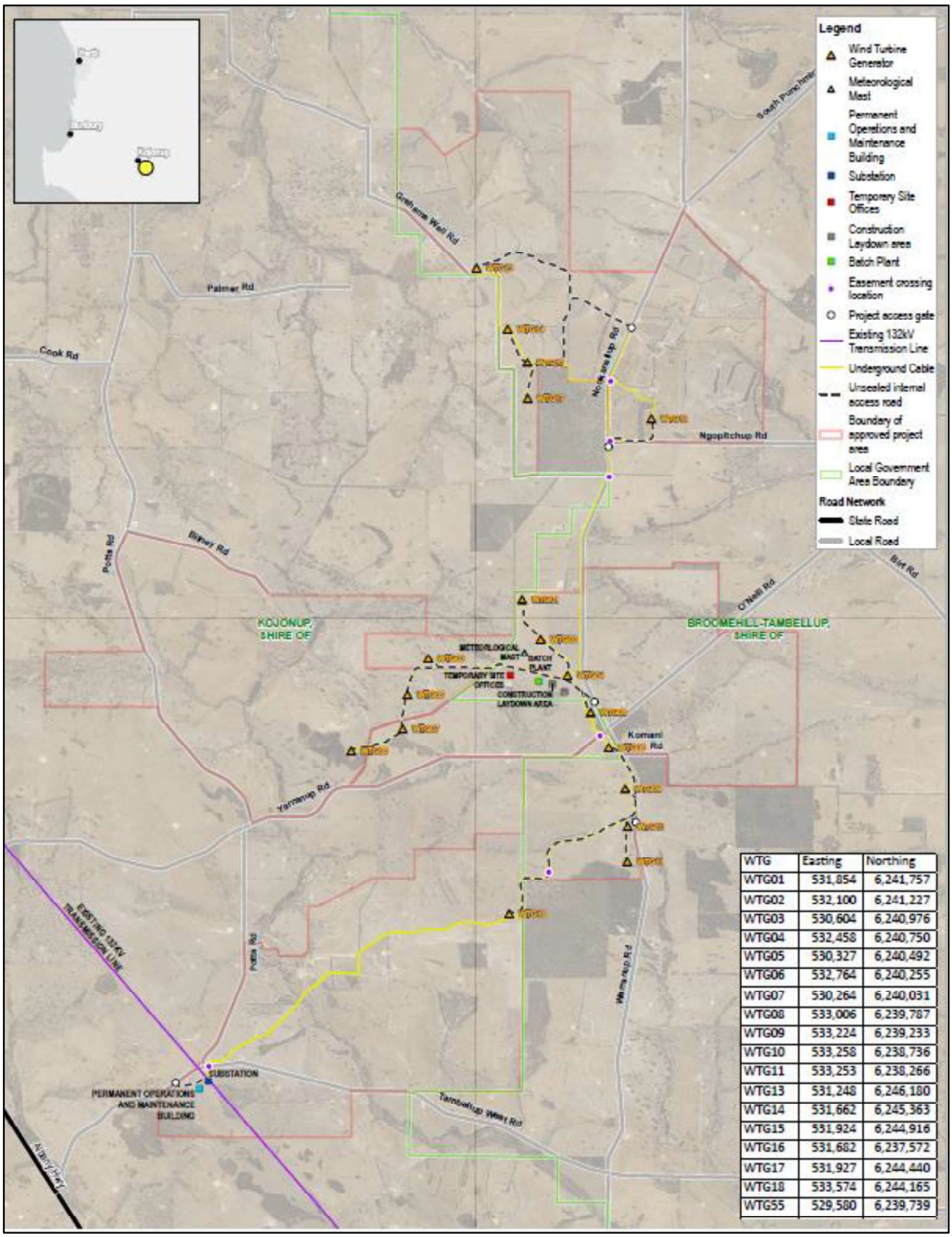


Plate 3: OBRM Bushfire Prone Area (pink*)*. The red boundary represents a 5 km separation from each asset.



WTG	Easting	Northing
WTG01	531,854	6,241,757
WTG02	532,100	6,241,227
WTG03	530,604	6,240,976
WTG04	532,458	6,240,750
WTG05	530,327	6,240,492
WTG06	532,764	6,240,255
WTG07	530,264	6,240,031
WTG08	533,006	6,239,787
WTG09	533,224	6,239,233
WTG10	533,258	6,238,736
WTG11	533,253	6,238,266
WTG13	531,248	6,246,180
WTG14	531,662	6,245,363
WTG15	531,924	6,244,916
WTG16	531,682	6,237,572
WTG17	531,927	6,244,440
WTG18	533,574	6,244,165
WTG55	529,580	6,239,739

Plate 4: Site Plan

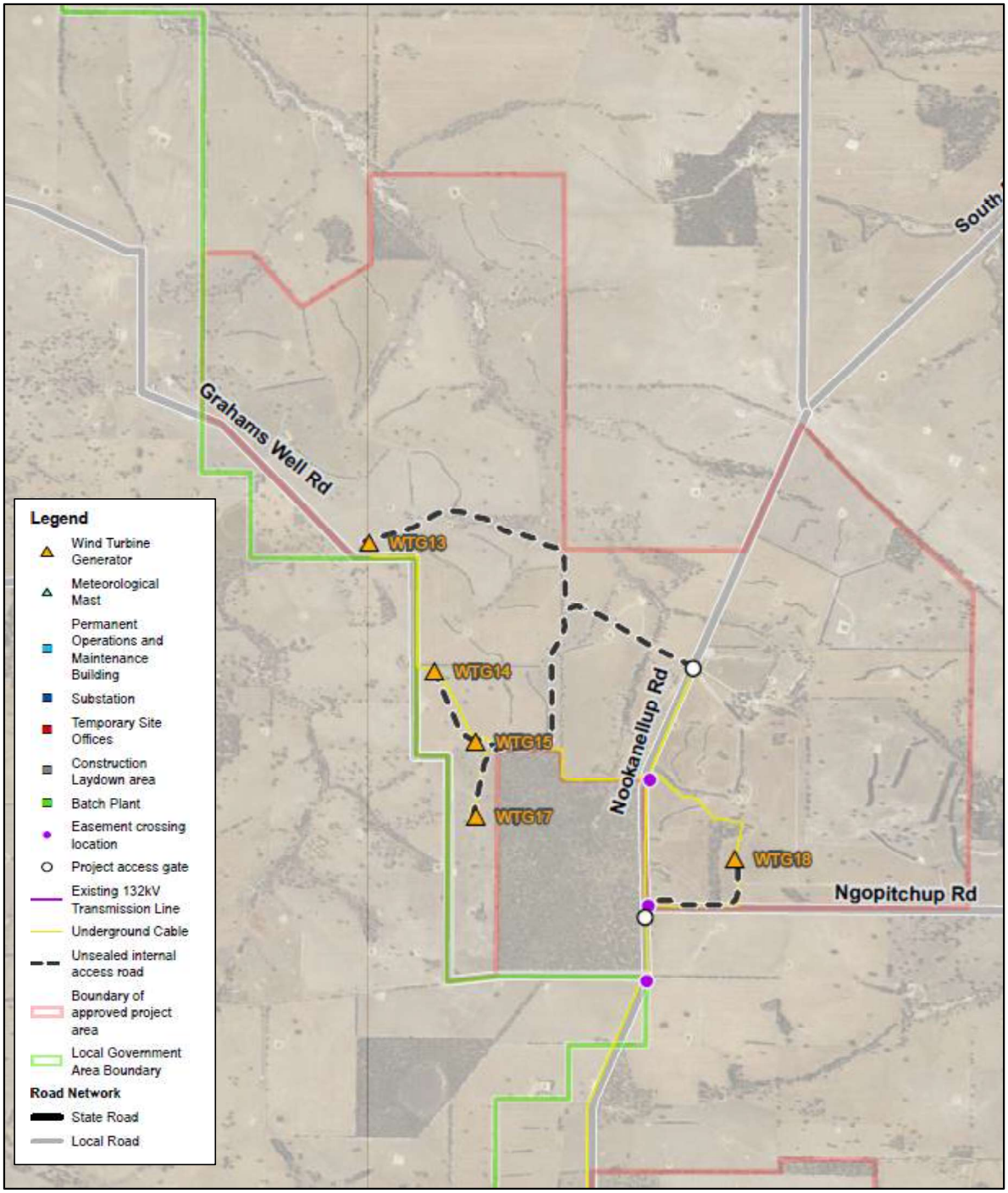


Plate 4a: Site Plan (enlarged north)

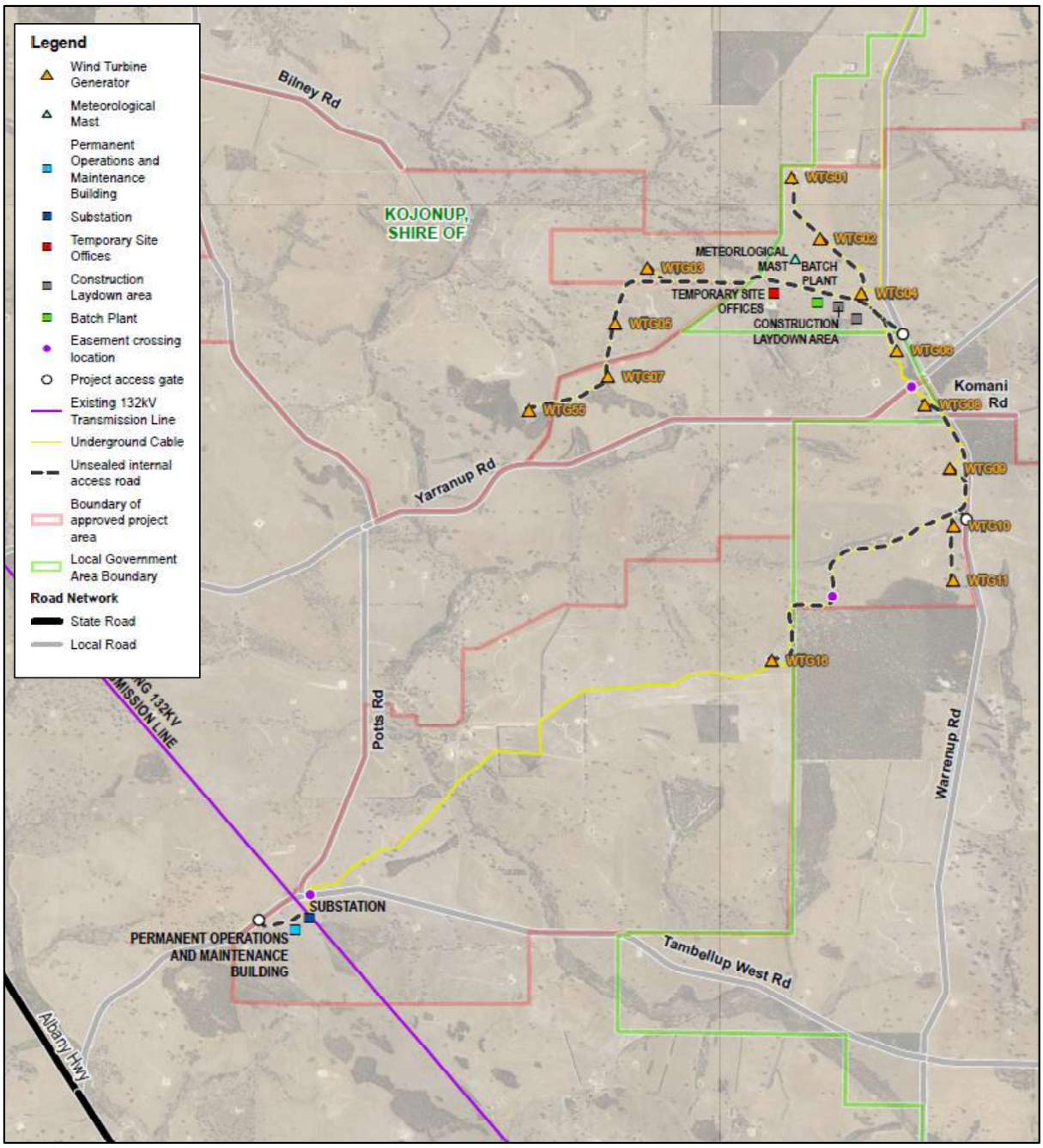


Plate 4b: Site Plan (enlarged south))

