Prepared for
SE Waroona Developments Pty Ltd
ABN: 64 139 522 553

AECOM

Environmental Management Plan

Waroona Solar Farm

07-Aug-2024

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Delivering a better world

Environmental Management Plan

Waroona Solar Farm

Client: SE Waroona Developments Pty Ltd

ABN: 64 139 522 553

Prepared by

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0	07-Aug-2024	Final	[redacted] Technical Director - Impact Assessment and Permitting	

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Abbreviations

Abbreviations	Term
AECOM	AECOM Australia Pty Ltd
AS	Australian Standard
ASS	Acid Sulphate Soil
ASSDMP	Acid Sulphate Soil and Dewatering Management Plan
BC Act	*Biodiversity Conservation Act 2016* (WA)
BESS	Battery Energy Storage System
CCW	Conservation Category Wetland
CPS	Clearing Permit System
DAWE	Department of Agriculture, Water and the Environment [now DCCEEW]
DC	Direct Current
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DFES	Department of Fire and Emergency Services
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EMP	Environmental Management Plan (detailed)
FES Act	*Fire and Emergency Services Act 1998*
GDA	Geocentric Datum of Australia
GPS	Global Positioning System
HV	High Voltage
Ha	Hectare
ISO	International Organisation for Standardisation
km	Kilometre
mAHD	Meter Australian Height Datum
MUW	Multiple Use Wetland
MW	Megawatt
NVCP	Native Vegetation Clearing Permit
NZS	New Zealand Standard
PCU	Power Conversion Unit
PEMP	Preliminary Environmental Management Plan
PRS	Peel Region Scheme
PV	Photovoltaic

Abbreviations	Term
REW	Resource Enhancement Wetland
RiWI Act	*Rights in Water Irrigation Act 1914*
SE	South Energy
SPP	State Planning Policy
The Applicant	SE Waroona Development Pty Ltd / South Energy
The Project	Waroona Solar Farm Project
The Scheme	Rural 1 – General Farming' under the Shire of Waroona Local Planning Scheme No. 7
WA	Western Australia
WAPC	Western Australian Planning Commission

1.0 Introduction

1.1 Project Overview

South Energy (SE) Waroona Development Pty Ltd (the Applicant) is proposing to develop and operate a Renewable Energy facility, comprising 120 MW direct current (DC) solar facility and decentralised Battery Energy Storage Systems (BESS) with the total capacity of 80 MW (the Project) in Waroona, WA. AECOM Australia Pty Ltd (AECOM) has prepared this Environmental Management Plan (EMP) for SE on behalf of the Applicant.

A Preliminary EMP was prepared by AECOM (2019a) setting out the initial environmental management framework and overarching environmental management processes to be implemented during the detailed design, construction, operation and decommissioning of the Project. Since the Preliminary EMP was drafted, the native vegetation clearing permit (NVCP) approval and the development approval (DA) have been obtained. During these approvals processes, regulators have requested additional matters be addressed in this updated EMP.

1.1.1 Project description

The Project is located approximately 105 km south of Perth and 10 km southwest of Waroona, in the Shire of Waroona. The site comprises 308 ha on two parcels of freehold tenure, Lot 25 on Plan 59266 (Land ID 3800597) and 981 Buller Road, Lot 24 on Plan 59266 (Land ID 11769799).

The Project concept design is provided in Figure 1 and may be subject to modification as a result of outcomes of the approval and detailed design process. The Project will comprise the following principal infrastructure:

- Solar arrays, comprising single axis tracking systems using monocrystalline solar photovoltaic (PV) panels and associated infrastructure
- Centralised inverter and transformer blocks
- BESS cabinets and associated infrastructure
- High Voltage (HV) substation and operations & maintenance facility area.
- Fencing
- Electrical transmission structures
- Power Conversion Unit (PCU)
- Site access tracks and associated drainage
- Landscaping

1.2 Purpose of this EMP

This EMP outlines how environmental impacts will be managed throughout construction, operation and decommissioning of the Project. The EMP addresses the potential environmental impacts identified in previous investigations.

Aligned with the principles of the *Australia / New Zealand – International Organisation for Standardisation – Standard 14001 (Environmental Management System)* (AS/NZS ISO 14001), this EMP aims to facilitate a regular review and 'continual improvement' in overall environmental performance over the life of the Project.

1.2.1 Planning Approval Conditions

The Preliminary EMP (AECOM, 2019a) was prepared to support the Project's Development Application (DA), granted on 19 November 2019. The Applicant intends to apply for amendment of the existing DA to include a change in design of the Project to include a BESS to the 120 MW (DC) solar facility to meet expected peak demand.

Condition 6 of the existing DA states:

"Prior to commencement of works the applicant shall submit and have approved by the local government, and thereafter implement to the satisfaction of the local government, an 'Environmental Management Plan' addressing the following matters:

- *remnant vegetation,*
- *foreshore management demonstrating the mitigation of risks to the* [Conservation Category Wetland] *CCW*
- *contamination*
- *stormwater and drainage*
- *fire management,*
- *stock management, and*
- *rehabilitation plan."*

This EMP has been prepared to satisfy condition 6 of the DA (as well as to address requirements of the NVCP).

1.2.2 Environmental Approval Conditions

The Project was referred to the Commonwealth Department of Agriculture Water and Environment (DAWE) (now Department of Climate Change, Energy, the Environment and Water (DCCEEW)) in 2020 to determine if an assessment and approval is required under the EPBC Act. The Project was determined to be "not a controlled action", and no conditions to the decision were set.

An NVCP under *the Environmental Protection Act 1986* (EP Act) was granted for the Project (CPS 8758/1) in September 2020. The NVCP Decision Report includes the management and reporting conditions listed in Table 1.

Table 1 CPS 8758/1 Management and Reporting Conditions

No.	Condition
5	Avoid, minimise and reduce the impacts and extent of clearing. In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference: a) avoid the clearing of native vegetation; b) minimise the amount of native vegetation to be cleared; and c) reduce the impact of clearing on any environmental value
6	Dieback and weed control When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of weeds and dieback: a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared; b) ensure that no dieback or weed-affected soil, mulch, fill or other material is brought into the area to be cleared; and c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.
7	Wind Erosion Management The Permit Holder must commence activities related to the purpose of the clearing no later than three (3) months after undertaking the authorised clearing, to reduce the potential for wind erosion.

No.	Condition
8	Record keeping The Permit Holder must maintain the following records in relation to the clearing of native vegetation authorised under this Permit: a) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees; b) the date(s) that the area was cleared; c) the size of the area cleared (in hectares); d) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with Condition 5 of this Permit; e) actions taken to minimise the risk of the introduction and spread of weeds and dieback in accordance with Condition 6 of this Permit; and f) activities undertaken in accordance with condition 7 of this permit;
9	Reporting The Permit Holder must maintain the following records in relation to the clearing of native vegetation authorised under this Permit: a) The Permit Holder must provide to the CEO, on or before 31 December of each calendar year, a report containing: i. the records required to be kept under condition 8; and ii. records of activities done by the Permit Holder under this Permit between 1 July of the preceding calendar year and 30 June of the current calendar year. b) If no clearing authorised under this permit has been undertaken, a written report confirming that no clearing under this Permit has been undertaken, must be provided to the CEO on or before 31 December of each calendar year. c) The Permit Holder must provide to the CEO, by 23 July 2025, a written report of records required under condition 8, where these records have not already been provided under condition 9(a).

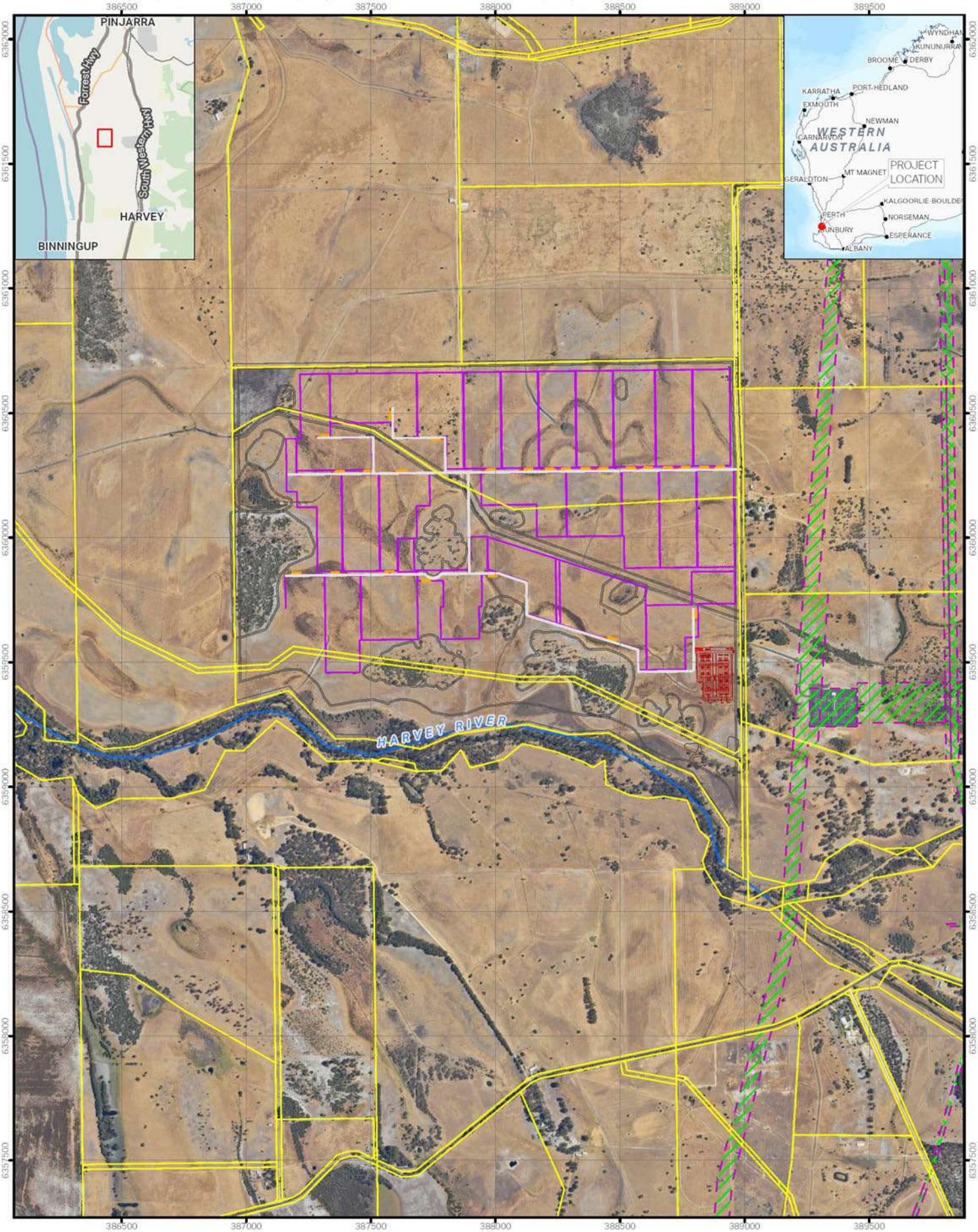
This EMP has been prepared to satisfy the requirements of the NVCP conditions (as well as the conditions of the DA).

1.2.3 Structure of EMP

The EMP structure is detailed in Table 2.

Table 2 Structure of the EMP

EMP Section	Description
Section 1.0 Introduction	Overview of the Project. The purpose of the EMP to manage environmental and planning conditions is outlined.
Section 2.0 Project Setting	Existing information of environmental values relevant to the Project.
Section 3.0 Legislation and Objectives	Environmental legislation and guidelines relevant to the Project.
Section 4.0 Environment Management Framework *Addressing Conditions 8 and 9 of the NVCP*	Environmental management framework, including: • Organisational structure, roles, and responsibilities for environmental management. • Procedures for staff environmental awareness training and communication. • Processes for stakeholder consultation and communication. • Procedures for environmental monitoring, auditing, record keeping and reporting. • Procedures for investigating and responding to complaints and incidents and implementing corrective actions. • Measures for emergency preparedness and response.
Section 5.0 Environmental Management *Addressing Condition 6 of the DA* *Addressing Conditions 5, 6 and 7 of the NVCP*	• Key management strategies to avoid and minimise the environmental and amenity impacts of the construction, operation and decommissioning of the facility including matters identified under approval conditions, including specifically those related to: - Fire Management - Community and Cultural Heritage - Air and Noise Pollution - Contamination - Stormwater and drainage - Foreshore management - Remnant vegetation - Fauna - Physical environment including erosion - Waste - Stock • Processes for periodic review of environmental performance and continual improvement.