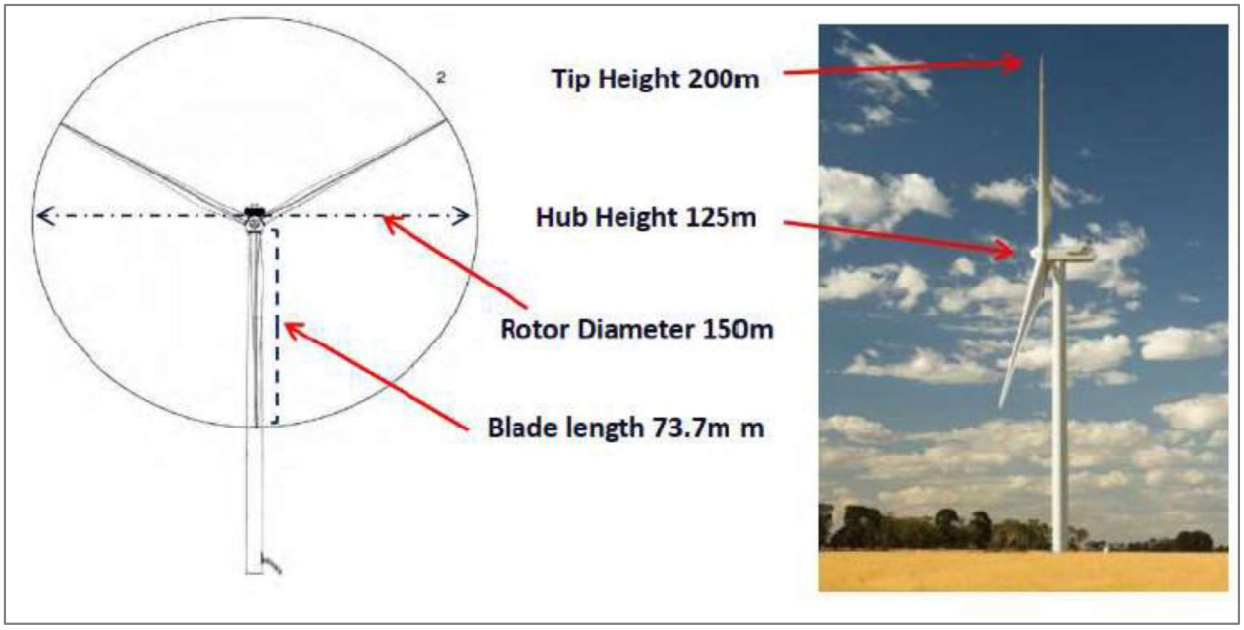


Plate 5: Turbine

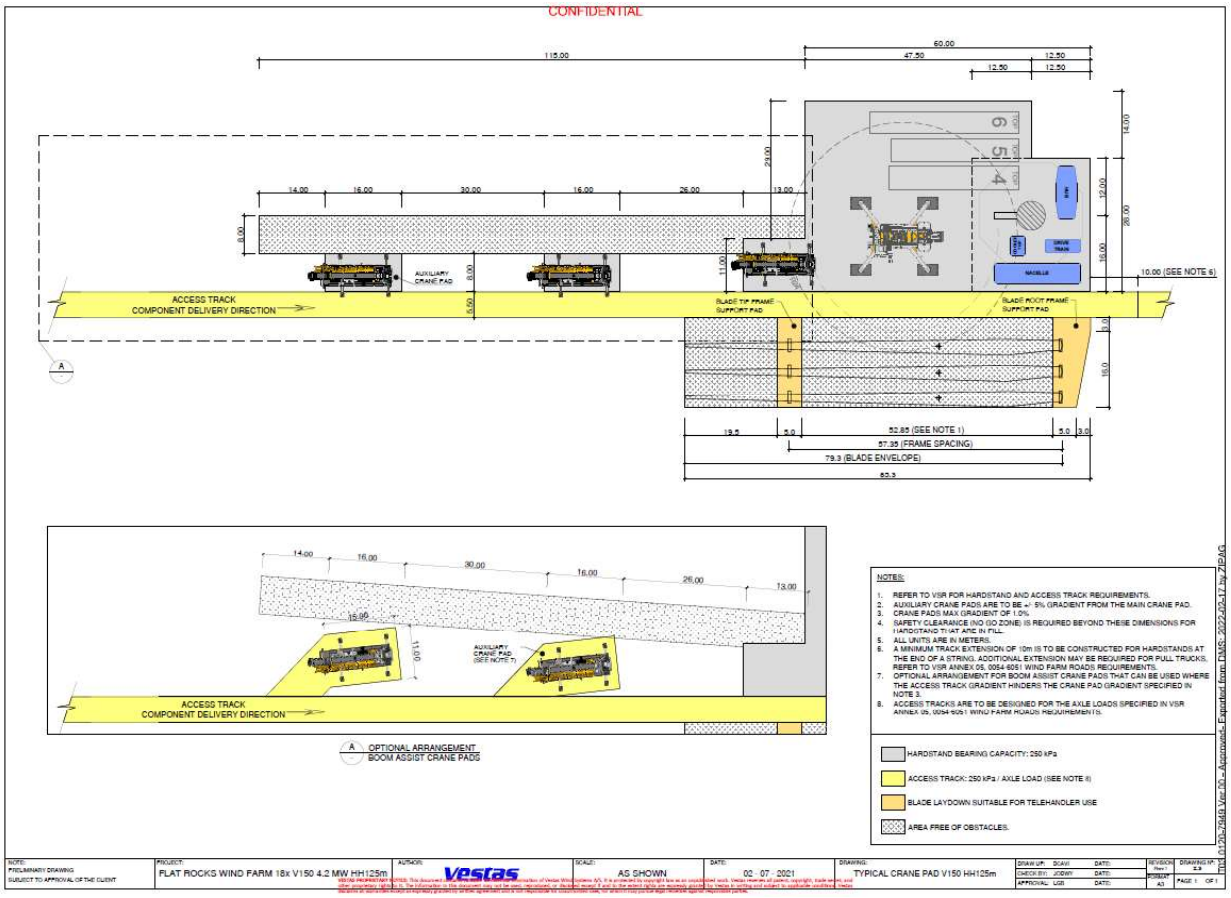


Plate 6: Turbine construction compound

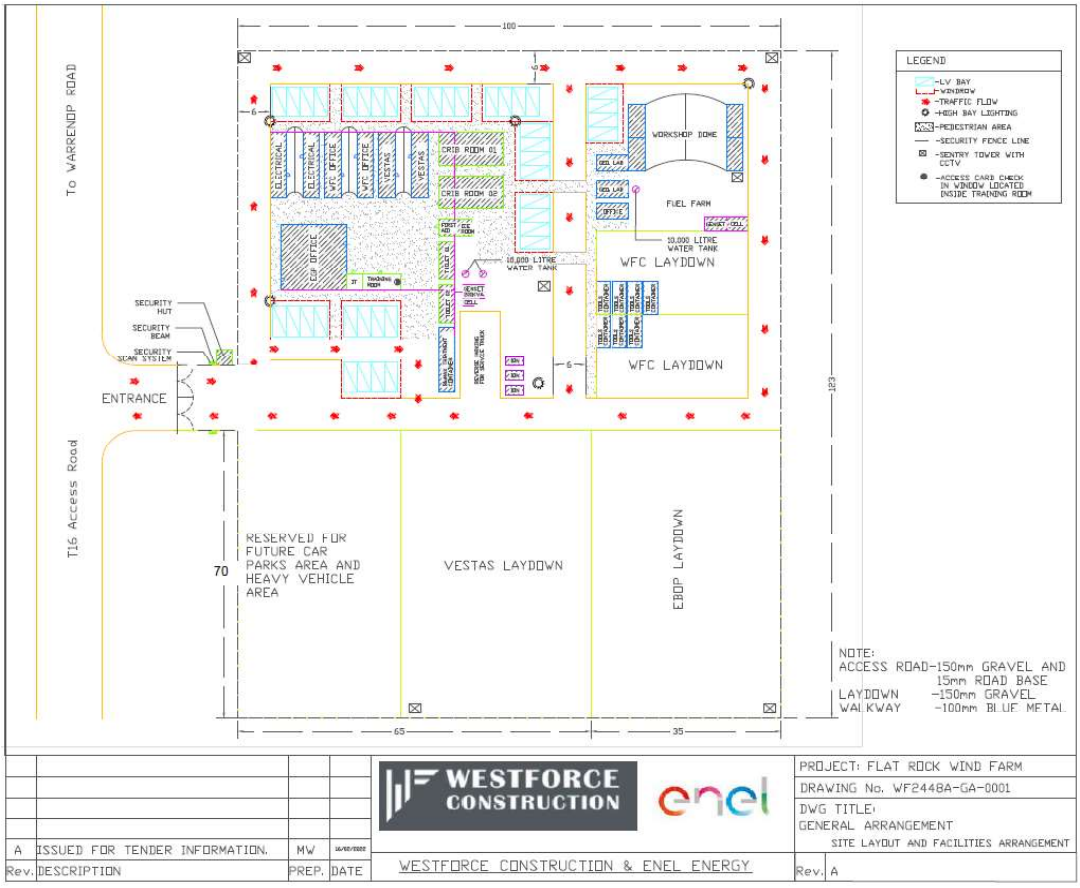


Plate 7: Indicative construction camp

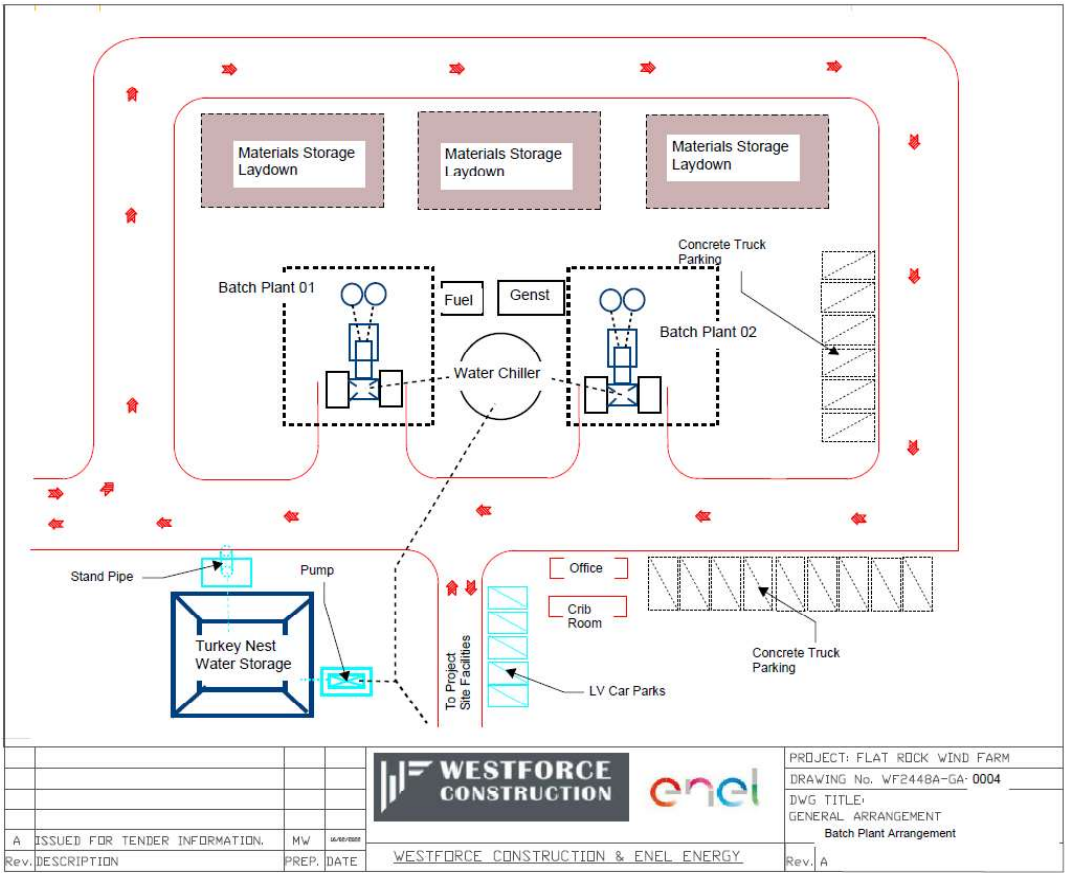


Plate 8: indicative Batching Plant

1.3 Regulatory Compliance Requirements

The following regulations have been applied to this assessment.

Planning and Development Act 2005 - SPP 3.7

On 7 December 2015, the State Government introduced a state map of Bushfire Prone Areas by order under the *Fire and Emergency Services Act 1998* and introduced development controls in Bushfire Prone Areas through the *Planning and Development Act 2005*. These controls were authorised by State Planning Policy 3.7 (Planning in Bushfire Prone Areas) regulations introduced under Part 10A Schedule 2 of the *Planning and Development (Local Planning Scheme) Regulations 2015* and guided by the *Guidelines for Planning in Bushfire Prone Areas*.

The State Planning Policy, Regulations, and Guidelines now form the foundation for fire risk management planning in WA at a community and land development level. The Policy Intent of SPP 3.7 is a risk-based land-use planning and development ***to preserve life and reduce the impact of bushfire on property and infrastructure***.

SPP 3.7 . Policy Objectives

> *5.1 Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.*
>
> *Examples of increasing a threat of bushfire may include a high-frequency ignition (increased likelihood) or converting a low bushfire hazard to an extreme bushfire hazard (converting pasture to forest).*
>
> *5.2 Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.*

Reducing vulnerability may include facilitating safe evacuation and ensure the building performance (by setback or construction standards) can exceed the bushfire impact.

***Clause 6.6 Vulnerable or High-Risk land uses* (Guidelines for Planning in Bushfire Prone Areas cl.5.5.1**

The proposal is a power generating landuse which is development type listed as high risk in the Guidelines.

> SPP 3.7 recognises that vegetation is not necessarily the only fuel in a bushfire event and that certain land uses may potentially ignite a bushfire, prolong its duration, or increase its intensity. Such uses may also expose the community, firefighters, and the environment to dangerous, uncontrolled substances during a bushfire event. High risk landuse may include, but are not limited to: service stations, landfill sites, bulk storage of hazardous materials, fuel depots and certain heavy industries as well as military bases, power generating land uses, saw-mills, highways and railways, among other uses meeting the definition.".[3]

Proposals for high-risk land uses in bushfire-prone areas are to be supported by a risk management plan that addresses bushfire risk management measures for any flammable on-site hazards such as the storage and location of flammable material to reduce the threat, among other considerations

There are a range of specific regulations that apply to the storage and handling of hazardous products, including petroleum products, that also include a design and licensing requirement. These are principally based upon a fire in a building (structural) fire.

It is not the role of SPP 3.7 to direct specific regulation in this regard. The role of SPP 3.7 is to consider the consequence of bushfire, either by the proposal igniting a bushfire or a bushfire arriving at the site.

Associated legislation acknowledged but not addressed in this BMP includes:

- Dangerous Goods Safety Act 2007
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007 (bulk >500 L)
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007

[3] Guidelines for Planning In Bushfire Prone Areas V1.3 page 34 under cl.5.6

DMIRS Accredited Compliance Consultant WA Dangerous Goods Storage and Handling Licensing assessment are responsible for the facility design and submission of applications for licencing.

This will apply to the bulk storage of fuels used for electricity generation, and the service of vehicles. It will also include the management of oils and flammable substances to be used at the substation.

Bush Fires Act 1954

Section 33 of the *Bush Fires Act 1954* recognises the responsibility of all land holders to prevent the spread of bushfire. Local government, at any time, may give notice in writing to an owner or occupier of land within the district of the local government. The Notice may specify works to be undertaken, including the management of grasses on the property usually to be maintained at less than 10cm during the fire season. It also provides that the identified works can be undertaken as a separate operation or in coordination with the neighbouring land.

The *Bush Fires Act 1954* also provides the basis for the declaration and enforcement of total fire ban days.

1.4 Environment Considerations

Environment Protection Act 1986 and Environmental Protection (clearing native vegetation) Regulation 2004

It is an offence to clear native vegetation without the authority of a permit or an exemption. The act of clearing native vegetation, requires a permit from either the Department of Water and Environmental Regulation (DWER) or the Department of Mines, Industry Regulation and Safety (DMIRS), unless an exemption applies.

Exemptions include:

Environment Protection Act 1986

- Clearing of regulated vegetation required by local Government Section 33 *Bushfire Act 1954.*
- Clearing of regulated vegetation in accordance with the terms of a subdivision approval.
- Clearing of regulated vegetation in accordance with a permit (for prescribed burning) under the *Bushfires Act 1954*.

Environmental Protection (clearing native vegetation) Regulation 2004 (exemptions do not apply in Environmentally Sensitive Areas, and clearing > than 5ha)

https://www.der.wa.gov.au/your-environment/environmentally-sensitive-areas

- Clearing of regulated vegetation to the extent necessary to construct an approved building.
- Clearing of regulated vegetation that is for fire hazard reduction burning.
- Clearing of regulated vegetation to maintain an area cleared in the last ten years.

(WA) Biodiversity Conservation Act 2016 and Bio-diversity Conservation Regulations 2018

The *Biodiversity Conservation Act, 2016*, replaces the *Wildlife Conservation Act, 1950*, and the *Sandalwood Act, 1929*, it became operational with the *Bio-diversity Conservation Regulations 2018*, on 1 January 2019.

The Act provides for listing species, threatened ecological communities (TECs), key threatening processes and critical habitats. It introduces criteria for listing species' endangered', 'critically endangered' or 'vulnerable', to align with the Environment Conservation and Biodiversity Conservation Act 1999 (Cth).

The subject land is not presently affected by a TEC.

Commonwealth Environment Protection Biodiversity Conservation Act 1999

The Commonwealth Environment Protection Biodiversity Conservation Act 1999 provides for the protection of matters of national environmental significance. National environment law does not generally regulate fire prevention measures taken by state and territory governments, but no specific exemptions are provided.

Bushfire Treatment and Environment Conservation

A fundamental consideration in determining the treatments for a given risk is to avoid conflict with biodiversity management measures, which may limit the treatment options.

In accordance with the Department of Planning Lands and Heritage template (BMP template to support a BAL Contour Assessment) a review of the listed databases has been undertaken as part of this assessment to identify whether restrictions or other specific considerations may apply that would affect the implementation of any bushfire protection initiatives that may otherwise be identified.

Table 2: Ecology datasets

Is the land affected by:	**Affected by the proposal**	**If yes - describe**	
Conservation Wetland or buffer (DBCA-019 DBCA-017)	No		
RAMSAR Wetland (DBCA-010)	No		
Threatened and Priority Flora (DBCA-036)	No		
Threatened and Priority Fauna (DBCA-037)	No		
Threatened Ecological Communities (DBCA-038)	No		
Bush Forever (COP-071)	No		
Environmentally Sensitive Area (DWER-046)	No		
Regionally Significant Natural Areas (DWER-070)	No		
Conservation Covenant (DPIRD-023)	No		
South West Ecological Linkages	No		
Does the proposal require the removal of restricted vegetation?			**No**

The proposed development does not require the displacement of vegetation other than pasture grasses.

During construction each turbine site will require an expanded area for the storage and assembly of the turbines. Following completion of construction the expanded construction area will be removed, and pasture returned up to the extent determined for the APZ.

2. BUSHFIRE RISK ASSESSMENT

2.1 Context Objective And Scope

Context

The land is gently undulating with slopes of 2.0^0 - 3.0^0. The land is suitable for broadacre farming and historically cleared of native vegetation to provide for pasture production. Consequently, only a few isolated pockets of remnant native vegetation remain.

The locality is sparsely populated comprising primarily single dwellings on rural production holdings. The approximate ratio is 1 dwelling per 100 km^2.

Various outbuildings are located within the area associated with agricultural production.

Public roads are separated by large distances. The site is located between Albany Highway, and the Great Southern Highway. The turbines are arranged along Warrenup Road which connects north to Broomehill Kojonup Road and south to Tambellup West Road. Both Broomehill Kojonup Road and Tambellup West Road are sealed roads that connect with Albany Highway, and the Great Southern Highway.

Objective

The relevant objective from SPP3.7 is:

To avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.

The attainment is the application of As Low as Reasonably Practical (ALARP) risk treatment measures.

This is to be recognised in context with the present risk that applies to the locality.

Scope

The scope defines the evidence and data that will be followed in determining the treatments that satisfy the objective.

- Determined risk to be assessed by AS 3959:2018 (site topography, fuels and fire danger index)
- Bureau of Meteorology climate data to verify the applicable FDI and prevailing wind directions
- DBCA bushfire History
- Literature review, wind farm fire incidents and bushfire impacts.
- A review of existing risk controls and strengths
- The identification of risk treatment following emergency management principles.

2.2 Risk Identification

Bushfire behaviour is the primary determinant of the bushfire risk and the design fire as a basis for identifying appropriate treatments. Bushfire behaviour is affected by three factors;

- Topography (slope of the ground, aspect, and wind influences) – fire travels faster uphill, the flame length is increased uphill (x 2 for every 10^0), landforms can channel and increase local windspeed and create turbulence. They are measured as 0.0^0 or in 5^0 increments downslope in AS 3959 (Method 1).
- Climate (drought and season) & weather (temperature, humidity, wind, atmospheric instability) – determines the intensity of a fire, the speed and direction, and potential for advanced spotting. It is measured as an FDI (FFDI or GFDI) in AS 3959.
- Vegetation (horizontal and vertical structure, flammability, mass, and availability). It is measured as a vegetation classification, or an exclusion, in AS 3959 (Method 1).

It is assumed that a bushfire will achieve a steady-state and be fully developed to maximum intensity over a 100 m (minimum fire run).

Grassfires travel faster (GFDI) than a forest canopy fire, but a forest canopy fire can eject a higher level of embers and also eject them over a greater distance.

The arrangement of fuel has a greater effect upon the intensity of the fire than just its mass; its exposure to oxygen is referred to as its availability in a bushfire.

Climate

The climate, using data from Kojonup Weather Station, can be described as Mediterranean with wet winters and warm summers from December through to March.

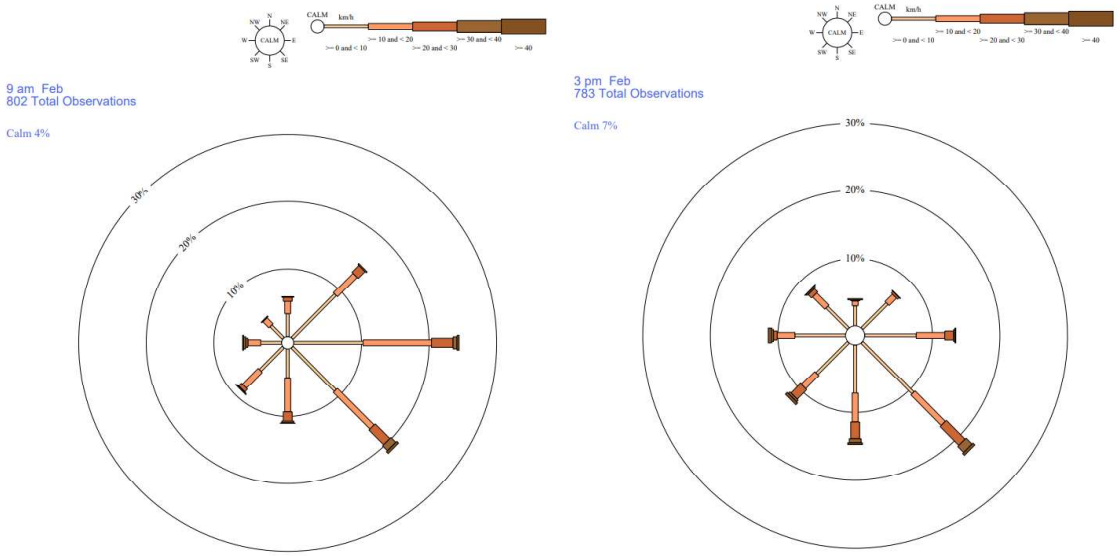


Plate 9: Wind roses (February 9 am and 3 pm), Bureau of Meteorology, Kojonup.

Bushfires generally travel in the direction of the prevailing wind. Prevailing wind conditions are most likely to be extreme in the afternoon in December to March (February is representative and selected below). The direction of the prevailing wind conditions, strength, and direction, can help anticipate the direction, the fuels present, the effect of topography from that direction and the fire intensity. Whilst a fire can come from any direction an uncontrolled fire at some time is likely to be influenced by the common prevailing winds.

The prevailing winds shows a bias to the eastern hemisphere, in the morning but it is noted that afternoon winds are distributed through the southern hemisphere.

Fire Danger Weather

The FFDI is calculated from temperature, wind speed, relative humidity, drought factor (time since last rain) and Keetch-Byram Drought Index (soil moisture) index which is a measure of soil moisture

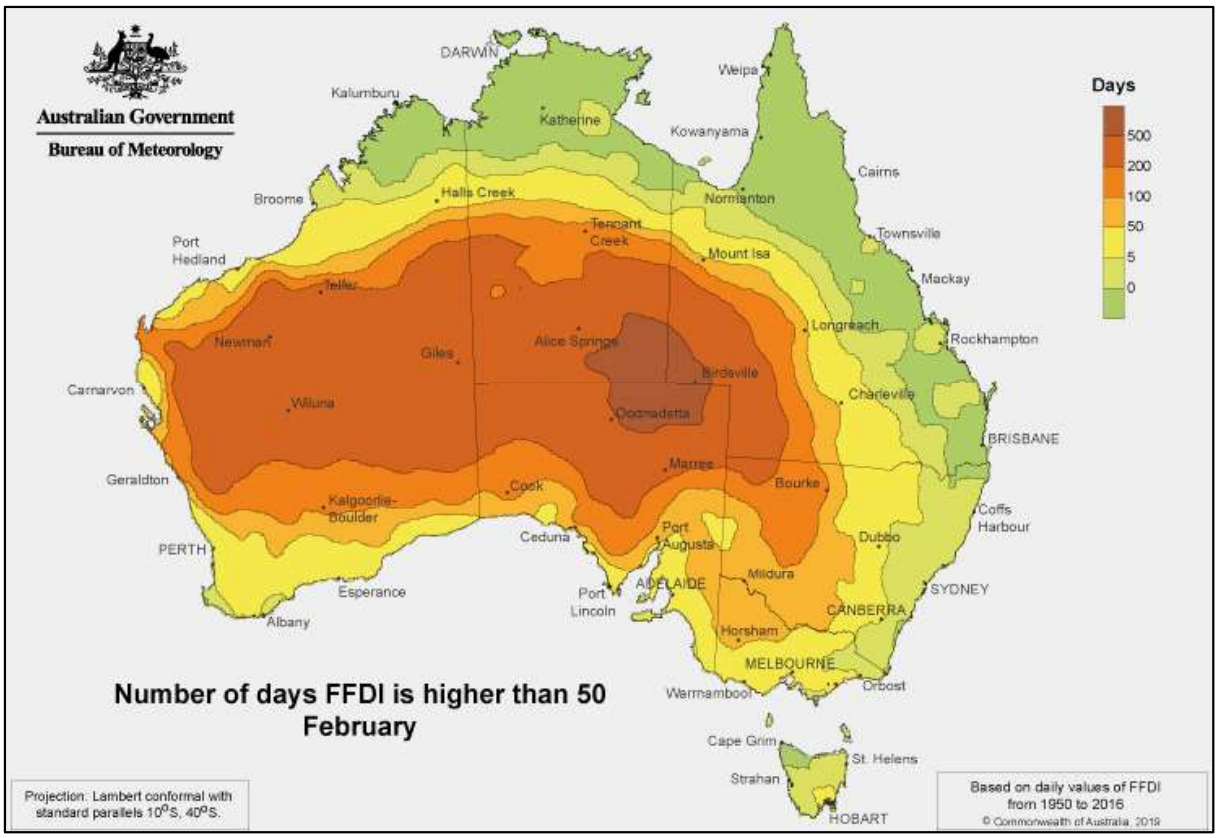


Plate 10: BoM national FFDI map, February illustrates the site is within the same band as Metropolitan Perth.

An assessment of the BoM national FFDI maps suggests a FFDI 50+ can occur in November through to March, at Kojonup (Plate 10), with February the highest frequency.

Days with an FFDI of 50 or over represent conditions where a fire may not be controlled, although grassfires over flat land whilst fast moving are more responsive to suppression efforts compared to a forest fire which has a higher intensity and has the complexity of distant spotting.

The map suggests Kojonup has a similar number of days above FDI 50 as the FDI for the Perth CBD. The Perth CBD corresponds to the nominal FFDI of 80 which is used across Western Australia for Bushfire Attack Level assessment purposes. Whilst it is possible to apply a higher or lesser FFDI than 80 if justified by climate data, in regard to the development site an FFDI of 80 is appropriate.

Topography

The topography can influence the direction and speed of a bushfire and the predictability of its behaviour. It can also determine the accessibility for firefighting purposes.

The topography and open pasture land presents few limitations for access through the pasture fields in order to undertake fire suppression.