PROJECT ID	60729404	CREATED BY	ROB.MCGREGOR
DATE MODIFIED	22 MAY 2024	APPROVED BY	K.THOMSON

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GDA2020 MGA ZONE 50

LEGEND

- Cadastre
- Easement
- Other Interests

WSF GA (Rev B)

- G-SITE
- 33kV Conductors
- Switchyard 330kV
- Clusters
- DC Battery
- Inverters
- Roads

Project Location and Layout

SE WAROONA DEVELOPMENT PTY LTD

WAROONA SOLAR BATTERY PROJECT

Figure 1

A4 size

Project: \\AUPER1pfil001.na.aecomnet.com\locals\Perth\Legacy\Projects\607x\60729404_Waroona_Solar_Project\900_CAD_GIS\920_GIS\02_MXD_APRX\01_2024_Rpt\01_2024_Rpt.aprx rob.mcgregor
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2.0 Project Setting

The Project is located within the Swan Coastal Plain within the Shire of Waroona, on 308 ha of freehold tenure (Lot 24 & 25 (981) Buller Road). The elevation ranges from 9 mAHD to 16 mAHD. The land is currently zoned as 'Rural 1 – General Farming' under the Shire of Waroona Local Planning Scheme No. 7 (the Scheme). The Project is surrounded by pastoral lands that are currently zoned as General Farming. The immediate surrounds can be described as follows:

- North: Farmland
- South: Harvey River, riparian forest and wetlands
- East: Landwehr Road, farmland and Buller Nature Reserve
- West: Farmland and Harvey River.

The site's main vehicle access point is via Landwehr Road at the south-eastern corner of the site. The site is surrounded by Buller Road approximately 1.25 km north of the site and Bristol road approximately 1 km south of the site. The transport corridor in the region include the South Western Highway to the east and Forrest Highway to the west, both of which connect Perth to Bunbury.

2.1 Site Hydrology

AECOM (2019b) completed a preliminary surface water assessment of the Project area, which included and assessment of groundwater, water management, and hydrology.

2.1.1 Surface water

The main surface water features within the Project area are the Harvey River Main Drain and Domain Main Drain. The Harvey River Main Drain runs along the southern and western boundary of the Project area. The Domain Main Drain runs through the northern section of the Project area and discharges into the Harvey River approximately 2 km northwest of the Project area (AECOM, 2019b). The aerial imagery indicates the site has multiple low-lying basins and/or ponds that collect surface water runoff. Where there is some relief, water drains away from the site, towards the Domain Main Drain and Harvey River Main Drain (AECOM, 2019b).

Almost half the Project area has been mapped as wetlands, comprising 14 Multiple Use Wetlands (MUWs), one Resource Enhancement Wetland (REW) and one Conservation Category Wetland (CCW) (DBCA, 2023). No clearing is proposed within REW (UFI 4347) or CCW (UFI 14,584).

The majority of the remaining mapped MUWs have been cleared and are now used for agriculture. These are likely to correspond with slight depressions in an otherwise flat landscape. In addition, the Project area contains several man-made irrigation channels that remove excess runoff and lower the water table (AECOM, 2019b).

No wetland-specific permits are required to develop MUWs, however, potential impacts to these wetlands have been addressed in Section 5.1.7.

2.1.2 Groundwater

The Project is situated within the Murray groundwater area and Waroona groundwater sub-area (AECOM, 2019b). The Murray groundwater area is proclaimed under Section 26D of *Rights in Water and Irrigation Act 1914* (RiWI Act).

Development is not anticipated to impact quality or recharge of groundwater, however, the water management in this area must comply with, but are not limited to the following objectives of the RiWI Act:

- Sustainable used and development to meet needs of current and future users.
- Promote orderly, equitable and efficient use of water resources.
- Protect ecosystems and the environment in which the water resource is situated.
- Foster consultation with members of local communities in the local administration.
- Assist in the integration of the management of water resources with the management of other natural resources.

2.2 Ecological Values

AECOM assessed 282.5 ha within the 308 ha Project area in 2019. The assessment included a preliminary site assessment, detailed desktop review, reconnaissance flora and vegetation assessment and targeted Black Cockatoo survey (AECOM, 2019c). The survey area excluded large patches of native vegetation and the vegetation along the Harvey River as these are to be retained.

Key ecological values identified during the survey are summarised below.

- A total of 18.98 ha of native vegetation covering six vegetation communities was mapped in a Degraded (6.85 ha) to Completely Degraded (12.13 ha) Condition. Native vegetation largely comprised native trees over weeds or paddock.
- Four broad fauna habitats were mapped, including Paddock, Riparian and Drainage, Stags, and Mixed Trees generally poor quality, isolated and highly modified.
- Three Threatened fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act) have potential to utilise the survey area, these included:
    - Baudin's Cockatoo (*Calyptorhynchus baudinii*) (listed as Endangered under the EPBC Act and BC Act). Foraging evidence for Baudin's Cockatoo was recorded within the survey area.
    - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (Endangered under the EPBC Act and BC Act).
    - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Vulnerable under the EPBC Act and BC Act).
- AECOM (2019c) recorded 201 potential Black Cockatoo breeding trees, of which 22 contained suitable hollows of which 21 were dead old trees without vegetation cover in the surrounding indicating limited likelihood of use by Black Cockatoos.
- Black Cockatoo foraging habitat was mapped for all three Threatened cockatoo species, predominantly comprising isolated patches of Marri trees in paddocks. The foraging habitat mapped included:
    - 1.80 ha of High Quality and 2.59 ha of Low Quality Carnaby's Cockatoo foraging habitat.
    - 0.64 ha of High Quality and 3.75 ha of Low Quality Forest Red-tailed Black Cockatoo foraging habitat.
    - 1.80 ha of High Quality and 2.59 ha of Low Quality Baudin's Cockatoo foraging habitat.

The survey area is considered to have low biodiversity, with remnant patches of significantly altered native vegetation and almost devoid of native understorey species. A large proportion of native trees were dead which may be a reflection of one or more factors including dieback, altered groundwater conditions, altered fire regimes, and salinity.