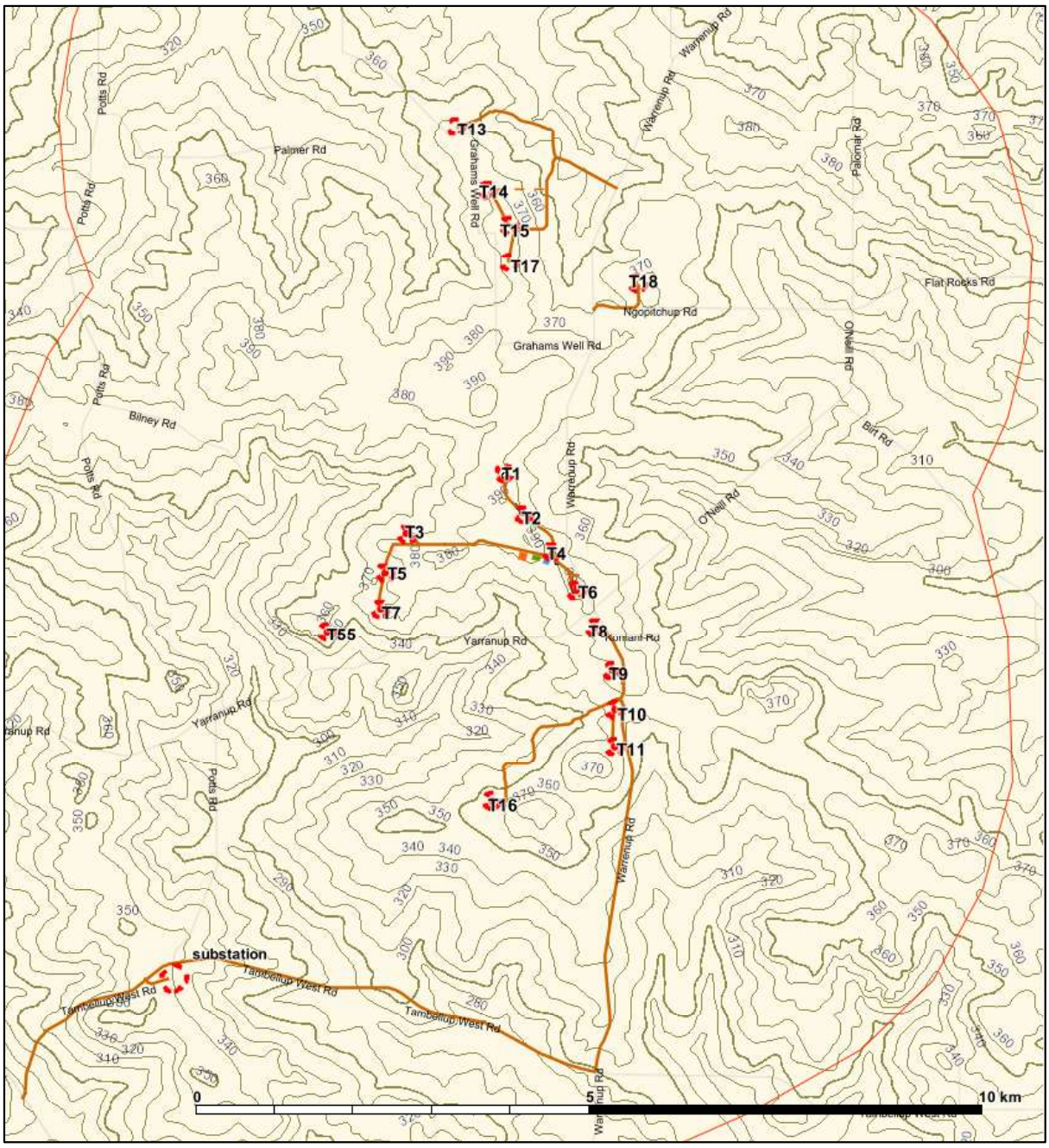


Plate 11: Topography illustrates the slope ranges of 0.0^0 – 3.0^0 is uniform across the site and characterised as gently undulating.

The turbines have been located upon the highest elevation, consequently the vegetation on the approaching slope toward the turbine is classed as downslope from the turbine. A bushfire approaching the turbine will be running up hill and a fire escaping a turbine site would be running downhill. For Bushfire Attack Level assessment purposes a slope of $0\text{-}5.0^0$ has been applied as a conservative measure.

Vegetation

The following vegetation descriptions from the Environmental Impact Statement (2010) have been applied to the following vegetation groupings in AS 3959:2018.

Grassland: Agriculture production pasture grasses

Woodland: Open Woodland of Eucalyptus rudis subsp. rudis Melaleuca rhaphiophylla over Acacia saligna, Acacia acuminata, Jacksonia sternbergiana over Ficinia nodosa and introduced grasses on sandy-loams and clay-loams on fringes of creeklines.

Forest: Woodland of Eucalyptus astringens subsp. astringens Eucalyptus wandoo on sandy-loam and some Eucalyptus marginata subsp. marginata over subshrubs and introduced grasses on sandy-loams on slopes.

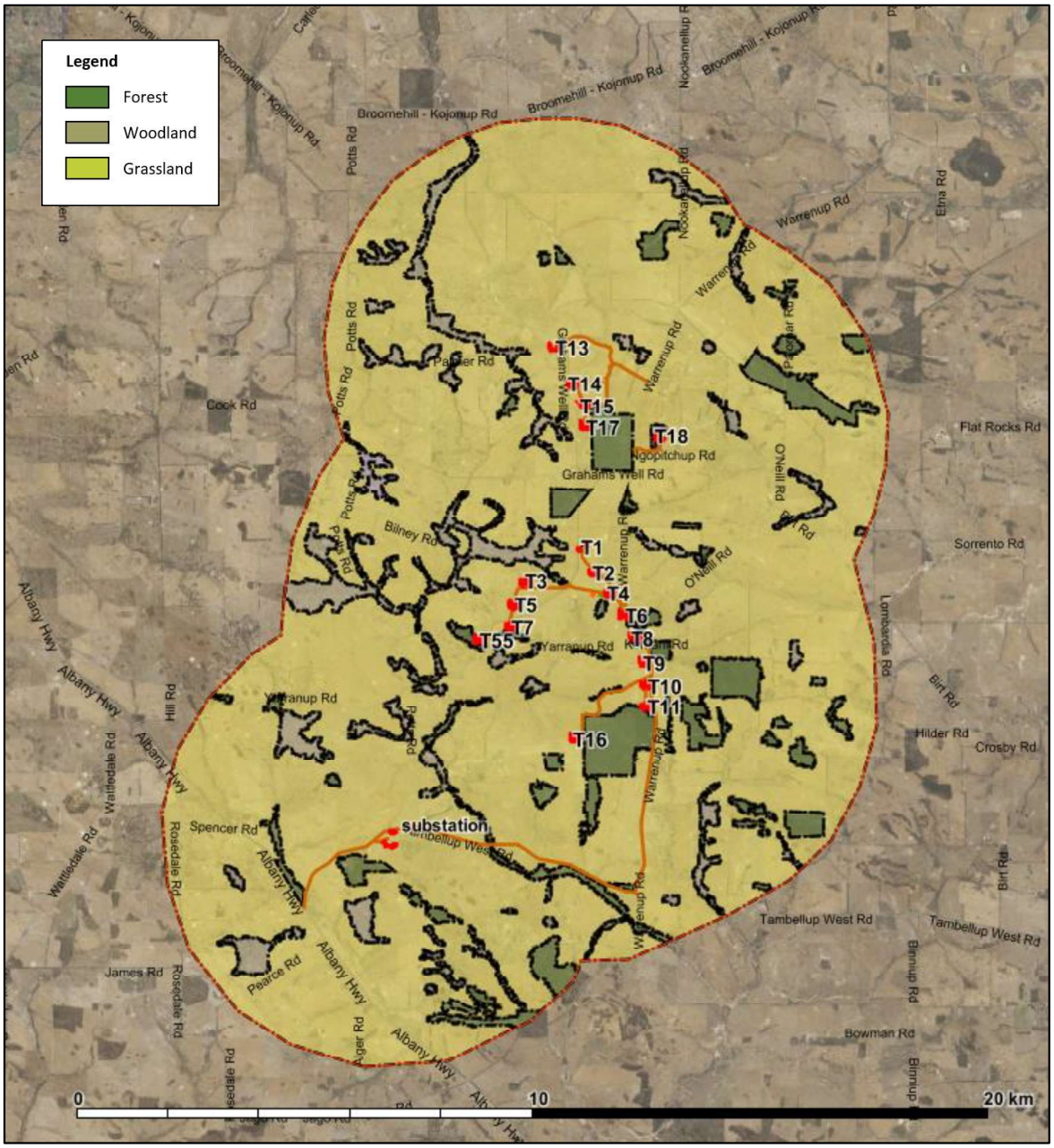


Plate 12: Landscape context 5 Km from assets.

Plate 12 illustrates the arrangement of classified vegetation within 5 km of the Stage 1 Flat Rocks Wind Farm assets.

All turbines are located no closer than 100 m to any other vegetation classification. Grassland has the most influential radiant heat impact at each site. Risk treatment to address the BAL at the site can be made in consideration of grassland.

An enlargement of the vegetation classifications at each Turbine location is shown in APPENDIX 2 (figures 1a - 1g) to provide the detail and photographic verification of the vegetation within 150 m of each Turbine location.

Bushfire Attack Level Inputs

The Bushfire Attack Level Assessment has been undertaken in accordance with the methodologies described in AS 3959:2018 and in accordance with the Guidelines, and the Fire Protection Association accredited practitioner methodology.

The BAL has followed:

All vegetation within 150 m **(context)** of an asset has been classified (AS 3959:2018 Clause 2.2.3) to determine the Bushfire Hazard Level at the locality;

The BAL rating has been determined through site inspection and assessment of the following parameters:

- Fire Danger Index (FDI) rating; assumed to be FDI - 80 for Western Australia; *Note for the purpose of planning for a shelter an FFDI with 1:200 APE is used. This equates to an FFDI of 100.*
- A separation distance between the building and the classified vegetation source(s) within 100 m (for BAL impact) the separation distance is measured from the wall face (receiver) to the unmanaged understory rather than the canopy edge (dripline) *see plate 6*; and
- Slope of the land under the classified vegetation.

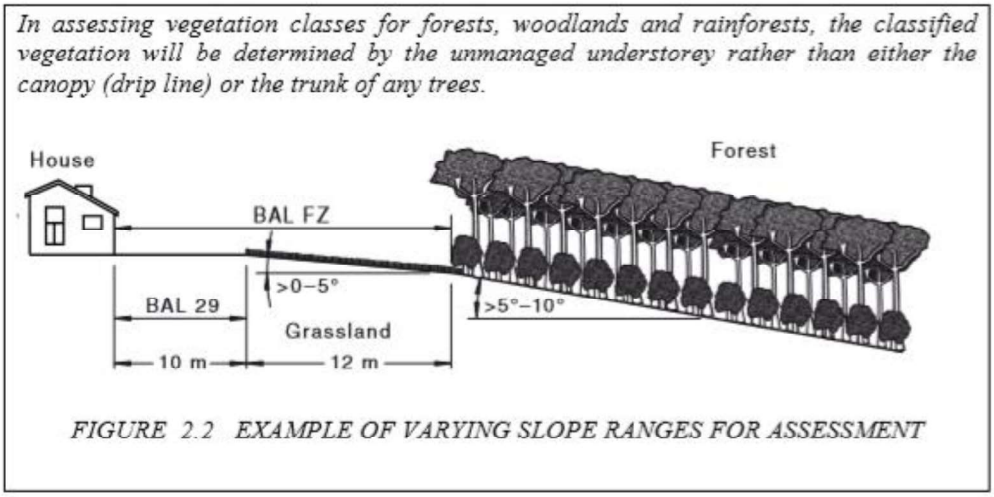


Plate 13: Arrangement of inputs for the determination of a BAL.

Determine bushfire Attack Level at each turbine location

There is no restriction upon clearing grassland to achieve the desired Bushfire Attack Level.

The bushfire attack level available at the Turbines, the construction compound and the substation and operations building will be determined by the clearing of grass.

The BAL level at the nominated receiver is dependent upon the separation (APZ) indicated as follows based upon a downslope of 5.0^0

Vegetation classification	Effective slope (degrees)	Separation Distance (AS 3959:2018 Table 2.5)	BAL
Grassland	0-5	< 7 m	BAL-FZ
		7 - < 9 m	BAL-40
		9 - < 14 m	BAL-29
		14- < 20 m	BAL-19
		20- < 50 m	BAL-12.5
		> 50 m	BAL-LOW

As an explanation, if pasture grasses were restricted to 9 m from the base of the pylon the BAL rating at the pylon would be BAL-29; if pasture grasses were restricted to 20 m from the base of the pylon the BAL rating at the pylon would be BAL-19.

Asset	APZ	BAL	Purpose
Construction compound	**30 m**	**<BAL - 12.5**	This equates to 7 kWm^2 which is a maximum operating level for a fire fighter to short term exposure corresponding to a grassfire. It would permit the perimeter to be defended and the defence of open stored assets.
Turbine Base	**30 m**	**<BAL - 12.5**	This equates to 7 kWm^2. It will enable shelter at the lee side of a turbine base, and a parking of a vehicle at the base would be less than 10 kWm^2 to provide tenability
Substation	**50 m**	**BAL - Low**	To provide a standoff position to supress a bushfire from penetrating or escaping.
Operations building	**20 m**	**BAL - 12.5**	Provides resilience to the passage of the fire front
Operations compound	**20 m**	**BAL - 12.5**	Provides resilience to the passage of the fire front and the suppression of external fires (external stores) after the passing of the fire front

Bushfire History

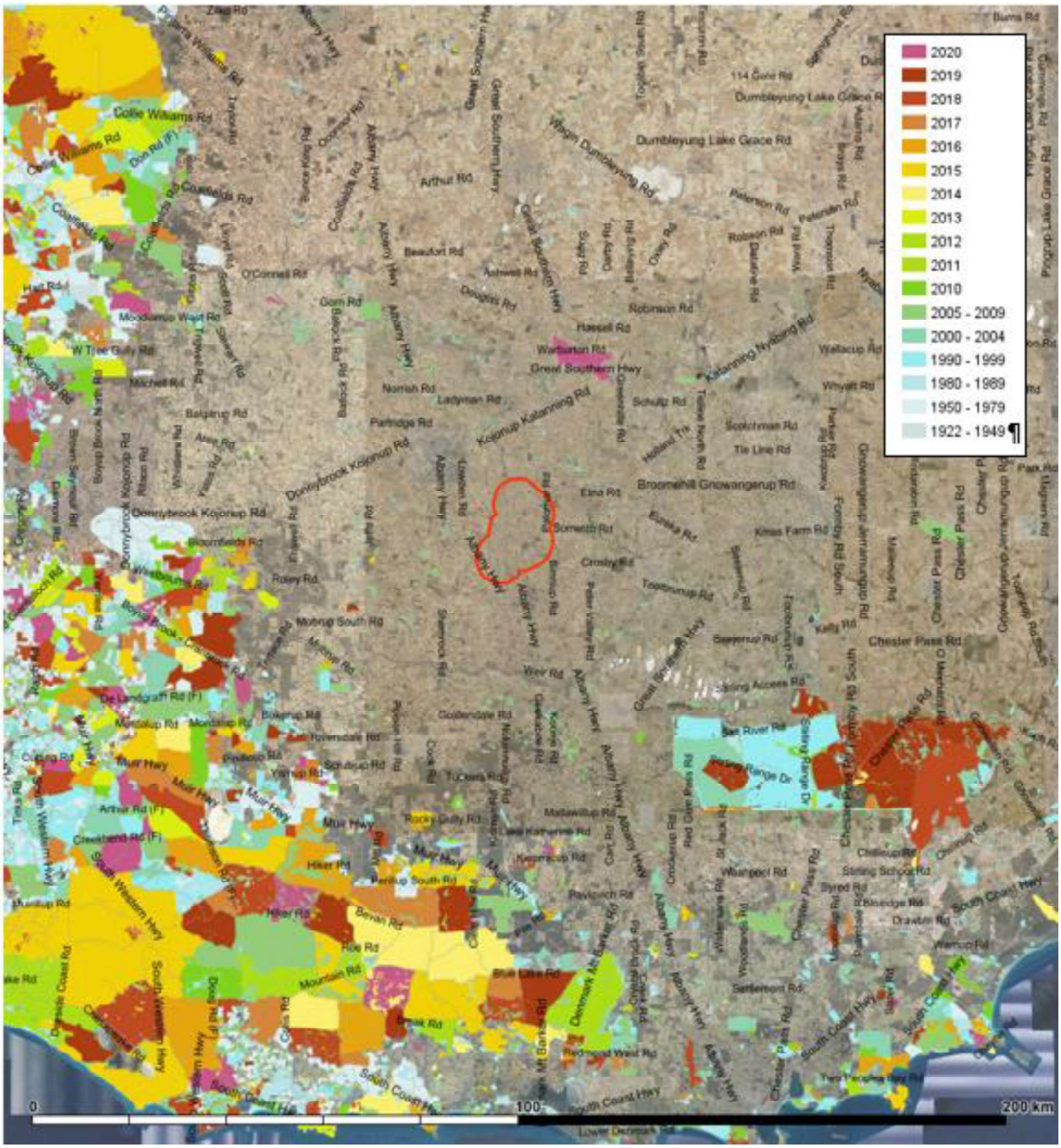


Plate 14: Recorded fire history within 100 Km of the site

Fire history within site area

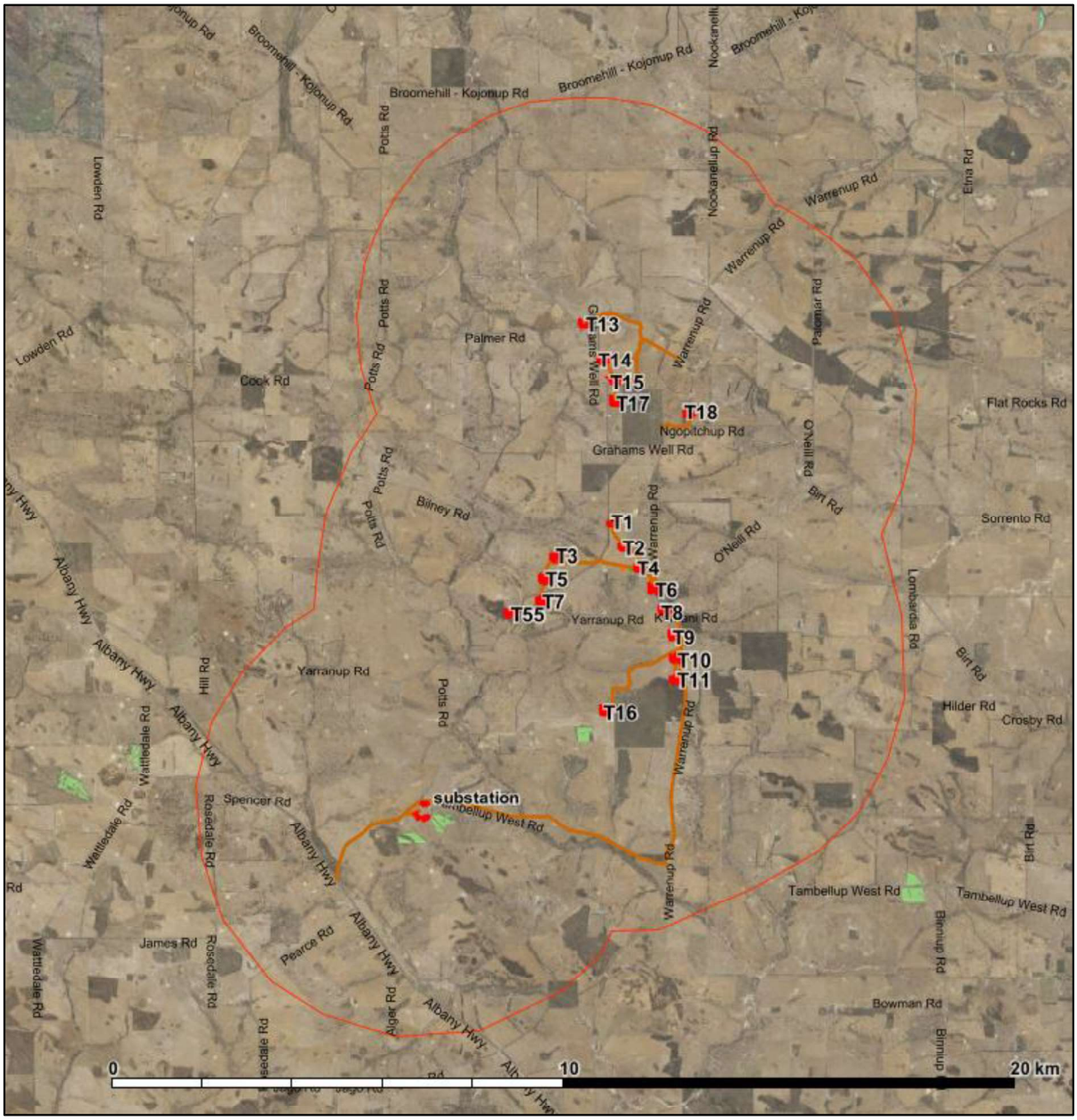


Plate 15: Fire history within 5 km of the site assets

The Department of Biodiversity Conservation and Attraction (DBCA) bushfire data identifies no landscape fires (> 20 ha) within the area of the site since 1922.

BoM data identifies that Kojonup has a similar frequency of lightning strike as the City of Perth. In wheatbelt areas lightning is a major source of natural ignitions which account for 6-10% of bushfire ignitions, suspicious and deliberate ignitions account for up to 50%, and the remainder are accidental. The vast majority of ignitions are attributed to human activities which include machinery failure, electric fences and powerlines, and outdoor works[4].

A landscape-scale bushfire based upon similarities with other wheatbelt areas occurs at a rate of 1-10 in every ten years; it is a measure of potential notwithstanding one has not occurred within the area of the site. This may be attributed to the effectiveness of local suppression or due to a lack of reporting because the ignitions have been suppressed early.