2.3 Site Heritage

AECOM completed a due diligence assessment of the Project area in April 2019 (AECOM, 2019d). This included a desktop cultural heritage review to identify any registered archaeological and heritage sites and heritage constraints. No known Registered Aboriginal Heritage Sites or European Heritage Sites were assessed to occur within the Project area.

There are no known cultural heritage values anticipated to be impacted by the development of the Project area, however archaeological surveys of the Project area have not been completed. If any artefacts of cultural significance are uncovered during development, further approvals may be required.

2.4 Bushfire Risk

The south-eastern corner of the Project is located within a bushfire prone area (DFES, 2018). This area is designated by the Fire and Emergency Services Commissioner under the *Fire and Emergency Services Act 1998* (FES Act) and may be subject to additional planning requirements.

The Project will involve storage of combustible/flammable materials onsite that may be exposed to ignition from direct contact with flames, embers, and radiant heat. Due to the classification of the Project area as a High-Risk Land Uses, a Bushfire risk assessment has been undertaken by Bushfire Prone Planning (2024) for the Project to identify the bushfire hazards with potential to impact the Project, assess the level of risks, recommend bushfire protection measures and inform planning for design and construction. The inherent risk was assessed to range from Low to High. However, with the implementation of protection measures to reduce bushfire threats, vulnerability and exposure, the residual risk was assessed to range from Low to Moderate as detailed in the Bushfire Risk Report (**Appendix A**).

The Bushfire Management Plan (BMP) (BPP, 2024) will be implemented to reduce the risks associated with bushfire. The BMP was prepared in line with State Planning Policy (SPP) 3.7. The foundation for bushfire planning statutory regulations in WA is the 'State Planning Policy 3.7 Planning in Bushfire Prone Areas' (SPP 3.7). Implementation of this SPP is guided by the 'Guidelines for Planning in Bushfire Prone Areas' and Australian Standard 3959:2018 Construction of Buildings in Bushfire-Prone Areas (AS 3959). The Bushfire Management Plan is provided as **Appendix A**.

3.0 Legislation and Guidelines

This section provides an overview of the relevant Commonwealth and State legislation related to the Project, as well as any necessary approvals, licenses, and the Project's environmental objectives.

3.1 Key Legislation

A wide range of laws, regulations and policies are relevant to Project construction and operation. **Table 3** describes the key Commonwealth and State environmental legislation relevant to the proposed development. It also considers key regulatory and industry guidance relevant to the Project.

Table 3 Regulatory framework relevant to Waroona Solar Farm

Topic	Legislation, policy and guidelines
Air Quality	Commonwealth Legislation National Environment Protection (Ambient Air Quality) Measure (1998) National Environment Protection (Air Toxics) Measure (2004) State Legislation EP Act
Contamination and Hazardous Materials / Waste	Commonwealth Legislation National Environment Protection (Assessment of Site Contamination) Measure 1999. State Legislation EP Act *Contaminated Sites Act 2003* *Dangerous Goods Safety Act 2004* Landfill Waste Classification and Waste Definitions 1997 amended 2009 Environmental Protection (Controlled Waste) Regulations 2004 Australian Standard 1940 (AS1940) Storage and Handling of Flammable and Combustible Liquids (2017) Guidelines and Best Practice Assessment and management of contaminated sites guidelines (2021) Identification, reporting and classification of contaminated sites in Western Australia Contaminated Sites Guidelines (2017)
Cultural Heritage	Commonwealth Legislation *Aboriginal and Torres Strait Island Heritage Protection Act 1984* State Legislation *Heritage Act 2018* *Aboriginal Heritage Act 1972* Aboriginal Heritage Regulations 1974 EP Act
Environmental Impact Assessment	Commonwealth Legislation EPBC Act *Environment Protection and Biodiversity Conservation Regulations 2000* State Legislation EP Act
Fire Prevention and Protection	State Legislation *Bushfires Act 1954* *Dangerous Goods Act 1985* FES Act *Occupational Safety and Health Act 1984* Bushfires Regulations 1954 (WA) Guidelines and Best Practice State Planning Policy 3.7- Planning in Bushfire Prone Areas (2015) DPLH Guidelines for Planning in Bushfire Prone Areas (2021) AS 3959-2009 Construction of buildings in bushfire-prone areas.

Topic	Legislation, policy and guidelines
Flora and Fauna	Commonwealth Legislation EPBC Act *Environment Protection and Biodiversity Conservation Regulations 2000* State Legislation BC Act Biodiversity Conservation Regulations 2018
Invasive Species and Pests	State Legislation *Biosecurity and Agriculture Management Act 2007*
Noise	State Legislation EP Act Guidelines and Best Practice Environmental Protection (Noise) Regulations 1997
Land Use and Planning	State Legislation Peel Region Planning Scheme (2003) Shire of Waroona District Planning Scheme No.7 *Planning and Development Act 2005*
Traffic	State Legislation *Road Traffic Act 1974* (WA)
Water Quality	State Legislation RiWI Act EP Act Guidelines and Best Practice Assessment and management of contaminated sites Contaminated sites guidelines (2014) Identification, reporting and classification of contaminated sites in Western Australia Contaminated Sites Guidelines (2017)

3.2 Environmental and Planning Approvals

3.2.1 Environment

The Project was referred to the Commonwealth Department of Agriculture Water and Environment (DAWE) (now Department of Climate Change, Energy, the Environment and Water (DCCEEW)) in 2020 to determine if an assessment and approval is required under the EPBC Act. The Project was determined to be "not a controlled action", and where impacts to matters of national environmental significance remain at or below the referred level of impact, no further Commonwealth approvals are required.

The WA approval process is administered by Part IV and Part V of the EP Act. Part IV applies to projects with potential significant environmental impact, involving protected flora, fauna, and habitats. Referral under Part IV (Section 38) to the EP Act is not required for this Project.

A NVCP was granted under Part V (Section 51) of the EP Act by the Department of Water and Environment (DWER) for clearing 8.8 ha of native vegetation. The conditions the NVCP (CPS 8758/1) are listed in Section 1.2.1 of this EMP.

Impacts on watercourses registered as proclaimed areas by DWER are permitted under the RiWI Act. Surface water permits, Section 11/17/21A and 5C licence to take water, are necessary for interfering with or to take water from a proclaimed resource. The Project is not expected to impact any proclaimed surface water resource. It is possible that a Bed and Banks Permit under the RiWI Act will be required for the Project to facilitate creek crossings for construction. Should this be the case, permits will be sought prior to construction.