[4] ABC Science Wednesday 20 November 2019

Residential proximity

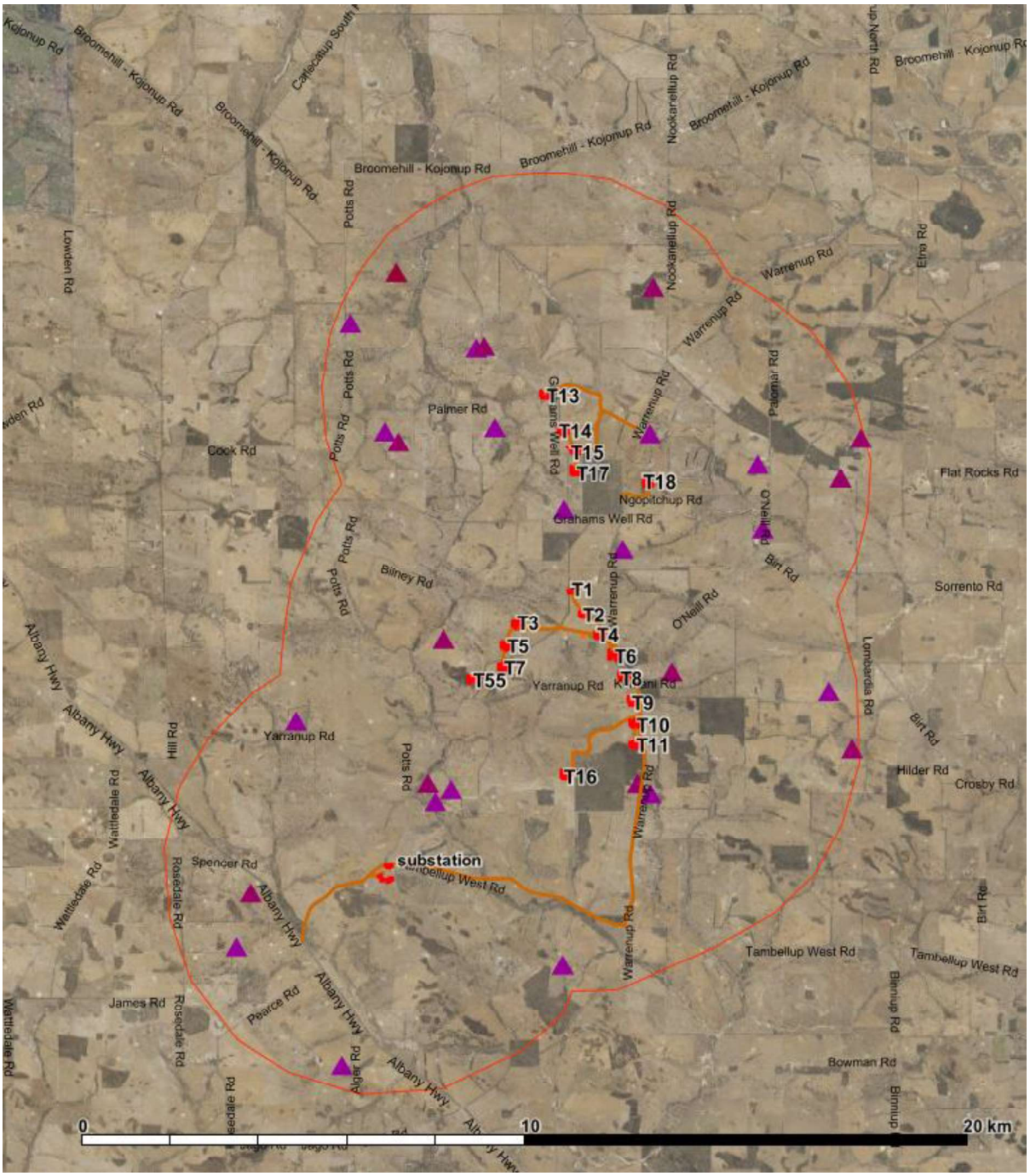


Plate 16: Residential dwelling locations (purple triangles) within 5 km of the site assets

Plate 16 illustrates the location of the dwellings within 5 km of site assets. The turbines have been sited to ensure no dwelling is located within 1 km of a turbine. Three dwellings located at 1 km from a turbine (T8, T11 and T17), are the closest turbines to a dwelling. Ten dwellings are distributed around the turbines and located within 2 km from the nearest turbine. Within the area 5 km from the site assets the ratio of dwellings equates to a density of 1 dwelling for every 90 km^2; a low density.

Risk identification

Bushfires have the potential to cause fatalities and serious injury, damage to property, extended community disruption and environmental degradation.

The objective of State Planning Policy 3.7 in examining development within bushfire prone areas is to reduce the vulnerability of development to the effects of a bushfire and to avoid increasing the threat of a bushfire external to the development.

The Risk assessment is therefore to analyse the potential (scenarios) for a bushfire to affect the site, to minimise the consequence, and the potential for a bushfire to escape the site and identify treatments to reduce the likelihood and consequence.

Expected site context Fire behaviour

The Flat Rocks Wind Farm is within an extended area of pasture grasses and comparatively level land with slopes under vegetation of up to 3.0^0 (5.0^0 has been used to assess the risk)

Grassfires travel faster (GFDI) than a forest canopy fire, but a forest canopy fire can eject a higher level of embers and also eject them over a greater distance; up to 5 km.

A grassfire influenced only by wind, over flat land with consistent fuel, will take an elliptical shape in the direction of the wind. The width of the elliptical will be narrower as the windspeed increases.

Scenarios

Given the land is flat and predominantly pasture, within and extending beyond the wind farm, the usual analysis of scenarios, a fire arriving from a different direction through different vegetation of different slopes is not necessary in this instance. Notwithstanding the prevailing wind directions identified by the nearest weather station, a fire can come from any direction and in this instance the surrounding conditions at each asset is the same and each asset has a surrounding area of grassland/pasture and slopes less than 5.0^0 at no less than 100 m.

Appendix 2 illustrates the vegetation at each site with a photograph, and Appendix 3 provides an assessment of each turbine and the substation and operations compound describing the vegetation (fire behaviour), resident location and nearest public road in each direction up to 5 km from each asset. It can be used to inform the arrival of a fire, to provide assistance and to alert those down wind of an asset should an uncontrolled ignition occur in an asset.

Two scenarios have been considered for risk identification.

A fire arriving at the site and a fire escaping from an asset within the wind farm.

Fire arriving at the site

A grassfire arriving at an asset within the wind farm (each turbine, the substation and operations compound, and the construction compound).

The windspeed has been increased for the calculation 45 kmph to 65 kmph to identify a worst-case rate of spread and an elliptical fire spread 25% of its length. The residence time for a grassfire (most intense flaming is 15 seconds[5], the temperature quickly rises reduces after its passing, and can travel over ground at up to 25 kmph[6], although may appear to travel faster.

Grassfires produce smoke and are easily observed in an open landscape.

The head width of the fire will be proportionate to the distance that the ignition occurred from the site. A fire arriving at the site may affect more than one turbine, either by its width or if multiple turbines are in line with the fire.

A fire during construction will affect more people distributed at the construction sites, up to 150 people, whereas during operation, outside of the operations compound two technicians may be in the field. Farming practices will also continue within the area of the wind farm and up to each turbine.

[5] P.Cheney Grassfire, weather and fire behaviour CSIRO 2008

[6] P.Cheney Grassfire, weather and fire behaviour CSIRO 2008

Fire escaping from an asset within the wind farm.

An ignition from within the wind farm may occur from the ongoing agriculture production, i.e. maintenance, harvesting vehicle movement, which will continue up to the base of the wind farm assets.

An ignition may also occur from activities directly associated with a wind farm, including the construction works, but through the ongoing operation may include hot works (although fabrication will mostly occur within the workshop requiring only installation at isolated sites) and vehicle movements. Separation areas, APZs, will be established around each asset to avoid a continuity of bushfire fuel and fire spread.

The most problematic fire ignition is a turbine nacelle fire due to accessibility constraints caused by the height.

Turbine nacelle fires

Plate 17: Illustration of the wind farm wake effect.

A Spanish study[7] into turbine fires (primarily to assess ASET time) identified they are related to diverse ignition sources including lighting strike, electrical equipment malfunction (electrical cabinet in the nacelle - common), hot surface ignition. The nacelle contains oils (up to 900 L) plastics i.e. wire coatings, and the nacelle cover and insulation. Rotor hub and blades can also become involved in a fire.

The study identified the nacelle is fitted with natural ventilation to prevent overheating, but this also provides an oxygen source to a large amount of highly flammable materials.

The study also identified that if suppression systems are overwhelmed, a total loss is expected as firefighters have difficulty dealing with the nacelle's height. A nacelle fire will therefore only extinguish when the available fuels have been consumed. The study also identified that falling materials may lead to wildfires (European).

The Australian Fire and Emergency Service Authorities Council (AFAC) in its 2018 Guidelines identified there is little evidence to suggest a grassland fire is a threat to a turbine. It identified the case example of a bushfire started on a paddock affecting the Waterloo Wind Farm in South Australia in January 2017.

> "The wind farm operator confirmed that there was no damage to any wind farm infrastructure and no danger at any time to human life as a result of the fire."

AFAC also identified that if the turbines are shut down there will be no consequence of a wake effect upon fire behaviour and the operations of low flying firefighting aircraft.

Whilst the AFAC position is acknowledged, it assumes a control of the turbine has not been affected by the failure. The process to shut down as identified should be to position the rotor head into the wind and lock the rotor in a Y position. Facing the rotor into the wind will reduce the likelihood of damage and ignition of the blades.

[7] Rengel, B Computational analysis of fire dynamics inside a wind turbine (2017)

2.3 Risk Analysis

Existing controls

There is an inherent risk of bushfire in the Australian landscape. Various activities undertaken and infrastructure is provided which work to reduce the risk we have today; the residual risk.

Identified Stakeholders

There are a range of stakeholders whose actions affect the bushfire risk, either by undertaking works that reduce the risk (preparation) or who are engaged in a response. They provide and maintain existing risk controls and an important part of understanding and adapting if necessary to the proposed development and risk treatments.

- The community
- Shire services
- Bushfire Brigade Captains and volunteers
- Landowners
- Water Corporation
- Western Power
- Telstra/ telecommunications sector
- Bureau of Meteorology
- Department of Fire and Emergency Services
- Office of Bushfire Risk Management
- Department of Biodiversity Conservation and Attractions
- Parks and Wildlife Service
- Main Roads Western Australia and
- WAPOL

State Emergency Management

The Bureau of Meteorology plays an important role in monitoring local weather conditions from local weather stations, providing analysis and climate information, forecasts of climate and weather conditions and Fire Danger Ratings as a basis for assisting preventative actions such as declaring total fire ban days.

The Department of Emergency Services provides a range of important communication services including public announcement of the fire danger ratings, bushfire incidents and warnings (Australian Warning System standard).

It is also responsible for coordinating local brigade responses (Comcen) and taking incident control for Level 2 (Complex) - 3 incidents (Protracted).

State Emergency Management Framework

The *Emergency Management Act 2005* has been established to detail roles and responsibilities at a State, district, and local level in the implementation of the emergency management principles of Prevention (Planning), Preparation, Response, and Recovery (PPRR).

The *State Emergency Management Policy* (State EM Policy) provides a strategic framework for emergency management in Western Australia, describing principles and objectives for the co-ordinated organisation of public authorities.

The policy is supported by a suite of documents that provide complete guidance on the strategic framework for Emergency Management in Western Australia.

Under s. 20(4) of the EM Act, a public authority that is given a role and responsibilities under a State EM Policy is to comply with the State EM Policy[8].

- State Emergency Coordinator (SEC)
- District Emergency Coordinators (DECs);
- Local Emergency Coordinators (LECs) (WAPOL officer for the City of Kalamunda); and
- Local Emergency Management Committee - oversees local emergency management activities PPRR, through articulation of stakeholder responsibilities in the Local Emergency Management Arrangements (LEMA).

A local government is to establish one or more Local Emergency Management Committees (LEMCs) for its area to ensure that effective Local Emergency Management Arrangements (LEMA) are prepared. The LEMA is to be consistent with the State Emergency Management policies and the State Emergency Management plan. The LEMA addresses all emergencies, but special considerations within the LEMA include the bushfire season.

It addresses the roles and responsibilities of public authorities and persons involved in emergency management (stakeholders) and includes the Hazard Management Agency (comprising the Shire , WAPOL, and DBCA) in addressing the emergency management concepts of Prevention, Preparation, Response, and Recovery.

The LEMAs are reviewed every 5 years.

Shire of Kojonup Local Emergency Management Arrangements, September 2017

Shire of Broomehill-Tambellup Local Emergency Management Arrangements, September 2021

Local Government Fire Management Planning

Activities in which local government is engaged, in addition to the LEMA, that relate to development planning include:

> Administration of the *Bush Fires Act 1954* and enforcement of the annual fire break notice to limit the ignition and spread of bushfire. It also provides the basis for declaring total fire ban days and the offences for causing a bushfire. It plays an important role in maintaining awareness of the bushfire risk, measures to reduce the spread of a bushfire and measures to reduce the ignition of a bushfire. Local governments also use the Act to require the provision of cleared space around buildings and structures.
>
> In regard to the importance of policing to prevent bushfire ignition the Bushfire Cooperative Research Centre *Fire Development, Transitions and Suppression* study 2014, studied urban and peri-urban areas around Perth and compared DFES incident data. It was noted that in the study, there was a 50% decline in the number of annual ignitions due to proactive arson reduction programs in cooperation between Local government and WAPOL[9].

The Shire of Kojonup firebreak order provides:

> RURAL LAND
>
> *Homesteads, Buildings, Haystacks, Bulk Fuel, Drums and Liquid Petroleum.*
>
> > *"During the period from 14th December to the 31st May inclusive you shall have firebreaks at least 20 metres wide"*
>
> It also provides, for harvesting and hot works:
>
> > *It is compulsory that an engine powered pumping unit and not less than 600 litres of water must be in attendance during grain harvesting operations. Trailed units must have the towing vehicle attached at all times. The firefighting unit must be located in or immediately adjacent to the paddock being harvested at all times*

[8] State Emergency Management *A Strategic Framework for Emergency Management in Western Australia* October 2019

[9] A L Sullivan et al *Bushfire Cooperative Research Centre Fire Development, Transition s and Suppression study CSIRO 2014 p 17*

The Shire of Shire of Broomehill-Tambellup firebreak order provides

LAND ZONED FARMING

> *"During the period from 31st October 2021 to 15th April 2022 inclusive, completely surrounding the perimeter of any homestead building (excluding isolated non-flammable buildings), fuel installation…… you shall have firebreaks at least 5 metres wide (if provided by burning, cultivating or chemical spraying), or 10 metres wide (if provided by being closely grazed or mowed)"*

Land >40 ha

> *"The owner/occupier must have a mobile firefighting unit (self-propelled, towed or slip-on) in good working order, with a minimum capacity of 400 litres."*

Administration of the *Planning and Development Act* 2005, includes the preparation of development policy and assessment supporting Development Approval, and compliance with the bushfire protection criteria.

The Planning and Development Act through the State Planning Policy is a risk management arrangement regulates the potential introduction of land uses that may increase the threat of bushfire, and ensure future development reduces the consequence of bushfire, through siting and design. It works in unison although separately with the Building Act 2011, which addresses the construction standard of the habitable building.

Responsibility for the ongoing enforcement of the development authorisation is provided through section 214 of the *Planning and Development Act* 2005.

Administration of the *Building Act 2011* and the requirements of the *National Construction Code*, specifying construction standards in declared bushfire prone areas. Not all structures require development approval or building approval. The *Planning and Development (Local Planning Scheme) Regulations 2015*, Deemed Provisions at clause 78E (1) states bushfire construction standards provided in the *National Construction Code* can be applied by development approval if not in conflict with the *Building Act 2011*.

Bushfire Risk Management Plans

The Shire of Kojonup is in the process of preparing a Bush Fire Risk Management Plans (BRMP) following the OBRM *Bushfire Risk Management System and Bushfire Risk Management Plan template*.

The aim of the BRMP is to document a coordinated and efficient approach to the identification and treatment of assets exposed to bushfire and the coordination and prioritisation of tenure blind bushfire reduction initiatives.

Utilities

Telecommunications

The telecommunications coverage within 5 km of the wind farm provides for mobile phone communication, although a black spot analysis was not available. All residents are also understood to have landline connection.

Calls may be received by the Shire directly from members of the public, or through the '000' service and DFES Communications Centre (ComCen) requesting a turn out message be sent

All brigades are registered with DFES SMS Callout system which is used to:

- Notify a Brigade to respond to a fire
- Notify Brigade members of meeting and training activities

Both Shires also have an SMS system for advising:

- Implementing and removing Harvest and Vehicle Movement Bans
- Notifying the community of Total Fire Bans
- Notifying the community of a fire
- Notifying the community of road closures

In addition to the SMS service it is understood the landowners within the vicinity of the wind farm also receive warnings based on 'WhatsApp' messages etc, to mobilise local farmer resources immediately.

Firefighting facilities, appliances, are sparsely distributed in the district. Most fires are addressed initially by local farmers/lot owners contributing their time and firefighting facilities to apply a quick suppression response.

Aerial support is available from Manjimup and Albany

Water resources

A reticulated water supply is not available. Potable water is to be provided by water tank. Production water requirements will also be provided by tanked water. Throughout the sites surface dams are provided at a frequency of 1 per 1 ha.

Power Supply

The work construction compound and batching plant will be connected to the reticulated power supply. On site power generation is not proposed at the construction compound but will be required at the individual turbine sites through construction.

Road Network

The site is framed by Albany Highway (primary access west of the wind farm - sealed) Broomehill-Kojonup Road (north of the site - sealed) Brit Road (east of the site – unsealed -joins Warrenup Road to meet Broomehill Kojonup Road) and Tambellup Road (south- sealed). The site is serviced through the centre by Warrenup Road (north south - unsealed).

An internal road network will be created to provide construction and ongoing connection to each turbine site.

Consequence Criteria

This risk assessment has followed AS/ISO 31000:2018 risk management and in turn the National Emergency Risk Assessment Guidelines (NERAG 2020) and has adapted it to a local scale.

For the purpose of this assessment, it is assumed a bushfire arriving at the wind farm is an insignificant consequence, that other than shutting down for the period of the bushfire, it will not delay a return to energy production[10]. A fire however can be fatal to people that are exposed to it, but the potential consequence can be reduced by management practices and human behaviour. The safety of isolated workers *will be addressed through the emergency management plan.*

The assessment has instead assessed the consequence of a nacelle fire, and a fire escaping a turbine site.

The risk assessment follows objective 5.1 from SPP 3.7

> 5.1 Avoid **any increase** in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.

The purpose is to consider the consequence of introducing a development within an area, and to avoid an increase in the threat of bushfire above that which currently exists, noting that pasture/agricultural production around and within the site also presents an existing degree of risk, a fuel potentially vulnerable to lightning strike, mechanical failure of equipment (harvesters), the exposure of hot surfaces from vehicles passing over grasses, and hot works i.e. welding and grinding in the field.

Grassfires are characterised as locationally predictable because they do not generally disperse embers far in front of the fire front. Resources are therefore deployed directly to the fire front.

The wind turbine wake effect, unless shut down during the bushfire event, has the potential to disperse ignitions down wind.

[10] As identified by Australasian Fire and Emergency Service Authorities Council Wind Farms and Bushfire Operations 2018

External Consequence Assessment

Human settlement

The site is adjoined by agricultural pasture land within 5 km of the wind farm. The associated residential density is 1 dwelling per 90 km^2. The nearest township is Kojonup 19 km to the north east.

Fire scenario, Risk bushfire, fire **escaping** from the site			
North	East	South	West
5 residences	6 residences	9 residences	9 residences

INJURY SEVERITY	DESCRIPTION
FATAL	Mortally injured, is certain to lead to death regardless of available treatments Counted among deaths, not injuries
CRITICAL	Injuries that pose an immediate life threatening condition if not treated adequately and expeditiously Examples include uncontrolled bleeding, a punctured organ, other internal injuries, spinal column injuries or crush syndrome
SERIOUS	Injuries requiring a greater degree of medical care and use of medical technology such as X-rays or surgery, but not expected to progress to life threatening status Examples include full thickness burns across a large part of the body or partial thickness burns to most of the body, loss of consciousness, fractured bones, dehydration or exposure
MINOR	Injuries requiring basic medical aid that could be administered by paraprofessionals, which would require bandages or observation Examples include a sprain, a severe cut requiring stitches, a minor burn (partial thickness on a small part of the body) or a bump on the head without loss of consciousness

Generally, agricultural residential properties within pastural area have separation spaces effective for preventing direct flame contact against the residence. The land owners are also provided with an annual firebreak notice. Aerial observation also finds the dwellings within 5 km are separated from pasture grasses by cleared land for driveways and gardens. As a general principle if a building survives a bushfire, then fatalities can be avoided if refuge can be taken in the dwelling.

Whilst grassfires are fast moving up to 25 km/h[11] the landscape is open affording visibility to avoid an approaching fire.

The potential consequence is classed as 'serious – Moderate', the consequence is reduced by the conditions, grassland is a moderate bush fire hazard level, not extreme, and the landscape is open providing the opportunity to see an approaching fire and take early action.

[11] P.Cheney Grassfires Fuel, weather and fire behaviour 2008.