3.2.2 Planning

The Peel Region Scheme (PRS) is a statutory region scheme administered by the Western Australian Planning Commission (WAPC). The PRS defines broad land zones and reservations for the City of Mandurah and the shires of Murray and Waroona. The PRS prevails over the local planning scheme, should any inconsistencies with the two schemes be identified.

The *'Shire of Waroona Planning Scheme No. 7'* is the regional development framework which the site falls within, currently zoned as Rural – General Farming. A DA under the Scheme is required. The Scheme provides the framework for relevant decisions and controls for the use and development of land for the Project. The DA was approved on 19 November 2019. An amendment of the DA is intended to be applied to incorporate design changes.

4.0 Environmental Management Framework

This section outlines the overarching environmental management framework, to be implemented through this EMP which identifies the key environmental objectives and management strategies required to manage the Project. These management strategies include compliance with applicable regulatory requirements, environmental protection policies, other relevant guidelines and codes of practice and, where appropriate, include performance indicators to be utilised for monitoring environmental compliance.

4.1 Roles and Responsibilities

The Applicant has overall responsibility for the environmental management of the Project, unless the Project ownership is transferred to another entity, in which case responsibility for environmental management will also be transferred to the new owner.

All contractors engaged on the Project will be contractually obligated to comply with this EMP which includes the Project's planning and environmental approval conditions. All personnel employed for the Project will be required to undertake work in accordance with this EMP and comply with all applicable environmental laws.

Table 4 provides an outline of the environmental responsibilities for key organisational roles. It is to be noted that role titles may be subject to amendment, depending on future Project developments.

Table 4 Key Roles and Responsibilities

Key Role	Responsibilities
Project Manager	• Have overall responsibility for the Project's environmental performance. • Communicate clear expectations in relation to environmental management and performance standards to the Project team. • Ensure resources are provided to implement the EMP.
Environment Manager	• Assist with the development and periodic review of the detailed EMP(s). • Direct on the ground implementation of the EMP. • Arrange required environmental awareness training of Project personnel. • Ensure monitoring and reporting of environmental performance.
Project Construction Manager	• Supervise day-to-day construction management and environmental performance. • Ensure implementation of EMP requirements.
Project Operation Manager	• Supervise day-to-day operation management and environmental performance. • Ensure implementation of EMP requirements.
Project Decommissioning Manager	• Supervise day-to-day decommissioning management and environmental performance. • Ensure implementation of EMP requirements.
Other personnel including contractors	• Ensure compliance with site environmental induction requirements. • Ensure compliance with the EMP when undertaking Project works. • Report all environmental incidents immediately to the appropriate supervisor or manager.

4.2 Environmental Awareness and Training

All personnel including staff, employees, contractors and subcontractors involved in any of the Project's activities will be required to complete the following training requirements to ensure compliance with outlined environmental performance requirements as part of the induction process:

- Site environmental management training prior to commencing work.
- Job-specific Project and / or site training relevant to their role, if and where required.

Regular toolbox meetings will be held to highlight relevant environmental and safety issues, as needed.

4.3 Communication and Consultation

The Applicant will establish clear internal and external communication procedures to address environmental management and performance requirements of the Project, as well as to maintain effective community engagement.

Examples of specific external stakeholder communication and consultation to be undertaken before and during construction include:

- Notification of proposed works to stakeholders within a specified area from the site, in good time.
- Notification of works relating to changes of traffic conditions to all stakeholders in accordance with traffic management requirements as outlined in the Traffic Management Plan.

4.4 Contractor Management

The Applicant will assign a Project role (e.g. Project Manager) to the overall responsibility for the management of all contractors. The Applicant will also assign roles (e.g. Project Construction Manager) with responsibility for on-the-ground contractor management and ensuring contractor compliance with this EMP.

Responsibilities may include, but are not limited to:

- Provide Project, site and environmental management induction and training of all contractors prior to commencement of any works.
- Ensure contractors are aware of all applicable environmental obligations.
- Oversee contractors' respective EMP implementation.
- Track and report contractor environmental performance.

Contractor management approaches and requirements will be reviewed regularly and adjustments may be incorporated in this EMP.

4.5 Monitoring and Auditing

A regular site monitoring schedule will be established to verify that EMP and environmental regulatory requirements are met and controls are in place and functioning effectively. Any issues, concerns and recorded non-conformances identified through monitoring will be addressed through regular revision of established, or implementation of additional, site management measures.

Works and contractor performance will be verified through regular environmental audits, conducted by suitably qualified auditors. Audits will coincide with phases of works that comprise the greatest environmental risk.

4.6 Record Keeping and Reporting

Environmental performance monitoring and audit reporting will be prepared and submitted regularly to an identified Project management member of staff.

All identified environment related non-conformances identified during audits will be documented as incidents in accordance with **Section 4.7** of this EMP and be submitted with the reporting.

All monitoring and auditing documentation will be handled in line with established document control procedures. If and where required, the findings of environmental performance, monitoring and audits will be reported to external stakeholders.

4.7 Complaint and Incident Investigation and Response

All Project-associated environmental complaints will be captured and responded to in a timely and adequate manner. A complaint management approach will be established, comprising of the following key components:

- Complaints Register, which will be maintained for the Project, recording all steps of the complaints handling process.
- Complaint reporting and management procedures to be followed, including:
  - Opening of an incident in the register.
  - Description of the complaint.
  - Coordination of responses, including corrective actions (see **Section 4.8**), to address complaints.
  - Planned follow-up actions, including monitoring of actions, to address the source of the complaint and verify its resolution.
  - Closure of incident, once all actions have been completed.

An environmental incident management approach will also be established, comprising of the following key elements:

- Environment Incident Register, which will be maintained for the duration of the Project and will be updated regularly to ensure actions are completed and that controls are effective.
- Incident reporting and management procedures to be followed, including:
  - Opening of an incident in the register.
  - Description of the incident.
  - An evaluation of the level of impact and corrective action (see **Section 4.8**) taken or proposed.
  - Assigning follow-up actions to be undertaken, where required, to prevent recurrence of the non-conformance.
  - Monitoring of the progress and status of follow-up actions.
  - Closing of incident once all planned follow-up actions have been completed and the incident has been resolved.

Environmental incidents associated with Project works may be identified through a variety of sources, including workplace observations, environmental monitoring and audits, review of environmental monitoring data, and / or stakeholder complaints.

Incident notification and response coordination will be undertaken in line with company procedures. Environmental incidents will be investigated and managed in accordance with the Project's incident management procedures to ensure that appropriate actions are taken. Where safe to do so, identified hazards will be contained immediately. Safety of the public and the Project workforce will be the first priority when interacting with environmental incidents.

To evaluate incidents more efficiently and respond appropriately, an incident classification will be established. Significant incidents may include those that have resulted in serious injury, significant property damage, offsite environmental release or involvement of the environmental regulators (DWER) and will be reported to Project management as soon as practicable. All incidents, associated with Project works, will be captured and responded to in a respective timely and adequate manner.

4.8 Corrective Actions

Corrective action procedures will be developed to address all environmental incidents and non-conformances with this EMP. All corrective actions to be undertaken will be specified within the environmental monitoring reports or audit reports, as applicable. Each corrective action will be assigned to a person responsible, as well as a target date for completion. Each corrective action will be re-visited in the following periodic monitoring event / audit to verify conformance.

4.9 Emergency Preparedness and Response

Emergency response is required when an unplanned incident occurs which has or has the potential to have a detrimental impact on the environment or human health (e.g. chemical spills, bushfire).

A site-specific Emergency Response Plan will be developed prior to construction. All personnel will be inducted into the use of emergency procedures and provided emergency contact numbers via respective inductions. All incidents and details of corrective actions will be recorded as per the procedure outlined in **Section 4.7**.

5.0 Environmental Management

The EMP objectives, actions, targets and compliance which implement the environmental management for the Project are detailed in the following sections. Detailed stand-alone management plans have also been produced:

- Bushfire Management Plan, and Bushfire Risk Report (**Appendix A**)
- Landscape Plan (**Appendix B**)

This EMP and the stand-alone management plans are considered live documents and will regularly be reviewed and improved if and when required.

Environmental management strategies for specific environmental aspects and values are provided in **Table 7** to **Table 17**.

5.1 Environmental Aspects and Objectives

In alignment with AS/NZS ISO 14001 environmental aspects are defined as "*elements of an organization's activities, products, or services that have, or may interact with the environment.*"

Corresponding with these identified aspects are environmental objectives. These objectives outline the environmental goals to be achieved by the Project. These goals align with the Project's performance targets and can be met through specified actions (e.g. management and mitigation measures) or through compliance with regulations, set standards, or codes of practice, within defined timeframes.

Principal Project aspects that may impact the environment, as well as respective objectives are outlined in **Table 5**. These should be subject to review under the following circumstances:

- Prior to the transition to the next phase of the Project lifecycle (e.g. operations or decommissioning).
- If there is a change in Project scope or site conditions, including significant design alterations or new technical information becoming available.
- If subsequent revisions of the EMP(s) indicate the need to re-evaluate one or more of the environmental aspects.

Table 5 Environmental Aspects and Objectives for the Waroona Solar Farm

Aspects	Objectives	Construction Phase	Operations Phase	Decommissioning Phase
Overall				
Project Approach	• Comply with all relevant environmental laws, regulations, policies and guidelines. • Safeguard Project associated human health, local amenity and natural environment. • Avoid or minimise Project impacts through utilisation of best industry practice and standards as best as reasonably practicable.	Y	Y	Y
Bushfire				
Project activities within bushfire prone areas	• Minimise bushfire hazards on site. • Comply with SPP 3.7 requirements. • Implement Bushfire Management Plan (BMP)	Y	Y	Y
Community Amenity				
Community engagement	Establish and maintain positive liaison with community.	Y	Y	Y
Additional traffic generation	Minimise additional Project associated traffic as far as reasonably practicable.	Y	Y	Y
Changes to visual amenity	Minimise negative changes to visual amenity as far as reasonably practicable.	Y		Y
Cultural Heritage				
Ground disturbance	No unapproved disturbance of heritage sites.	Y		
Emissions / Discharge				
Air emissions	• Minimise release of air contaminants. • Minimise dust generation.	Y	Y	Y
Noise and vibration	Minimise noise and vibration generation.	Y	Y	Y
Stormwater discharge	Avoid or minimise run-off discharge of soil, sediment and any potential contaminants off site.	Y	Y	Y
Water Quality				
Accidental release of hydrocarbons and other chemicals	• Prevent accidental release of hazardous chemicals as far as reasonably practicable. • No discharges of hydrocarbons to Harvey River.			
Ground Disturbance	• No disturbance of ASS resulting in acidification of groundwater. • No contamination of Harvey River or Domain main drain from sedimentation. • Minimise surface and groundwater regime disturbance.	Y	Y	Y

Aspects	Objectives	Construction Phase	Operations Phase	Decommissioning Phase
Soil				
Accidental release of hydrocarbons and other chemicals	• No long-term contamination of soils attributable to the Project. • Prevent accidental release of hazardous chemicals as far as reasonably practicable.	Y	Y	Y
Ground Disturbance	• No acidification of the landscape from the disturbance of ASS. • Excavations will be self-draining. • Preserve or reinstate pre-existing environmental values and / or land uses.	Y	Y	Y
Flora and Fauna				
Removal of native vegetation, including scattered trees	• Avoid or minimise clearance of native vegetation as far as reasonably practicable. • Comply with clearing permit application requirements and conditions (as applicable). • Preserve or reinstate pre-existing environmental values and / or land uses.	Y	Y	Y
Introduction and / or spread of pest flora and fauna	Prevent introduction and spread of pest flora and fauna.	Y	Y	Y
Physical interaction with fauna	Avoid or minimise physical negative impacts on fauna as far as reasonably practicable.	Y	Y	Y
Waste				
Accidental release of hydrocarbons and other chemicals	Prevent accidental release of hazardous chemicals as far as reasonably practicable.	Y	Y	Y
Generation of on-site industrial and household waste	• Minimise raw material use. • Minimise waste generation. • Maximise recycling and reuse. • Ensure safe waste disposal in compliance with relevant legislation. • No contamination of the Project area.	Y	Y	Y
Wetland				
Ground disturbance	Minimise disturbance to the CCW.	Y	Y	Y

5.1.1 Project Approach

The overarching environmental management strategies for the Project are outlined in **Table 6**.