Economic

Fire scenario, Risk bushfire, fire **escaping** from the site			
North	East	South	West
Agriculture production pasture	Agriculture production pasture	Agriculture production pasture	Agriculture production pasture

LEVEL	IMPACT ON IMPORTANT INDUSTRY
CATASTROPHIC	Failure of a significant industry or sector in area of interest as a direct result of emergency event
MAJOR	Significant structural adjustment required by identified industry to respond and recover from emergency event
MODERATE	Significant industry or business sector is significantly impacted by the emergency event, resulting in medium-term (i.e. more than one year) profit reductions directly attributable to the event
MINOR	Significant industry or business sector is impacted by the emergency event, resulting in short-term (i.e. less than one year) profit reductions directly attributable to the event
INSIGNIFICANT	Inconsequential business sector disruption due to emergency event

A fire is likely to occur from only one part of the development. A fire at a turbine site, a fire at the substation and the permanent operation and maintenance building, a fire from the construction compound, or a fire from a vehicle. The fire will expand downwind in an elliptical shape from the source of ignition. The extent of loss of pasture will be determined by the wind strength and the event duration. Suppression intervention will reduce the extent of loss.

The most extreme fires conditions occur through the summer, after the harvest. Traditionally summer season fires are not a significant loss of pasture production, and whilst fires can occur outside the summer season the fire spread can be slower (a lower fire danger index< 50 potentially controllable) or restricted before pasture grasses have cured.

The consequence is classed as ‘minor’. A fire from the nacelle has the potential to spread downwind (elliptical) destroying a season’s crop and disrupting the livelihood of a landowner by a year, in addition there is a potential for damage to fences and other infrastructure. It is assumed existing controls promoted through the firebreak notice to provide a separation of buildings from grassland has been applied

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Environmental

Fire scenario, Risk bushfire, fire **escaping** from the site			
North	East	South	West
Contiguous pasture grasses	Contiguous pasture grasses and isolated bush blocks	Contiguous pasture grasses and isolated bush blocks	Contiguous pasture grasses

LEVEL	IMPACT ON ENVIRONMENTAL VALUES
CATASTROPHIC	Permanent destruction of environmental values of interest
MAJOR	Severe damage to environmental values of interest
MODERATE	Significant damage to environmental values of interest
MINOR	Minor damage to environmental values of interest
INSIGNIFICANT	Inconsequential damage to environmental values of interest

The site is largely surrounded by land cleared for agricultural purposes with the exception of isolated bush block that are representative of pre-European settlement.

The Flora, Vegetation and Fauna Assessment of the Flat Rocks Wind Farm Survey Area Prepared by Mattiske from field survey found no declared rare or priority flora to be present.

The consequence is classified as 'insignificant'.

Cultural

Fire scenario, Risk bushfire, fire **escaping** from the site			
North	East	South	West
Nil	Nil	Nil	Nil

LEVEL	IMPACT ON CULTURAL ASSETS
CATASTROPHIC	Widespread and permanent loss of objects of identified cultural significance
MAJOR	Widespread damage or localised permanent loss of objects of identified cultural significance
MODERATE	Damage or localised widespread damage to objects of identified cultural significance
MINOR	Damage to objects of identified cultural significance
INSIGNIFICANT	Minor damage to objects of identified cultural significance

The report on an Ethnographic Survey of the Proposed Flat Rocks Wind farm site between Kojonup and Broomehill found "As a result of the inspections the indigenous representatives were satisfied that the Project area contains no sacred or significant Aboriginal heritage sites".

The consequence is classified as 'insignificant'.

Likelihood Level

Notwithstanding the FDI (see section 4) has a similar occurrence of days over FDI 50, as the Perth CBD as a comparison, it has a low likelihood history.

Event likelihood is guided by the fire history, and the climatic precursors, which may lead to a landscape and uncontrollable fire. Not all fires are considered damaging, however a landscape fire threatens life and property.

LIKELIHOOD	ANNUAL EXCEEDANCE PROBABILITY (AEP)	AVERAGE RECURRENCE INTERVAL (ARI) (INDICATIVE)	FREQUENCY (INDICATIVE)
Almost certain	63% per year or more	Less than 1 year	Once or more per year
Likely	10% to <63% per year	1 to <10 years	Once per 10 years
Unlikely	1% to <10% per year	10 to <100 years	Once per 100 years
Rare	0.1% to <1% per year	100 to <1000 years	Once per 1000 years
Very rare	0.01% to <0.1% per year	1000 to <10,000 years	Once per 10,000 years
Extremely rare	Less than 0.01% per year	10,000 years or more	Once per 100,000 years

(NERAG 2020)

The likelihood level is classed as 'unlikely.' There is no identified history of landscape fire affecting the site and whilst turbine fires (nacelle fires) have occurred it is rare, with 5 having occurred in Australia between 2004 and 2018. International studies find a typical wind farm with 150 turbines may experience one or two fires during 20 years of operation.[12]

Risk Level

	CONSEQUENCE LEVEL				
LIKELIHOOD	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN	Medium	Medium	High	Extreme	Extreme
LIKELY	Low	Medium	High	Extreme	Extreme
UNLIKELY	Low	Low	Medium	High	Extreme
RARE	Very low	Low	Medium	High	High
VERY RARE	Very low	Very low	Low	Medium	High
EXTREMELY RARE	Very low	Very low	Low	Medium	High

(NERAG 2020)

A comparison of the proposal with the current situation, both are classed as 'unlikely' as an indication of frequency of event. There is always the potential for a grassland fire to occur if the fuel is present.

The wind farm is expected to present a similar level of risk of ignition that exists within the locality. The overall risk level is classed as 'medium'. Whilst construction materials and APZs can ensure a building survival, the potential for injury to humans if caught in the open is serious.

The particular feature of the wind farm is the significance is not the frequency of ignition, or the intensity of the fire, rather it is how the ignitions could be distributed, as multiple ignitions at a distance from the source. This will require a different firefighting approach that may stretch resources. Whilst a grassfire requires suppression focused upon the fire line, if a fire is to occur at a turbine site spot fires may occur downwind due to the height of the nacelle. A fire at a turbine site will require a consciousness to plan to fight spot fires that may ignite downwind in addition to suppression at the fire line.

[12] Firetrace international 2020 citing studies into the frequency of turbine ignitions https://www.firetrace.com/hubfs/_img/reports/Firetrace-Report-In-The-Line-Of-Fire.pdf

2.4 Risk Evaluation

The risk evaluation is used to decide and prioritise a range of risk treatments that had been identified to reduce the risk level. The highest priority risk treatments are applied first, to fit with the resources available, and become part of the risk controls identified in the first review. The second tier risk treatments then become the priority outcomes in the subsequent review.

This assessment however is part of a development assessment and has followed an approach to minimise the risk to *As Low as Reasonably Practical* (ALARP). The measures are to be implemented and complete as part of the authorisation.

Whilst the wind farm may contribute an additional ignition source, it is considered a comparable frequency and consequence to that of pasture farming operations. An ignition will result in a spreading grassfire.

The risk profile can also be considered in two phases. The construction phase involves a range of activities that could result in ignitions and grassfire but is likely to have people in close attendance to respond effectively if provided with suppression facilities. The operational phase has a different set of potential ignition causes that may be remotely detected and will take time to respond to.

2.5 Risk Treatment

The attached Risk Register has identified the risk items and a corresponding treatment arranged in order following preparations and response. Each treatment has been identified for its practicality and effectiveness in reducing the residual risk, after treatment through construction and operation to a Low level risk.

As part of a continuous improvement model the risk level is recalibrated in the risk register is recalibrated to high as an objective to achieve and *As Low as Reasonably Practical* (ALARP) risk following treatments that are within the owner's control. In this approach there is a point of declining benefit where it becomes impractical. The risk treatments are therefore nominated for their practicality, benefit, and acceptance (expediency) and effectiveness (confidence). The NERAG risk assessment method is an orderly method of qualitative assessment, residual risk is also a qualitative estimate.

Risk Register and Residual Risk

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
TURBINE SITE - APPROACHING FIRE					
Construction All the turbine sites are located within pastural grasses. Grassfire is fast moving, potentially fatal to exposed persons and may cause the ignition and loss of flammable objects. The turbine sites are open isolated and distant to the construction compound Up to 20 persons are expected at the construction site and will arrive at the site by private vehicle. Transportable buildings in the construction compound will provide amenities and ablutions Assembly machinery may be significantly damaged by flame contact and extreme heat Turbine components in the laydown area may be significantly damaged by flame contact and extreme heat. There is only one egress route from the turbine sites until reaching Warrenup Road (east). This may limit the opportunity to evacuate a turbine site in the event of a short onset fire arriving from the east.	**High**	**Preparation** – The supervisor at the turbine site is to be aware of the emergency procedures and trained in the operation of firefighting equipment[15]. – At induction all workers and visitors are to receive a summary of the emergency procedures. **Managing the fuels** – Establish an APZ around the turbine compound 30 m. – Establish the compound as low threat (no vegetation within the compound) and flammable materials separated by 6 m. – Firefighting appliance 1@ 1000 L is to be stationed at the compound. **Response** – Evacuate when safe: or – Shelter in open the open space in areas furthest from the approaching fire (Passenger vehicles may be used for shelter, parked and moved in the open space to maintain the furthest distance from the fire) – Extinguish small fires.	**High**	**High**	**Low**

[13] Each item is a potential consequence or external risk which forms part of the authorisation to be implemented as part of the authorisation, it is not a matter of choice between treatments.

[14] There is a high certainty of the cause and direct consequence

[15] Western Australian Department of Fire and Emergency Services *Guidelines for Operating Private Equipment at Fires* March 2022

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
<u>Operation</u> The turbine site upon completion will be open and clear of objects at ground level The turbines are distant to the operations room the nearest turbine is 10 km away and furthest is 20 km away. Occasional isolated work, attended by private vehicle except for times of exceptional maintenance. There is only one egress route from the turbine sites until reaching Warrenup Road (east). This may limit the opportunity to evacuate a turbine site in the event of a short onset fire arriving from the east.	**High**	**Managing the fuels** – Establish an APZ around the turbine base: – 20 m diameter area compacted limestone – 40 m diameter area grass < 100 mm **Response at turbine site** – Evacuate if safe. – Shelter on the lee side of the pylon. – Evacuate when safe. **Operation response** – The Operations Manager is to shut down the rotation of the turbines upon notice of a bushfire within 5 km of the wind farm until the 'all clear' is given by emergency services. – The turbine is to be inspected after the 'all clear' is issued.	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
CONSTRUCTION COMPOUND - APPROACHING FIRE					
Construction The construction compound is isolated and located within an area of pastural grass. It comprises the site camp, the batch plant, crane pad and vestas laydown are Up to 120 persons may be in attendance and will arrive by private vehicle The site contains potentially flammable objects: transportable buildings, fabric awnings over shipping containers, laydown area and materials, refuse bins and fuel store (regulated management of hazardous material under the *Dangerous Goods Safety Act 2007*) There is only one egress route from the turbine sites until reaching Warrenup Road (east). This may limit the opportunity to evacuate a turbine site in the event of a short onset fire arriving from the east.	**High**	**Preparation** – The supervisor at the construction compound is to be aware of the emergency procedures and trained in the operation of the of the firefighting equipment. – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. **Managing the fuels** – Establish an APZ around the site camp 30 m. – Establish the site camp as low threat (no vegetation within the compound) and flammable materials separated by 6 m. – Establish the Batch Plant, Crane Pad and Vestas laydown as low threat, grass maintained at less than 100 mm or a mineral or paved surface. – Firefighting appliance 2 @ 1000 L will be stationed at the compound. – 50 000 L water tank retained on site for firefighting. **Minimising Exposure** – All persons are to gather at the site camp if safe to reach – The amenities building is capable of accommodating all attending personnel. – If it is not safe to reach the site camp from the Batch Plant, Crane Pad and Vestas laydown **Response** – Shelter within compound if not safe to leave. – Extinguish small fires. – Evacuate when safe.	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
SUBSTATION AND PERMANENT OPERATIONS BUILDING AND MAINTENANCE COMPOUND - APPROACHING FIRE					
Construction The substation and operations building, and maintenance compound is located within pastural grasses. Grassfires are fast moving, are potentially fatal to exposed persons and may cause the ignition and loss of flammable objects. Vulnerabilities to ignition are: – The site will contain equipment awaiting installation. – The site include the storage of oils Up to 40 persons are expected during construction and will arrive at the site by private vehicle. The substation and operation's compound location has through road options Tambellup Road West (east-west) and is close to Albany Highway (north-south). Options are available to evacuate away from an approaching fire.	**High**	**Preparation** – The supervisor at the turbine site is to be aware of the emergency procedures and trained in the operation of the of the firefighting equipment. – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. **Managing the fuels** – Establish an APZ around the construction compound 30 m. – Establish the compound as low threat (no vegetation within the compound) and flammable materials separated by 6 m. **Response** – Evacuate when safe. – Shelter within open area if not safe to leave. – Extinguish small fires.	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
<u>Operation</u> Up to 10 persons may be in attendance at the operations building at any one time, including field technicians and routine maintenance equipment. Vulnerabilities to ignition are: – Oil reservoirs (for substation) – Operations building – Workshop, equipment and maintenance materials. The substation and operations compound has through road options Tambellup Road West (east-west) and is close to Albany Highway (north-south). Options are available to evacuate away from an approaching fire.	**High**	**Preparation** – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. – A Firefighting appliance 1000 L is to be stationed at the maintenance compound (to be taken to site works). – A 50 000 L tank is to be provided at the maintenance compound for firefighting – grassfires. **Managing the fuels** – Maintain an APZ around the substation 30 m. – Maintain the area within the substation clear of vegetation. – Maintain an APZ zone 21 m around the operations building and maintenance compound. – The operations building is to be constructed to BAL 29 bushfire standard. **Response** – Evacuate if safe. – Shelter in the operations building. – Evacuate when safe. – Trained personnel, in attendance, may attend to grassfire suppression if safe to do so.	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
THE MAKING OF ROADS					
Personnel may be injured by exposure to bushfire attack, extreme heat, smoke and airborne particles. Work is undertaken in the open, within pasture grass.	**High**	**Preparation** – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. **Response** – Evacuate to the site camp if safe. – Evacuate to the nearest turbine construction compound if the site camp cannot be reached.	**High**	**Medium**	**Medium[16]**
TRENCHING AND INSTALLING POWERLINES					
Personnel may be injured by exposure to bushfire attack, extreme heat, smoke and airborne particles. Work is undertaken in the open, within pasture grass.	**High**	**Preparation** – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. **Response** – Evacuate to the site camp if safe. – Evacuate to the nearest turbine construction compound if the site camp cannot be reached.	**High**	**Medium**	**Medium[17]**

[16] A safe space may be distant.
[17] A safe space may be distant

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
TURBINE SITE - ESCAPING FIRE					
<u>Construction</u> Potential ignition sources from activities at the turbine compound • Hot works, open flame and spark generating activities • Cigarette disposal • Vehicle movements to the site, hot elements or vehicle mechanical failure • Mechanical or electrical failure at the site • Refuelling and flammable material spillage	**High**	**Preparation** – The supervisor at the turbine site is to be aware of the emergency procedures and trained in the operation of the of the firefighting equipment. – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. **Managing the fuels exclusion** – Establish an APZ around the turbine compound 30 m. – Establish the compound as low threat (no vegetation within the compound) and flammable materials separated by 6 m. – Stationed a Firefighting appliance 1000 L is at the compound whilst construction works are being undertaken. **Response** – Report ignition immediately to the operations office. – Operations Manager is to report immediately to the Shire. – Operations manager is to advise the land owner firefighting appliances to assist suppression of ignition. – Extinguish fires with firefighting appliance.	**High**	**High**	**Low**

Operation • Nacelle fire The turbine nacelle has a fire detection and suppression system but there have been instances where a mechanical failure has overwhelmed the suppression system and a nacelle fire has occurred. Given the height of a nacelle and the wake effect, there is a potential for embers from the turbine fire to be deposited up to 5 km down wind and potentially igniting a grassfire.	**High**	**Preparation** – The Operations Manager is to be aware of the emergency procedures and communication contacts. – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. – The landowners, hosting the turbine, are to be trained in the event of a nacelle fire, to establish and not to enter the 75 m exclusion area, to suppress the fire line and monitor for spot fire igniting downwind from the turbine. **Managing the fuels** – Maintain the APZ around the turbine base: – 20 m diameter area compacted limestone – 40 m diameter area grass < 100 mm – Firefighting appliance 1000 L is to accompany any undertaking of hot works at a turbine site. – Establish 3@ 50 000 L standalone water tanks ▪ Inside the access gate to WTGs 13,14,15,17 ▪ Inside the access gate to WTGs 1,2,3,4,5,6,7,55 ▪ Inside the access gate to WTGs 8,9,10,11,16 **Response** – Report ignition immediately to the operations office. – Move clear 75 m from the turbine base (away from falling debris). **Operation Response** – The operation manager is to shut down the rotation of the turbines upon notice of a bushfire within 5 km of the wind farm until the 'all clear' is given by emergency services. – The affected turbine should if possible be oriented head to wind and shut down. – Operations Manager to immediately report the incident to the land owner for the undertaking of the first response including ▪ Establishing the 75 m exclusion zone from the base of the turbine. ▪ Suppressing the fire line; and ▪ Monitoring for ignitions down wind – Operations Manager is to report immediately to the Shire.	**High**	**Moderate**	**Medium**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
<u>Operations Maintenance</u> Technicians attending the turbines and associated infrastructure. Sources may include: • Hot works, open flame and spark generating activities • Vehicle mechanical failure		**Preparation** – The Operations Manager is to be aware of works being undertaken at the site. – All workers attending the site are to have mobile phones and contacts. – All worker attending the site are to report their attendance to the Operation manager or delegate before entering the site. – At induction (upon attending the windfarm) all workers and visitors are to complete a risk assessment and receive a summary of the emergency procedure. – Fire extinguishers are to be collected from the operations building and taken on site. – Hot works are not to be undertaken on total fire ban or harvest ban days without a permit. **Response** – Fire extinguishers are to be used to suppress the spread and extinguish a grassfire ignited by the activity at the site. – Report the incident to the operations manager			

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
CONSTRUCTION COMPOUND – ESCAPING FIRE					
Construction Sources of ignition • Hot works, open flame and spark generating activities • Cigarette disposal • Vehicle movements to the site, hot elements or vehicle mechanical failure • Mechanical failure at the site • Refuelling and flammable material spillage	**High**	**Preparation** – The supervisor at the construction compound is to be aware of the emergency procedures and trained in the operation of the of the firefighting equipment. – At induction all workers and visitors are to receive a summary of the emergency procedure. – A firefighting appliance 1000 L stationed at the compound. – A 50 000 L tank is to be provided at the site camp for firefighting – grassfires. **Managing the fuels** – Establish an APZ around the construction compound 30 m. – Establish the compound as low threat (no vegetation within the compound) and flammable materials separated by 6 m. **Response** – Report ignition immediately to the operations office – Operations Manager is to report immediately to the Shire – Extinguish fires with firefighting appliance	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
SUBSTATION AND PERMANENT OPERATIONS BUILDING AND MAINTENANCE COMPOUND - ESCAPING FIRE					
Construction Sources of ignition • Hot works, open flame and spark generating activities • Cigarette disposal • Vehicle movements to the site, hot elements or vehicle mechanical failure • Mechanical failure at the site • Refuelling and flammable material spillage	**High**	**Preparation** – The supervisor at the turbine site is to be aware of the emergency procedures and trained in the operation of the of the firefighting equipment. – At induction all workers and visitors are to receive a summary of the emergency procedure – A Firefighting appliance is to be 1000 L stationed throughout the construction **Managing the fuels** – Establish an APZ around the substation 30 m – Maintain the area within the substation clear of vegetation – Establish an APZ 21 m around the operations building and maintenance compound. – The operations building is to be constructed to BAL 29 bushfire standard – Maintain the area within the workshop area clear of vegetation **Response** – Report ignition immediately to the operations office – Operations Manager is to report the incident immediately to the Shire – Extinguish grassfires with firefighting appliances (water is not to be applied to an electrical fire)	**High**	**High**	**Low**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
<u>Operation</u> Sources of ignition • Transformer, or electrical shorting • Building fire • Vehicle movements over grass • Hot works undertaken at the workshop	**High**	**Preparation** – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure – A Firefighting appliance 1000 L is to be stationed at the maintenance compound. – A 50 000 L tank is to be provided at the maintenance compound for firefighting – grassfires. **Managing the fuels** – Maintain the APZ around the substation 30 m – Maintain the area within the substation clear of vegetation – Maintain the APZ 21 m around the operations building and maintenance compound. Maintain the operations building at the BAL 29 bushfire construction standard **Response** – The Operations Manager is to report the incident immediately to the Shire – Extinguish grassfires with firefighting appliances (water is not to be applied to an electrical fire)	**High**	**Moderate**	**Medium**

Risk Register					
Risk statement	**Risk Level**	**Risk Treatment**	**Expediency/ priority[13]**	**Confidence level[14]**	**Risk Residual**
USE OF ACCESS ROADS					
Operation Sources of ignition • Vehicle movements to the site, hot elements or vehicle mechanical failure igniting a grassfire.	**High**	**Preparation** – Attendance on the site is to be reported to the Operations Manager. – At induction (upon attending the windfarm) all workers and visitors are to receive a summary of the emergency procedure. – Fire extinguishers are to be collected from the operations building and taken on site. **Managing the fuels** – A 20 m cleared access road is to be maintained with a minimum 6 m carriageway. **Response** – Operational procedures are to restrict vehicles to the made access roads and cleared compounds, unless required for firefighting. – Mechanical failure of vehicles are to park in the centre of the access road. – Fire extinguishers are to be used to suppress the spread and extinguish a grassfire ignited by the activity at the site. – Report the incident to the Operations Manager.	**High**	**High**	**Low**

APPENDIX 1 - EMERGENCY MANAGEMENT PLAN

EMERGENCY MANAGEMENT PLAN

The following Emergency management Plan follows the Emergency Management System Approach, Planning, Preparation, Response and Recovery.

1. PREPARATION

Roles and responsibilities – fire preparedness

Emergency Planning Committee (EPC)

The Emergency Planning Committee represents the wind farm owners and management together with the Chief Warden. During the construction phase representatives for each function may be included on the EPC.

Prior to the commencement of construction the EPC is responsible for ensuring consistency is achieved between the work practices and emergency procedures of each function contractor.

The Emergency Planning Committee is responsible for:

- overseeing the preparation of the site buildings and grounds prior to the approaching bushfire season including the operational readiness of all fire suppression systems , alarms and communications.
- reviewing the EMP and ensuring all information is up to date
- liaising with Shire emergency services
- establishing the Emergency Management Team and assigning roles and responsibilities to staff; and
- overseeing the undertaking of education and training.

The **Emergency Planning Committee** evaluates the outcomes of any drills and ensures appropriate resources are provided to prepare for the bushfire season.

Emergency Management Team (EMT)

The Emergency Management Team shall comprise staff assigned to the following positions:

- Chief Warden

The Chief Warden

The Chief Warden will be the Site Manager in attendance during the construction phase and subsequently the Operations Manager, during operation of the wind farm.

A Deputy Chief Warden may be appointed as a representative at each work site during the construction phase; to be coordinated by the Chief Warden.

Chief Warden responsible for:

- Coordinating response to a bushfire event.
- Ensure the induction of emergency procedures for all Visitors/ Contractors undertaking work at a site
- Overseeing practice exercises and reporting to the EMC – continuous improvement
- Overseeing the training of all staff on emergency shut down procedure, and emergency service notification
- Overseeing the training of all staff, on evacuation and shelter procedures
- Overseeing the training of the EMT, communication and emergency service liaison, facility evacuation, firefighting and the use of facilities

  Note: Personnel attending the site are responsible for fire prevention and extinguishing minor fires caused by works on site - where it is safe to do so
- Providing event control
- Maintaining records

Alarm system

Each wind turbine is monitored for excessive heat and each nacelle is equipped with a fire suppression system that is automatically activated in the event of detection of fire, smoke or excessive heat.

The wind farm's fire detection system is monitored from the operations room.

Evacuation plan

Construction

The construction of the wind farm will result in multiple activities and works across the site. Each working area will be provided with a nominated fire warden.

All attending workers at induction will be made aware of the emergency procedures to be followed at the site.

An alarm may be raised at each working area and immediately reported to the site operations manager (Chief Warden).

An alarm may be raised by the site operations manager (Chief Warden) or delegate, alerting personnel at each working area to implement the emergency procedures.

Communications between the site operations manager (Chief Warden) and the nominated fire warden at each working site will be by two way radio (Primary), in addition to mobile phone.

Operation

All attending workers at induction will be made aware of the emergency procedures to be followed at the site.

All employees working remotely on the site will maintain communications with the operations manager (Chief Warden) by two way radio (Primary), in addition to mobile phone

Emergency evacuation routes

Construction

The emergency evacuation routes are the nearest public road or the nearest turbine compound (cleared space), whichever is in the opposite direction to an approaching fire (safest opportunity)

Operation

The emergency evacuation from the operations building and substation is to Albany Highway.

Field workers, isolated, are to evacuate to the nearest public road or take shelter at the nearest turbine base (the access road network on completion should provide the opportunity in most instance to evacuate the site and avoid the passage of a fire).

Assembly points

Construction

The main Assembly Point is the construction compound (between turbine sites T3 and T4).

In an emergency each nominated fire warden will report to the site operations manager (Chief Warden), to advise of their destination and account for all personnel.

A daily log of personnel and visitors to the construction compound and all work sites should be maintained by the site manager (or nominated delegate).

The site manager (Chief Warden) will undertake a roll call and all personnel are to be accounted for.

Operation

The permanent operations building is the main Assembly Point

Command centre

Construction

The initial operations management will be coordinated from the construction compound (between turbine sites T3 and T4). It will provide the command centre in an emergency.

Operation

The permanent operations building will provide the command centre in an emergency.

Training

All site employees, at induction are to be aware of the emergency procedures

- Identify access and egress options and safer places.
- To report an incident immediately.
- Stay in contact, maintain access to radio communication at all times.
- Determine the safest action evacuate or take shelter.
- Report destination.

Each working area will have at least one person present who is trained in basic fire operations and will be responsible for managing the operation of the firefighting appliance 1000 L.

Operation

Regular employees at the site will be trained in basic firefighting and the operation of firefighting appliances.

Workers and technicians prior to entering the site are required to collect a fire extinguisher and operation instructions, to extinguish a grassfire and report an incident before entering the site.

The Chief Warden is to be aware of attendance at the site.

Emergency drills

Through both the construction phase and during operation an emergency drill is to be undertaken prior to the bushfire season (August) and again mid-season (January). All employees are to be notified prior to an alarm being tested or a drill exercise.

A debriefing shall be held as soon as practically possible, after each drill.

Resources

Internal suppression systems

Each turbine is fitted with a fire detection system, and internal suppression system.

On site equipment

The following equipment

Construction

- Each working area is to be provided with a 1000 L fire appliance in attendance

Example of a 1000 L slip on unit, it can be loaded on a vehicle or on a trailer

- A 1000 L fire appliances (1000 L Slip on unit) is to be retained at the construction compound to be dispatched to assist fire suppression at a working area.
- A 50 000 L standalone tank is to be provided at the site construction compound.
- 3 @50 000 L water tanks are ae to be distributed though the windfarm to provide a reliable water supply to be used to supress grassfires.

Operation

- A 50 000 L standalone tank is to be provided at the and the permanent operation and maintenance building.
- A 1000 L fire appliances (1000 L Slip on trailer units) are to be retained at the permanent operation and maintenance building; to be used to accompany field /turbine works.
- Each attending technician vehicle is to carry the equivalent of one 9 kg fire extinguisher per vehicle and a first aid kit when on site. (These can be collected from the permanent operations building).
- The permanent operations building (construction and operation) will be equipped with two larger first aid kits.

Communication

Within site

Two way radio communication is to be provided with each working area and remote employee during operation.

External

Contact information for all adjoining properties is to be prepared and maintained up to date. This may include an SMS register, or another communication means e.g. WhatsApp.

Shire notification contacts and in turn emergency services contacts are to be confirmed.

Chemical storage and handling

All chemicals will be stored in a designated chemical store during construction and operation. A register is to be kept and provided to any attending emergency services.

A register will be kept at the construction compound and the operations building.

Hazardous materials will be stored following the requirements of:

- Dangerous Goods Safety Act 2007
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007 (bulk >500 L)
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007
- Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007

Hazardous materials at the substation are bunded with sufficient capacity to contain the volume of stored material and around the transformer in the event of a major oil leak.

Hot works

No hot works will be undertaken outside on Total Fire Ban Days or harvest ban days without a permit.

Any planned hot works to be undertaken in the field are to follow a risk assessment and be accompanied by a 1000 L fire appliance.

Fire preparedness review

A Fire Preparedness Inspection is to be undertaken in September each year and confirmed with the Emergency management committee

- An inspection of the APZ s

  The following APZ s apply

  – Around the site camp (Construction compound) a30 m wide area of grass maintained at less than 100 mm and no grass within the compound.

  – Around the Turbine construction compound a 30 m wide area of grass maintained at less than 100 mm and no grass within the compound.

  – Around the base of the Turbine (operational) a 20 m diameter area of compacted limestone or equivalent, and a 40 m diameter area of grass maintained at less than 100 mm.

  – Around the Substation a 30 m wide area of grass maintained at less than 100 mm and no grass within the substation area

  – Around the Operations building and maintenance compound a 21 m wide area of grass maintained at less than 100 mm and no grass within the maintenance compound. The operational building is to be constructed and maintained to the BAL 29 standard.

  – Access route easements are 20 m wide
- Turbine suppression systems in operating order.
- An inspection of the on-site firefighting equipment to be in operating order: Firefighting appliance, fire extinguishers, first aid and PPE.
- A review of currency this Emergency Management Plan (update contacts and learnings from drill exercises or bushfire events).
- Confirm firefighting arrangements with the Shire and neighbouring properties.
- Confirm landowners are aware of the fire fighting procedures in the event of a nacelle fire.

Throughout the fire season

All employees are to report any defects

- Continual observation of the condition of the roads and cleared areas: grass is fast growing and will require regular attendance. Maintenance works should be accompanied by a 1000 L fire appliance

2. RESPONSE

In the event of a fire the following priorities will be observed:

1. Protect and rescue human life.
2. Report incident – land owner
3. Report incident – Shire
4. Render assistance in affected areas.

2.1 Chain of command

The chain of command on site in the case of a fire is as follows:

1. Chief Fire Warden (Operations Manager) or proxy
2. Nominated staff to undertake firefighting (construction phase)
3. Land owner
4. Emergency Services upon arrival will have authority to deal with the fire.

The landowner, during operation, is in closest proximity to apply suppression to extinguish a grassfire; until the brigade arrives. Landowners are to be trained in responding to a Nacelle fire event, to establish an exclusion zone, apply suppression to the fire line outside of the exclusion zone, and monitor for spot fires downwind, up to 5 km.

FIRE RESPONSE ACTIONS

Key contacts		
Community Emergency Services Manager	Cindy Pearce	0417 071 567
Kojonup Fire Brigade	Tony Fisher (Chief)	0428 311 504
Broomehill and Tambellup Fire Brigade	Kim Oliver (Chief)	0427 258 157
Turbine land owners		
WTG	TBA	
WTG	TBA	
WTG	TBA	

Alarm	Obtain information about the type and nature of the fire, including the direction of travel. – Determine need for shut down of turbines. – Alert adjoining residents (SMS contact/WhatsApp) – Instruct evacuation or shelter of personnel on site – Report incident to the Shire and DFES – Dispatch site fire services to assist with suppression
Approaching Fire	**If a fire is likely to encroach within 5 km of the Wind farm assets.** Construction Phase – Direct the shutdown turbines and lock in the Y position – Vehicles and equipment are to be moved out of the path of any fire to and parked on clear ground. – All personnel not directly involved in the fire response are to evacuate the site. – Alert adjoining residents (SMS contact/WhatsApp) Operation Phase **If a fire is within 5 km of the Wind farm assets** Construction Phase <u>Determine the impact to the area</u> – Direct the shutdown turbines and lock in the Y position, until the' all clear is received' <u>Determine the impact at the site</u> – Determine the severity of the fire. If there is potential endangerment of the site. – Workers at a turbine (if not safe to evacuate) should park vehicles at the base of the turbine at the lee side of the approaching fire – Guide personnel at risk to safety (evacuate or take shelter) – All personnel not directly involved in the fire response are to evacuate the site to a safe location as directed by the management team in coordination with public emergency services. – The Chief Warden (operations manager), and designated personnel, will ensure the evacuation of personnel has been successfully completed and that all personnel are accounted for.

Turbine Fire	Report fire – Shut down turbine, Y position and head to wind if possible – Shut down other turbines – Alert the turbine land owner – Alert the Shire. The Shire will alert the community (SMS contact/WhatsApp) and mobilise the local brigade response
Substation Fire	– Shut down the wind farm and electricity supply to the substation – Do not apply water to electrical fires. – Contain fires within the APZ. (This procedure does not account for structural fire procedures at substation; this is to prevent the escape and a spread of bushfire from the substation).
Access route fire	All technicians attending the site are to acknowledge the emergency procedures (incident reporting) by induction certification before proceeding onto the wind farm. All technicians attending the site are to collect an extinguisher and first aid kit from the operations building before proceeding onto the wind farm. At induction, technicians attending the site should be aware in the event of a mechanical failure the vehicle should be parked immediately within the road way or on a cleared space. Do not drive over cured grass. The fire extinguisher should be used to suppress any fire escaping into or spreading into the adjoining grass. Immediately report the incident to the Operations Manager.
Building Fire **Workshop Fire**	Follow structural fire procedures Evacuate buildings Account for all staff Set up an exclusion zone. Contain fires with the fire appliance to within the APZ to prevent the spread of fire to become a bushfire
If evacuations of staff is expected to extend beyond the normal work shift, communicate an expected return	

3. RECOVERY

After the 'all clear' is announced by emergency services (Shire or DFES)

Contaminated fire-fighting water

Contaminated fire-fighting water should not be permitted to enter the watercourse or contaminate the ground that supports the surface flows into a dam – bund and remove.

Dealing with the media

All enquiries are to be directed to the Project Manager.

Restore operation

If the site has not been adversely affected by fire, and an all clear has been issued down wind of the wind farm, up to 5km, the operation can commence.

If the facility is affected damaged by fire, it may be possible to restore operation to the areas that were not damaged. Damage to affected areas should not be interfered with until any required investigations are completed.

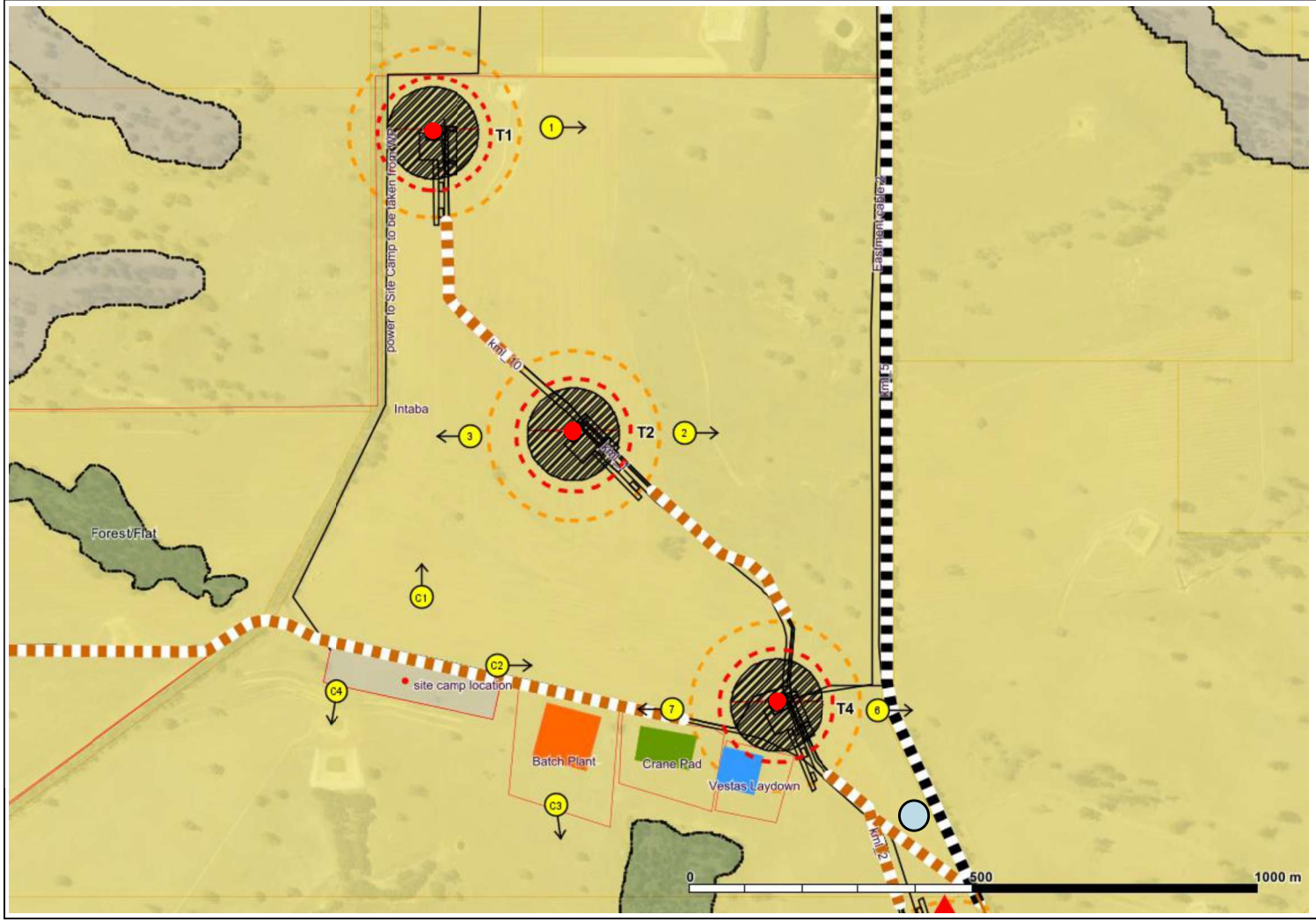
Debriefing and continuous improvement

A debriefing of staff will be held after the incident and opportunities for improvement identified.

A debriefing of staff, Emergency service and the local community should also be held after the incident and opportunities for improvement identified.

APPENDIX 2 - VEGETATION CLASSIFICATION

Figure 1a Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road (21 tonne)

Access gate (push through)

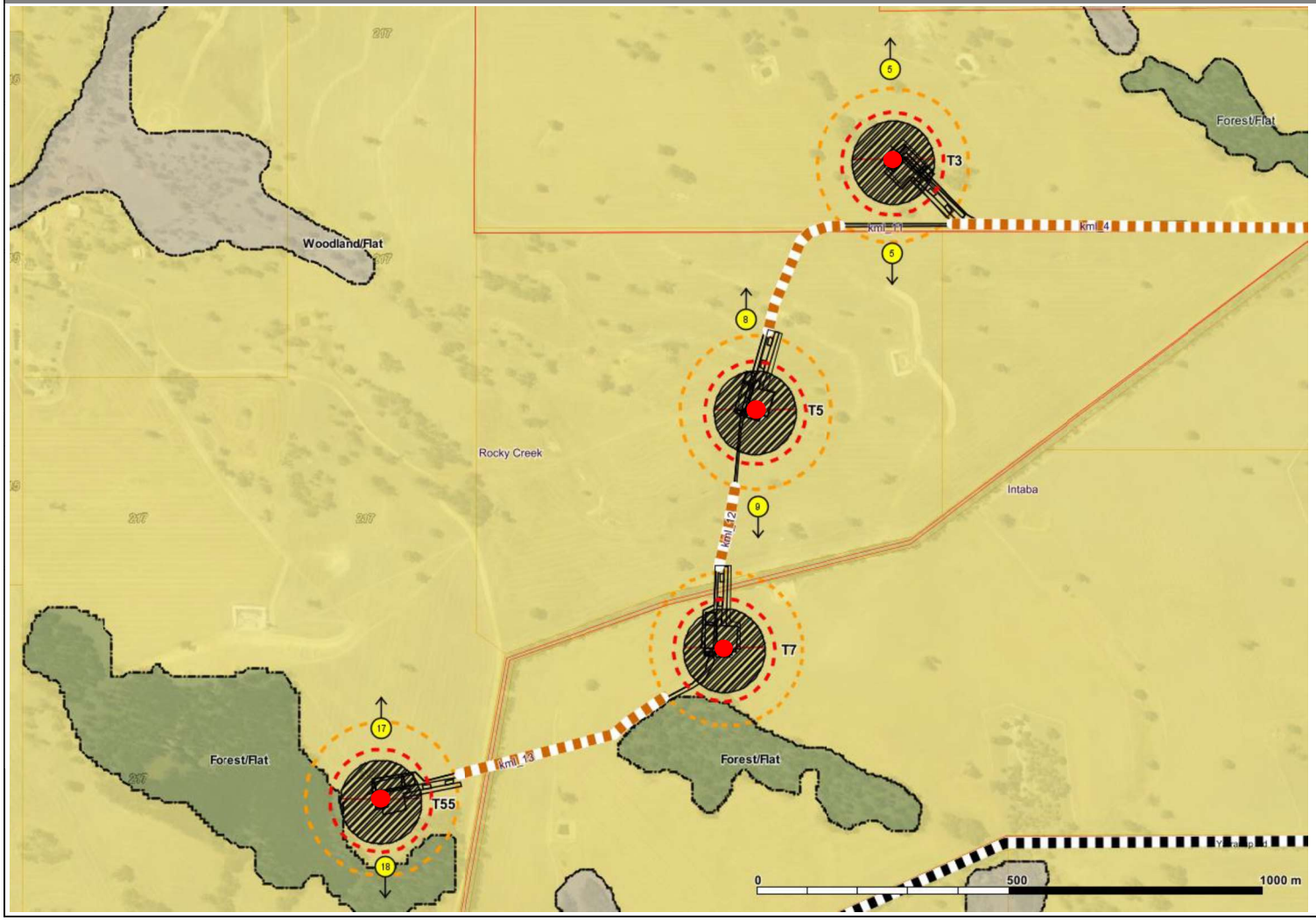
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1b Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road