Table 6 Project Approach

Management Actions	Management targets	Monitoring	Reporting	Phase
Review and implement all relevant laws, regulations, policies, standards and guidelines through performance targets and environmental objectives.	Comply with all relevant environmental laws, regulations, policies and guidelines	N/A	Environmental incidents register	Construction, Operation and Decommissioning
• Focus on safeguarding priorities in all relevant Project decisions as best as reasonably practicable. • Prepare and Implement the Site Emergency Response Plan.	Safeguard human health, local amenity and natural environment	As per the Site Emergency Response Plan	As per the Site Emergency Response Plan	Construction, Operation and Decommissioning
Review and implement latest industry standards and guidelines in all phases of the Project as best as reasonably practicable.	Avoid or minimise Project impacts through utilisation of best industry practice and standards as much as reasonably practicable	N/A	N/A	Construction, Operation and Decommissioning

5.1.2 Fire Management

Condition 6 of the DA requires the Applicant to address fire management within this EMP to the satisfaction of the local government.

The actions, targets and monitoring and reporting requirements for fire and bushfire management are provided in **Table 7**.

Table 7 Fire Management

Management Actions	Management targets	Monitoring	Reporting	Phase
• Site and emergency procedure inductions are to be undertaken by all Project personnel. • Implement and maintain appropriate site access tracks. • Liaise with DFES during high fire danger periods, if necessary.	Minimise bushfire hazards on site	As per the Site Emergency Response Plan	As per the Site Emergency Response Plan	Construction, Operation and Decom-missioning
• Fire management to be undertaken in accordance with the DBCA's Corporate Policy Statement 19- Fire Management (DPaW, 2015). • Stop conducting any works with the risk of causing fire when Total Fire Ban are declared. • Register for SMS message notification service with the LGA to get information on Total Fire Bans and Vehicle Movement Bans.	No incidents of fire attributable to construction or operation activities	Permit to work system. As per the Site Emergency Response Plan	As per the Site Emergency Response Plan	Construction and Operation

Management Actions	Management targets	Monitoring	Reporting	Phase

• Park vehicles and machineries at designated area.
• Implement 'No Smoking" within the Project area.
• Install appropriate firefighting equipment in adequate numbers at accessible location within the Project area.
• Fire detection and reporting system to be in place.
• Permit to work system or similar to be implemented for all hot works during construction.
• Regular maintenance of infrastructure during operations (to reduce risk of accidental fire caused.
• Implement Bushfire Management Plan (**Appendix A**) prepared in line with SPP 3.9 and associated Guidelines for Planning in Bushfire Prone Area (BPA), including:
  ○ Smoking restrictions or designated smoking locations.
  ○ Procedures regarding vegetation management and accidental ignition prevention.
  ○ The specifications of Schedule 1 of the Guidelines for Planning in Bushfire Prone
  ○ Areas and the Shire of Waroona Firebreak Notice can be achieved via livestock grazing. The vegetation must continue to be monitored for compliance with Schedule 1, and additional vegetation management works undertaken as required.
  ○ Heavy equipment is not to be operated where long grass (>100mm) or heavy leaf litter is present, particularly during the bushfire season (see the Local Government Prohibited Burning Period).
  ○ Servicing of battery energy storage systems should not take place on days of High, Extreme or Catastrophic Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.
  ○ Hazard identification - ensuring that infrastructure, plant, equipment, vehicles and safety/warning signs show no signs of damage or dilapidation.				

Management Actions	Management targets	Monitoring	Reporting	Phase
○ Facility access - ensuring all vehicle site access points, including emergency access points, are clear and accessible. ○ Fire protection systems and equipment – ensuring that all equipment is unobstructed, clearly identifiable, in-service and performing optimally. ○ Vegetation management - ensuring that any accumulation of combustible materials is cleared from infrastructure, buildings and fire breaks, and removed from the site. ○ Security measures - ensuring that fences, gates, and security cameras are inspected for damage, and that any damage is immediately actioned (eg., repaired or replaced).				

5.1.3 Community and Cultural Heritage

The actions, targets and monitoring and reporting requirements for community and cultural values are provided in **Table 8**.

Table 8 Community and heritage

Management Actions	Management targets	Monitoring	Reporting	Phase
Consult with nearby communities (Harvey and Binningup) regularly and continuously throughout Project lifecycle, provide regular updates and obtain public feedback, specifically in relation to environmental matters.	Establish and maintain positive liaison with community	N/A	Complaints register	Construction, Operation and Decom-missioning
• Where feasible, manage the construction, operation and decommissioning programs to reduce traffic generation (in line with the Traffic Impact Assessment). • Utilise accredited traffic control services contractors. • Implement the incident reporting system, allowing implementation of traffic improvement measures.	Minimise additional Project associated traffic as far as reasonably practicable	N/A	Complaints register	Construction, Operation and Decom-missioning
• Limit vegetation clearing and establish landscaping if required to minimise visual impacts. • Remove equipment from site as soon as practicable.	Minimise negative changes to visual amenity as far as	N/A	Complaints register	Construction, Operation and Decom-missioning

Management Actions	Management targets	Monitoring	Reporting	Phase
• The nearest airstrip is about 10 km North of the Project site. It is unlikely that the Project would have any impact on aviation operations. However, to mitigate potential risks, implement measures based on glint and glare assessments, such as adjusting array tilt angles during low sun conditions, installing fencing or mesh screens, or planting vegetation along the array border.	reasonably practicable			
Implement management measures of the unexpected finds procedure, including "Stop work", and unexpected finds management and reporting procedures in the event heritage items or values are uncovered during construction.	Prevent disturbance of heritage sites, items and values	N/A	Weekly construction reports	Construction

5.1.4 Air and Noise Pollution

The actions, targets and monitoring and reporting requirements for air and noise pollution are provided in **Table 9**.

Table 9 Air and Noise Pollution

Management Actions	Management targets	Monitoring	Reporting	Phase
Where feasible, utilise latest technology, to minimise release of pollutants.	Minimise release of air contaminants as far as reasonably practicable	N/A	Environmental incidents register	Construction, Operation and Decom-missioning
• Avoid or minimise ground disturbance, soil movement and other dust-producing activities. • Utilise water or wetting agent on any exposed areas, including unpaved roads and laydown areas. • Utilise wind breaks and silt fencing. • Undertake flexible management of speed limits in accordance with road and wind conditions.	Minimise dust generation	[*Weekly*] inspections of retained remnant vegetation Daily monitoring of weather conditions	Complaints register. Inspection reports	Construction, Operation and Decom-missioning
• Shut off / throttle down any vehicles or equipment not in use. • Where reasonably practicable, utilise latest noise reduction equipment and technology.	Minimise noise and vibration generation as far as reasonably practicable	N/A	Complaints register	Construction, Operation and Decom-missioning

5.1.5 Contamination

Condition 6 of DA states the Applicant must address potential risks of contamination to the satisfaction of the local government in this EMP.