Access gate

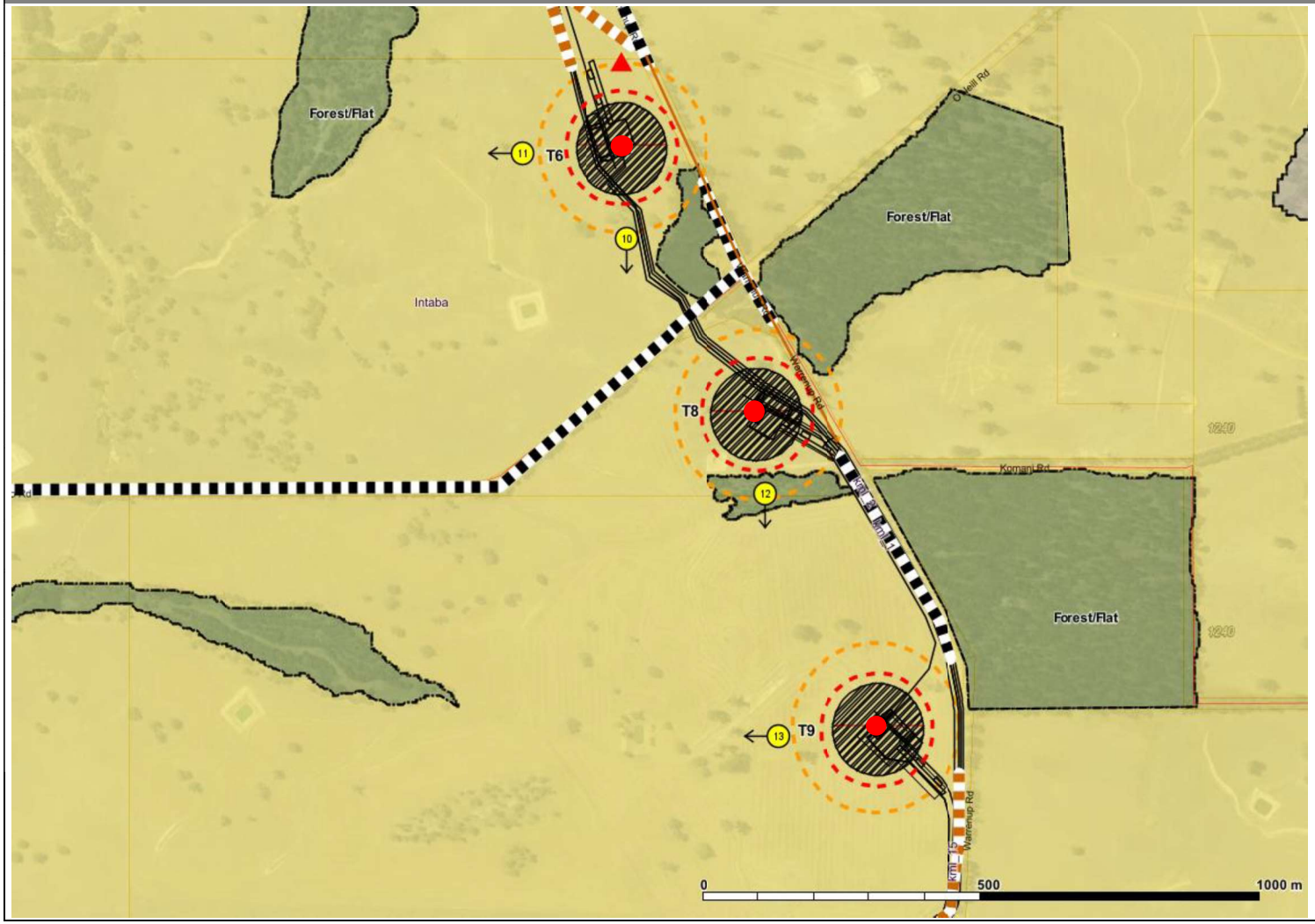
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1c Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road

Access gate

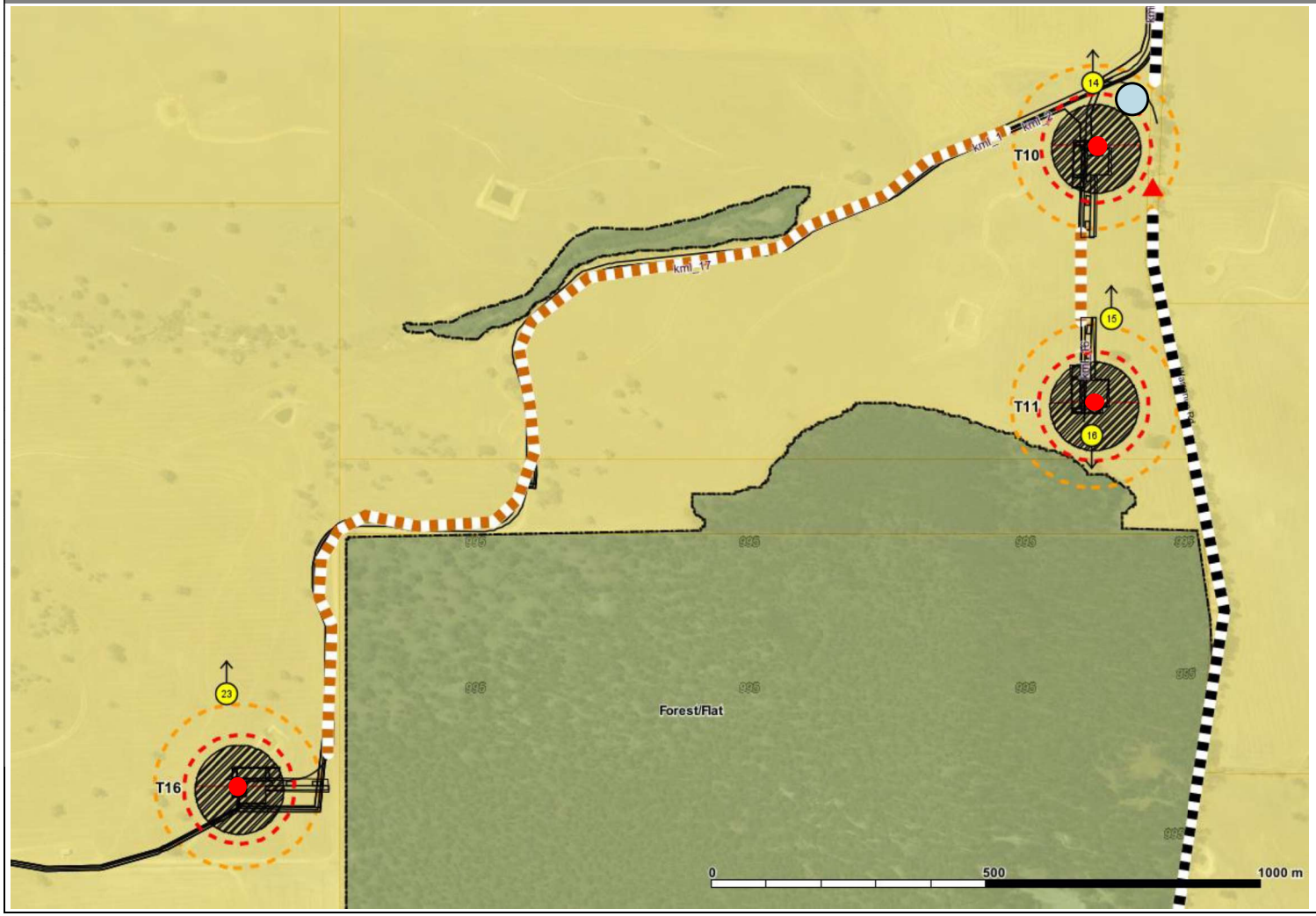
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1d Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road

Access gate

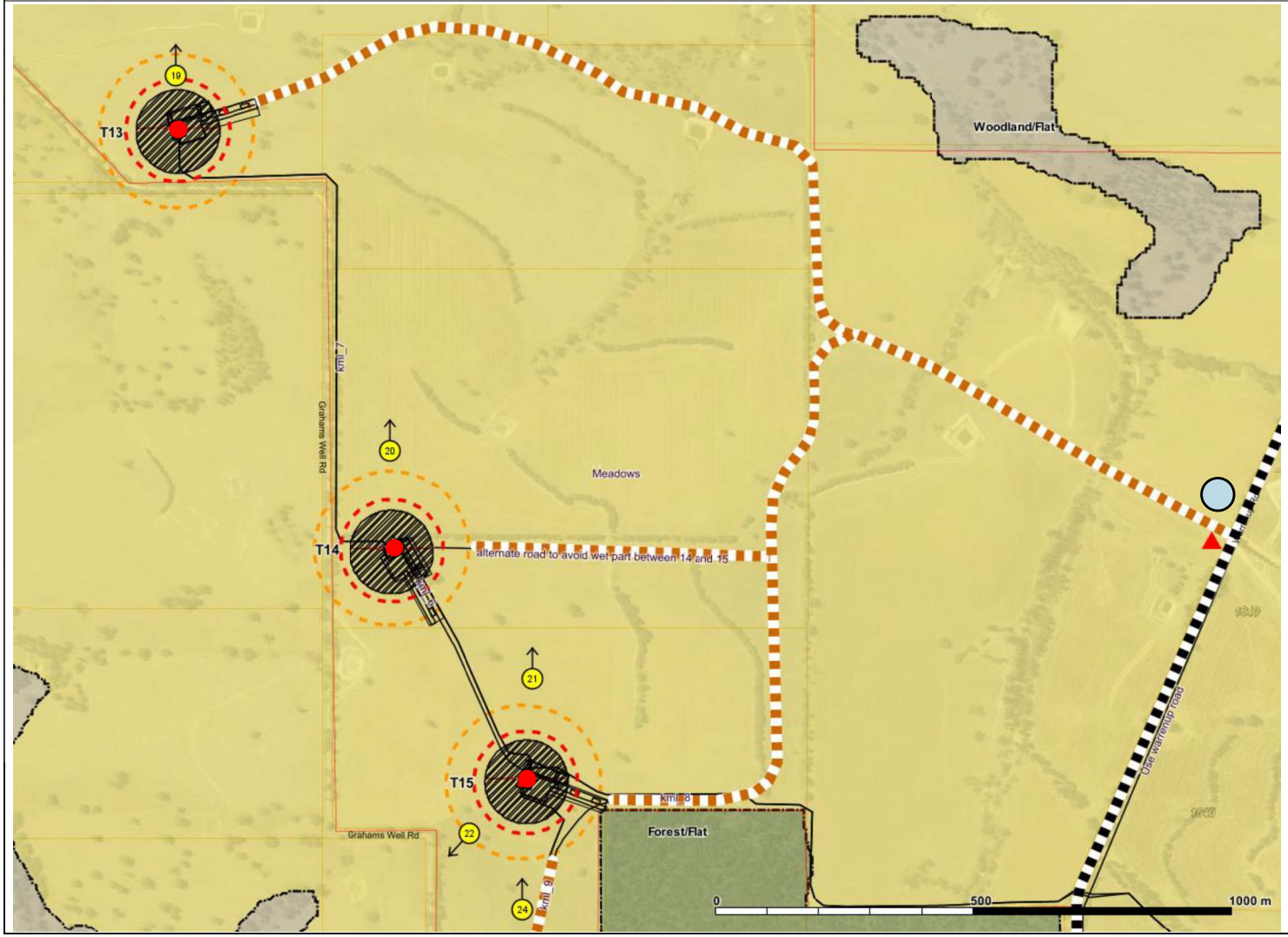
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1e Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road

Access gate

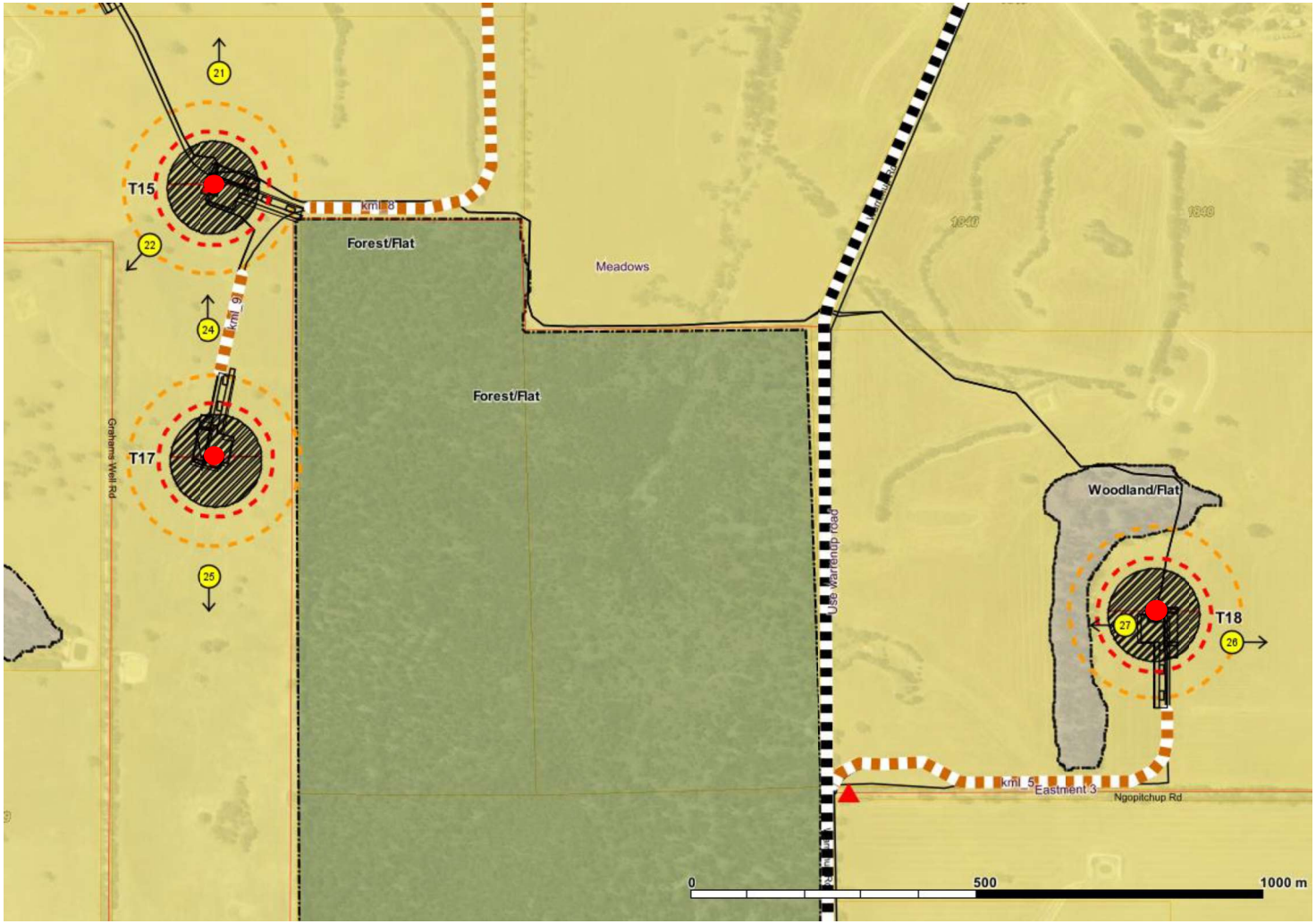
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1f Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Photo point

Public road

Access road

Access gate

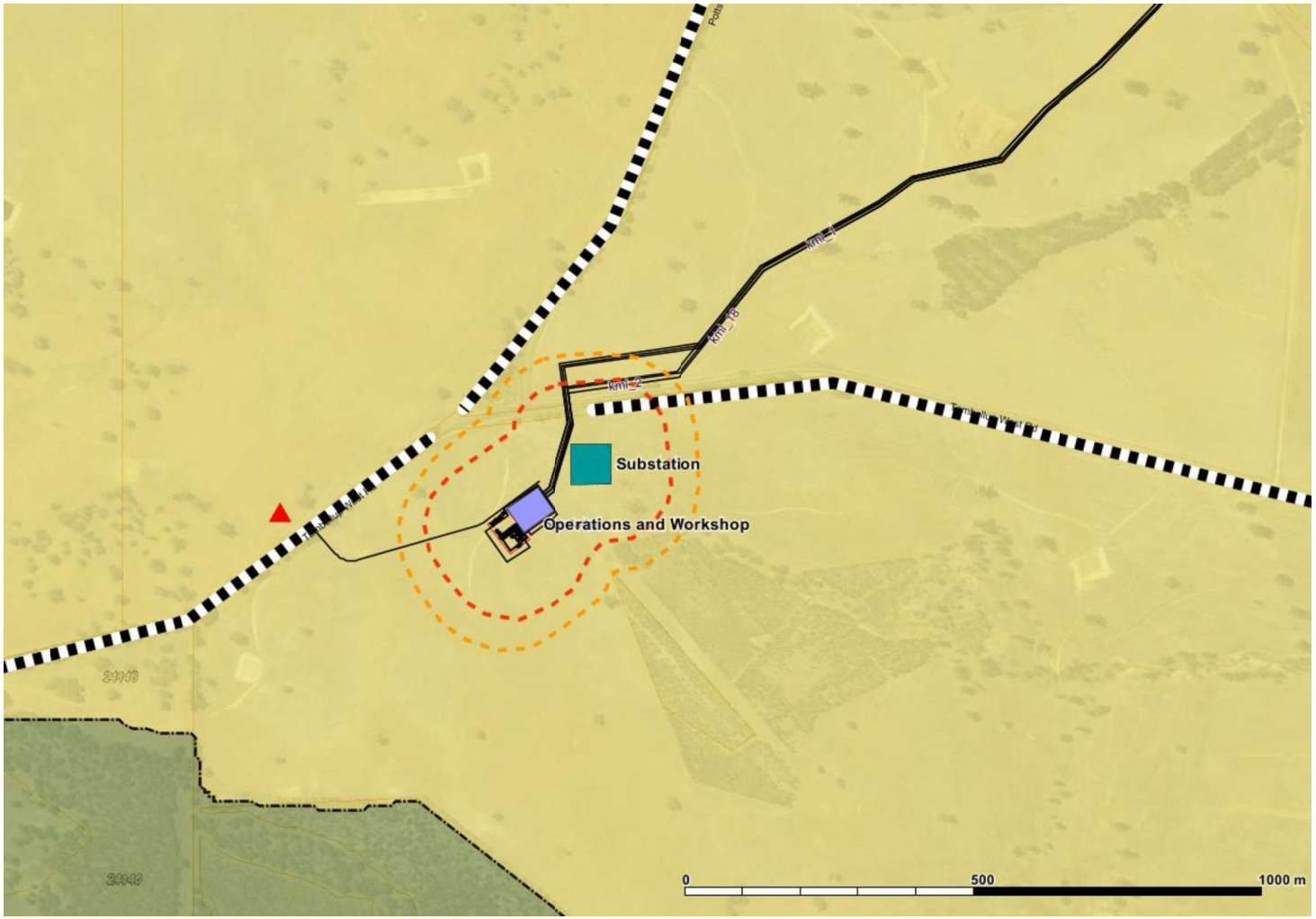
Turbine Base APZ
20 m compacted limestone
40 m grass < 100 mm

75 m Exclusion Zone

50 000 L water tank

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Figure 1g Vegetation Classification



Construction boundary

150 m assessment area

100 m assessment area

Class A Forest

Class B Woodland

Class G Grassland

Public road

Access road

Access gate

75 m Exclusion Zone

50 000 L water tank

Substation	50 m grass < 100 mm
Operations building	21 m grass < 100 mm

Assessment Date: 13/06/2022
Prepared: Anthony Rowe
Accreditation Level: BPAD L3
Accreditation Number: 36690
Accreditation Expiry: Dec 2022
FPAA FIRE MAP 2022
GADA 1994 MGA Zone 50

Photograph verification of vegetation at the construction compound and turbine sites

	
C1 Construction compound	C2 Construction compound
	
C3 Construction compound	C4 Construction compound
	
Photo 1: T1	Photo 2: T2
	

Photo 3: T2	Photo 4: T3
	
Photo 5: T 3	Photo 6: T4
	
Photo 7: T4	Photo 8: T5
	
Photo 9: T5	Photo 10: T6
	
Photo 11: T6	Photo 12: T8

	
Photo 13: T9	Photo 14: T10
	
Photo 15: T11	Photo 16: T11
	
Photo 17: T55	Photo 18: T55
	
Photo 19: T13	Photo 20: T14

Photo 21: T15

Photo 22: T15

Photo 23: T16

Photo 24: T17

Photo 25: T17

Photo 26: T18

Photo 27: T18

APPENDIX 3 – SCENARIO RESPONSE PLAN

Turbine	Predominant Vegetation								
	North	East	South	West	North	East	South	West	Houses
T1									
<150 m	G	G	G	G	G	G	G	G	
151 m - 2.5 km	G,F	G	G	G	Grahams Well Road 1 km	Warrenup Road 780 m	Work Camp Road 900 m		1.7 N, 1.3 NE
2.5 km - 5 km	G	G	G	G	T15 access and T 13 access	O'Neil Road 3.2 km	Yarranup Road 2.1 km	Bilney Road 3.2 km	
T2									
<150 m	G	G	G	G	Grahams Well Road 2.1 km	Warrenup Road 540 m			1.6 NE, 2.3 N, 2.4 SE
151 m - 2.5 km	G	G	G	G		O'Neil Road 2.4 km	Work Camp Road 480 m Yarranup Road 1.5 km	Bilney Road 3.3 km	
2.5 km - 5 km	G	G	G	G					
T3									
<150 m	G	G	G	G					
151 m - 2.5 km	GW	G	G	G	Grahams Well Road 2.1 km	Warrenup Road	Yarranup Road		1.7. E
2.5 km - 5 km	G	G	G	G				Potts Road 3.6 km	2.7 N, 2.8 N, 3.7 SE,,
T4									
<150 m	G	G	G	G					
151 m - 2.5 km	G	G	G	G	Grahams Well Road 2.1 km	Warrenup Road	Yarranup Road		1.9 N. 1.8 SW
2.5 km - 5 km	G	G	G	G		O'Neil Road 1.4 km	Tambellup Road 6.4 km	Potts Road 5.4 km	2.8 N 4.3 NE. 3.4 W

Turbine	Predominant Vegetation								
	North	East	South	West	North	East	South	West	Houses
T5									
<150 m	G	G	G	G					
151 m - 2.5 km	G w	G	GF	G		Warrenup Road 2.4 km	Yarranup Road 1.2 km	Potts Road 3.4 km	
2.5 km - 5 km	G	G	G	G	Grahams Well Road 2.7 km	O'Neil Road 3.2 km			
T6									
<150 m	G	G	G	G		Warrenup Road	Yarranup Road		
151 m - 2.5 km	G	G	G, F(SE)	G		O'Neil Road 600 m			1.3 NE, 2.3 NE
2.5 km - 5 km	G	G	G	G	Grahams Well Road 3.1 km	Birt Road 5.1 km		Potts Road 5.5 km	3.9 W, 4.7 E, 4.3 NE, 3.5 N 3.1 S 3.3 S, 4.7 SW
T7									
<150 m	G	G	G	G					
151 m - 2.5 km	G	G	G	G			Yarranup Road 700 m		1.4 NW
2.5 km - 5 km	G	G	G	G	Grahams Well Road 3.1 km	Warrenup Road 2.6 km	Tambellup Road 4.9 km	Potts Road 3.2 km	3.8E, 3.7 NE, 3.8 NE, 4.8 W, 3.1 SW, 3.2 SW, 3.5 SW, 4.1 SE, 4.3 SE.
T8									
<150 m	G	G, F(NE)	G	G		Warrenup Road 113 m			
151 m - 2.5 km	G	G	G	G	Yarranup Road 200 m				1.1E, ,2.4 S
2.5 km - 5 km	G	G	G	G	Ngopitchup Road 4.1 Grahams Well Road 3.6 km	Birt Road 5.1 km	Tambellup West Road 5.7 km	Potts Road 4.8 km	2.8 N, 3.8 N 4.6 E, 5.4 E , 2.7S 4.6 SW, , 5.01SW, 5.2 SW, 4.1W

Turbine	Predominant Vegetation								
	North	East	South	West	North	East	South	West	Houses
T9									
<150 m	G	G	G	G		Warrenup Road 140 m			
151 m - 2.5 km	G	G, F(NE)	G	G	Yarranup Road 800 m				1.1NE, 1.8S, 2.2 S
2.5 km - 5 km	G	G	F,G	G	Ngopitchup Road 4.6 km Grahams Well Road 4.1 km	Birt Road 5.9 km	Tambellup West Road 5.1 km	Potts Road 5.0 km	3.3N, 3.8 N 4.7 NE , 4.3E 4.7SW,5.1SW, ,5.1SW, 4.8NW
T10									
<150 m	G	G	G	G		Warrenup Road 100m			
151 m - 2.5 km	G	G	F(SE)	G	Yarranup Road 1.2 km				1.3NE, 1.4S, 21.7 S
2.5 km - 5 km	G	G	G	G	Ngopitchup Road 4.6 km Grahams Well Road 4.1 km	Birt Road 6.4km	Tambellup West Road 4.6 km	Potts Road 5.0 km	3.9N, 5.2NE, 4.9E , 4.4SW, 4.8SW, 4.9SW, 4.7NW
T11									
<150 m	G	G	F	G		Warrenup Road 140m			
<2.5 km	G	G	G	G	Yarranup Road 1.5 km				1.7NE, 1.1S, 1.3S
<5.0 km	G	G	G	G	Ngopitchup Road 5.5 km	Birt Road 6.6 km	Tambellup West Road 4.1 km	Potts Road 4.9 km	4.3N, 5.5NE, 4.4E , 4.9E, 4.4W, 4.7W, 4.8W 4.9NW
T12									
<150 m	G	G	G	F					
151 m - 2.5 km	G	G	G	G			Yarranup Road 800m		1.1nw
2.5 km - 5 km	G	G	G	G	Grahams Well Road 5.0 km	Warrenup Road 3.5 km	Tambellup West Road 4.5 km	Potts Road 4.9 km	4.3NE, 4.4E, 4.3SE, 4.7SE, 2.6S,2.6S,3.0S, 4.1SW

Turbine	Predominant Vegetation								
	North	East	South	West	North	East	South	West	Houses
T13									
<150 m	G	G	G	G	Grahams Well Road 120 m		Grahams Well Road 120 m		
151 m - 2.5 km	G	G	G	G		Warrenup Road 2.5 km			2.5SE,1.3SW, 1.6NW, 1.8NW
2.5 km - 5 km	G	G	G	G	Broomehill-Kojonup Road 5.1 km	Palomar Road 5.1 km	Yarranup Road 6.4 km	Potts Road 4.9 km	3.4NE, 5.0SE. 3.9S, 2.9S, 3.5W,3.7W, 4.6NW
T14									
<150 m	G	G	G	G				Grahams Well Road 120 m	
151 m - 2.5 km	G	G	G,F(SW)	G		Warrenup Road 1.5 km			1.9E. 1.4S, 1.8W
2.5 km - 5 km	G	GG	G	G	Broomehill-Kojonup Road 6.0 km	Palomar Road 4.7 km	Yarranup Road 5.6 km	Potts Road 5.4 km	3.7NE, 4.4E, 5.0SE, 3.0S, 3.7W, 4.0W
T15									
<150 m	G	G	G	G					
151 m - 2.5 km	G	G	F(SE)	G		Warrenup Road 1.2 km		Grahams Well Road 180 m	1.7E. 148S, 1.5W
2.5 km - 5 km	G	G	G	G	Broomehill-Kojonup Road 6.0 km	Palomar Road 4.4 km	Yarranup Road 5.2 km	Potts Road 5.4 km	4.0NE, 4.0E, 4.6SE, 2.6S, 4.0W, 4.4W
T16									
<150 m	G	F	G	G					
151 m - 2.5 km	G	G	G	G	Yarranup Road 1.2 km				1.6E, 1.9E
2.5 km - 5 km	G	G	G	G	Ngopitchup Road 4.6 km Grahams Well Road 4.1 km	Birt Road 6.4 km	Tambellup West Road 4.6 km	Potts Road 5.0 km	5.2N, 3.2NE, 4.4E , 4.9E, 2.5W, 3.0W, 3.1W 4.1NW

Turbine	Predominant Vegetation								
	North	East	South	West	North	East	South	West	Houses
T17									
<150 m									
151 m - 2.5 km		F				Warrenup Road 1.1 km		Grahams Well Road 160 m	1.8NE. 1.0S, 12.0W
2.5 km - 5 km					Broomehill-Kojonup Road 6.0 km	Palomar Road 4.4 km	Yarranup Road 4.7 km	Potts Road 5.5 km	4.5NE, 4.1E, 5.1SE, 4.8S, 4.0W, 4.4W
T18									
<150 m	G	G	G	W					
151 m - 2.5 km	G	G	G	G		O'Neil Road/ Palomar Road 1.8 km	Ngopitchup Road 0.3 km	Warrenup Road 0.6 km Grahams Well Road 1.8 km	1.0N, 2.4E, 1.6S, 2.0e
2.5 km - 5 km	G	G	G	G	Broomehill-Kojonup Road 6.4 km		Yarranup Road 4.7 km	Potts Road 7.3 km	4.3N, 4.8E, 4.2E,4.4S, 3.9W,4.7NW, 4.4NW.
Construction									
<150 m	G	G	G	G					
151 m - 2.5 km	G,	G	G	G		Warrenup Road 0.5 km	Yarranup Road 1.2 km	O'Neil Road 1.2 km	2.1N, 2.2E
2.5 km - 5 km	G,F(N)	G	G, F(SW)	G	Grahams Well Road 2.8 km Broomehill-Kojonup Road 611 m	Birt Road 5.9 km	Tambellup West Road 6.0 km	Potts Road 5.0 km	2.8N,4.7N, 4.6NE, 5.6E, 3.6S, 3.9S, 4.6SW, 4.8SW,5.1SW
Substation									
<150 m	G	G	G	G	Tambellup West Road 150 m			Potts Road 150 m	
151 m - 2.5 km	G	G	G	G				Albany Highway 2.4 km	1.8N,2.2,N,2.3N
2.5 km - 5 km	G	G	G	G	Yarranup Road 3.1 km	Warrenup Road 5.3 km	Albany Highway 4.1 km		4.5SE, 4.6SE,3.8SW, 3.1W,3.9NW

APPENDIX 4 – NACELLE SUPPRESSION SYSTEMS

Technical description and data for fire suppression system

Document no.: 0079-9639 V00
Class: RESTRICTED
Type: T09
Date: 2018-12-04

Wind. It means the world to us.™

Wind turbine type

Read the full document before you start to do work.

Send questions or concerns about the document to Vestas Wind Systems A/S.

Wind turbine type	Mk version
V117-4.0/4.2 MW	Mk 3E
V136-4.0/4.2 MW	Mk 3E
V150-4.0/4.2 MW	Mk 3E

Change description

Description of changes
First edition.

Table of Contents

1 Abbreviations and technical terms

0020484495

Table 1.1: Abbreviations

Abbreviation	Explanation
AMT	Access and maintenance tools
APS	Auxiliary power supply system
CCI	Control and communication infrastructure system
FSS	Fire suppression system

Table 1.2: Explanation of terms

Term	Explanation
None	

2 Reference documents

0020484494

Table 2.1: Reference documents

Document no.	Title
0053-1210	Electrical diagram 4 MW Mk 3E
0063-3807	Novec 1230 safety datasheet

3 Purpose

0011516197

The purpose of the document is to give a detailed technical description of the FSS.

The objective of the Vestas FFS for the wind turbine is to provide suppression of fires in the components specified in section 7 *Technical and functional description*, page 6.

The system is intended to provide an additional layer of fire protection, together with the supplied arc detector technology, the lightning protection system, and the optional smoke/heat detection sensor package.

4 Weights and (overall) dimensions

0011516194

Table 4.1: Weights

Item no.	Description	Weight [kg]
29079139 29079260	Cylinder unit, CONV/CONTR/TRAFO	85.0
29079334 29079335	Cylinder unit, CONV/CONTR	36.0
29063707	PIPE FSS C3 ASM CONTR	2.55

Item no.	Description	Weight [kg]
29077542	FSS PIPE C3 ASM CONV	5.60
29077543	PIPE FSS C3 ASM TRAFO	9.09

5 Technical description and data

0011516199

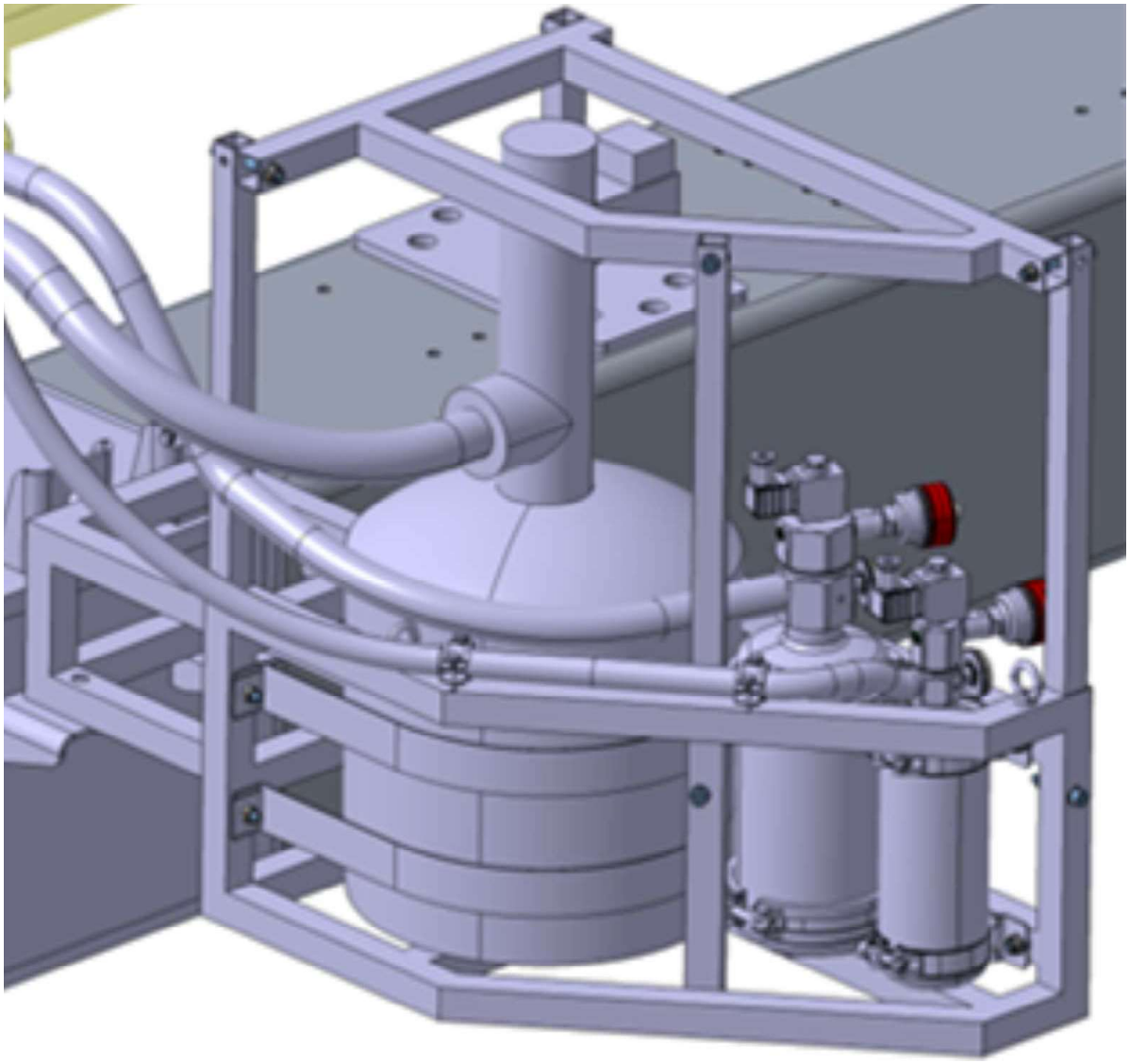


Figure 5.1: Illustration of cylinder unit

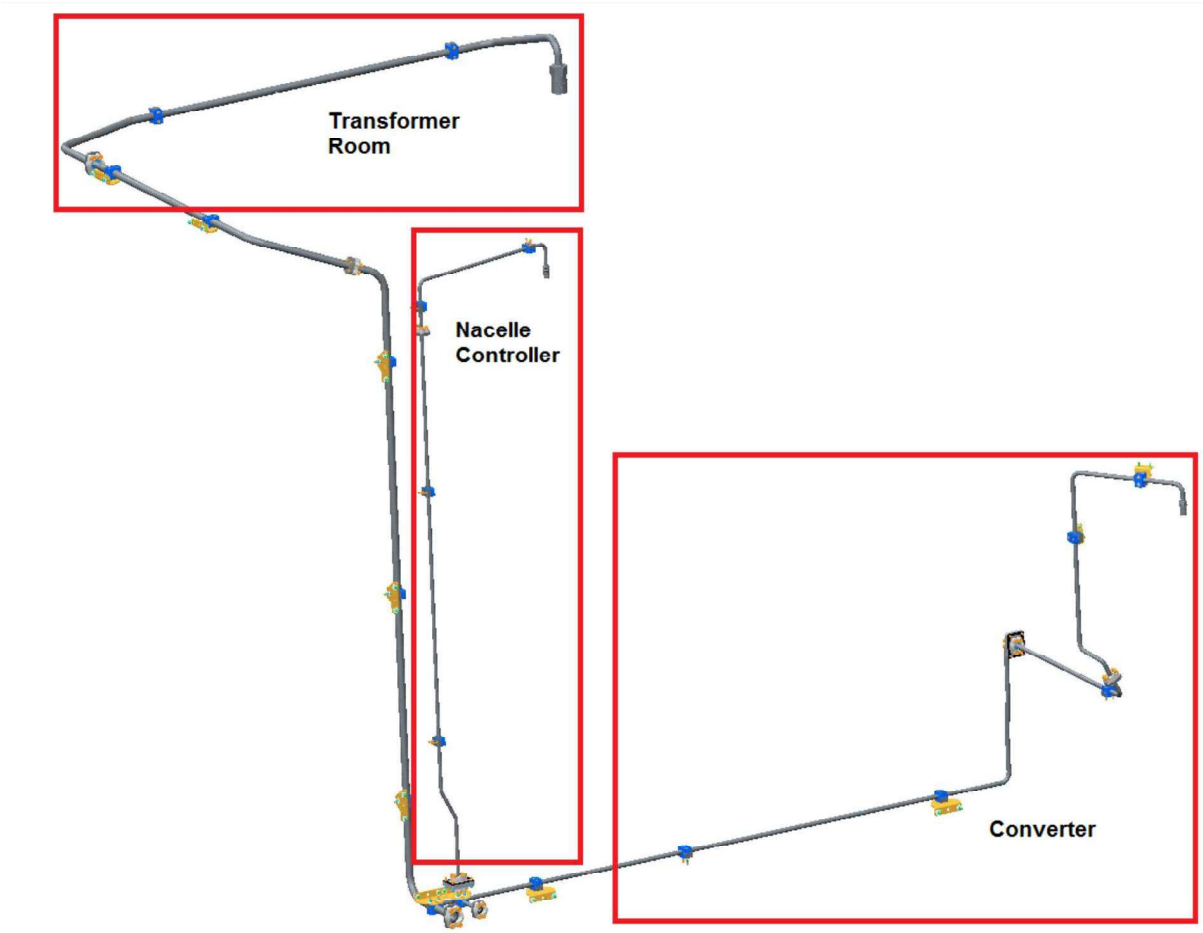


Figure 5.2: Illustration of pipe system

6 Location of the equipment

0011516196

The location of the equipment is in the nacelle.

7 Technical and functional description

0011516195

This FSS is a so-called electrically activated, fixed fire-fighting system.

When the FSS is activated by the smoke detection system, the cylinder valve in question is automatically opened by the valve actuator. This allows the agent inside the cylinder to flow through the pipe system and distribute the suppression agent into the fire hazard zones.

Upon actuation, the pressure switch, which is employed on all cylinders, must give a feedback signal to the wind turbine CCI to set an FSS alarm.

The fire hazard zones are as follows:

- Nacelle controller cabinet
- Converter cabinet
- Transformer room

The fire protection strategy is to individually detect and extinguish potential fires in the targeted compartments given above before the fire spreads to other components.

The system consists of the main components that follow:

1. Cylinder unit
2. Suppression agent
3. Pipe system with nozzles

A fire suppression event in all the fire hazard zones is triggered by the related smoke sensors.

8 Key electrical data

0020493502

Table 8.1: Key electrical data

Item	Data
See 'Electrical diagram' section -700-06-05	0053-1210

9 Interfaces

0011516210

The FSS has mechanical interfaces to the following modules and systems:

- Rear frame structure
- Trafo wall
- Nacelle controller
- Converter
- Trafo room

The electrical interfaces of the FSS are as follows:

- CCI
- APS
- Smoke detection system

The FSS also has interface to the wind turbine software and AMT.

10 Environmental and design data

0011516209

The 3M Novec 1230 fire protection fluid, according to ISO 14520-5:2006, was developed as a sustainable clean extinguishing agent for use in total flooding applications. This agent is a replacement for Halon and first-generation Halon replacement alternatives. Novec 1230 extinguishes principally by removal of heat from the fire. The agent/air mixture has a heat capacity much higher than that of air alone. A higher heat capacity means that this gas mixture will absorb more energy (heat) for each degree of temperature change it experiences than the same mass of air. This energy absorption causes the combustion zone to cool to the point that the fire is extinguished. Fires can be extinguished if any of the required components are removed: heat, oxygen, fuel source, or the chain reaction. Novec 1230 has the highest heat capacity of any commercially available Halon alternative, resulting in the lowest extinguishing concentrations for a given fuel.

Novec 1230 was also selected as a suppression agent for its environment-friendly characteristics. Novec 1230 has zero impact on ozone depletion and the same impact on global warming as that of carbon dioxide. Novec 1230 also leaves no residue for clean-up in the event of a false suppression event. Novec 1230 is electrically non-conductive and can be exposed to live circuits without side effects. The cost of a false suppression is limited to wind turbine downtime, service cost of the alarm, and the cost of replacement of the specific system (heat

reactive tubing and suppressant agent storage container), as there are no clean-up costs or damaged components to the suppression system that needs to be replaced.

Novec 1230 is safe for human presence in the event of an unintended suppression event without open flames.

In case of a fire event with open flames, special precautions shall be taken before you enter the fire hazard zone in question.

For further details in case of a fire event, see 0063–3807 ‘Novec 1230 safety datasheet’, section 5.

APPENDIX 5 – REFERENCES

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