The actions, targets and monitoring and reporting requirements for contamination and spills are provided in **Table 10**.

Table 10 Contamination / Spills

Management Actions	Management targets	Monitoring	Reporting	Phase
• Fuel storage tank to be always bunded to prevent spills into the environment. • Check vehicles and machineries for leaks. • Spill kits to be made available in easily accessible location within construction workplace. • Prepare and implement Emergency Response Plan for preparedness for any contaminant spill according to Water Quality Protection Note 10 (WQPN 10) (DWER 2020). • Notify spills to DWER-Pollution response (1300 784 789) as soon as practicable. • Installing battery chambers on concrete slabs to prevent ground contamination by liquids inside the batteries	Avoid or minimise spill	[*Weekly*] inspections of fuel sources and bunded areas. [*Daily*] Vehicle pre-starts Additional requirements as per the Site Emergency Response Plan	Environmental incidents register. Incident reports. As per the Site Emergency Response Plan	Construction, Operation and Decom-missioning
• Undertake the Project in accordance with DWER ASS investigation and management requirements. • Comply with approval conditions and requirements of the ASSDMP (if required).	No disturbance of ASS resulting in acidification of groundwater or landscape	N/A	N/A	Construction, Operation and Decom-missioning
• Implement best industry practice for sediment and erosion management, including minimising ground disturbance, implementing erosion and sediment controls, strategic stockpile location selection, stabilisation of stockpiles etc. • Ensure revegetation or stabilisation of disturbed areas as soon as reasonably practicable.	Avoid and minimise run-off discharge of soil, sediment and any potential contaminants	[*Daily*] inspections of site to identify any contamination / spill issues	Any non conformances recorded as per Incident Reports and Site Emergency Response Plan	Construction, Operation and Decom-missioning
Commence activities related to the purpose of the clearing no later than three (3) months after undertaking the authorised clearing, to reduce the potential for wind erosion, in accordance with Condition 7 of the NVCP.	Avoid and minimise wind erosion of soil, sediment and any potential contaminants	N/A	TBC	Construction

5.1.6 Stormwater and Drainage

Condition 6 of DA states the Applicant must address potential risks of stormwater and drainage to the satisfaction of the local government in this EMP.

The actions, targets and monitoring and reporting requirements for stormwater management are provided in **Table 11** .

Table 11 Stormwater and Drainage

Management Actions	Management targets	Monitoring	Reporting	Phase
• Incorporate adequate drainage system for stormwater management in detail design. • Site water run-off to be collected and treated, if necessary, before conveying to Harvey River or Domain Main Drain. • Maintain natural contours and drainage patterns as far as practicable. • Design pipe network of adequate size for run-off conveyance. • Engage the Local Government Authority in detail design. • Develop and implement robust storm water management plan.	Avoid impact to surface and ground water by the Project development	As per storm water management plan (e.g. *Annual inspections of stormwater infrastructure prior to and post Winter rainfall*)	As per storm water management plan (*inspection reports*)	Construction, Operation and Decom-missioning
• Design to ensure surface water hydrological process in not disrupted. • Construction should not be performed within the 1% AEP floodplain boundary. Development out of this boundary might pose significant risks and require additional drainage infrastructure and flood protection.	Prevent potential flooding	N/A	N/A	Construction and Operation
• Treat any water within the bund before release into the environment in accordance with Department of Water's Water Quality Protection Note 56: Tanks for fuel and chemical storage near sensitive water sources. • Construction of Best Management Practices such as swales to treat water quality. • Fuel storage tanks are to be bunded where practicable at all times in accordance with industry best practice to prevent spills from flowing to drainage lines. • Retain and treat small rain fall events (15 mm) close to the source.	Avoid or minimise deterioration of water quality	[*Weekly*] inspections of fuel sources and bunded areas	Inspection reports	Construction, Operation and Decommission ing

5.1.7 Foreshore Management

Condition 6 of DA states the Applicant must address foreshore management, and demonstrate mitigation of risks to the CCW to the satisfaction of the local government in this EMP.

The actions, targets and monitoring and reporting requirements for managing impacts to the Harvey River (CCW) are provided in **Table 12**.

Table 12 Foreshore Management (Harvey River CCW)

Management Actions	Management targets	Monitoring	Reporting	Phase
• Reduce velocity of site runoff discharged into Harvey River. • Maintain pre-development peak flow rates and total volume run-off from the outlets of Project area for 1% AEP rainfall event to maintain hydrological regime of Harvey River. • Avoid disturbance to existing vegetation adjacent to the river and revegetate where practicable.	Avoid or minimise streambank erosion	N/A	N/A	Construction
• Maintain a minimum buffer distance of 50m from the mapped boundary of the Conservation Category Wetland • Maintain buffer from the Resource Enhancement wetland as determined in accordance with Western Australian Planning Commission's Guidelines for the Determination of Wetland Buffer Requirements (WAPC, 2005). • Construct fence along the site adjacent to the wetland. • Signage with information about the wetland and its environmental values.	Avoid or minimise native vegetation clearing	N/A	N/A	Construction
• Implement sediment and suspended solids controls. • Treat any site runoff carrying contaminants before conveying into the wetland. • Retain and treat, if required, run-off generated by small rainfall even on-site to minimise transport of pollutants downstream.	Avoid or minimise deterioration of water quality	As per contamination management actions	As per contamination reporting requirements	Construction and Decommissioning

5.1.8 Remnant Vegetation and Rehabilitation

Condition 6 of DA states the Applicant is to address potential risks to remnant vegetation and rehabilitation to the satisfaction of the local government in this EMP.

The landscape plan is attached as **Appendix B**.

The actions, targets and monitoring and reporting requirements managing flora and vegetation (including remnant vegetation and rehabilitation) are provided in **Table 13**.

Table 13 Flora and Vegetation

Management Actions	Management targets	Monitoring	Reporting	Phase
• Total clearing of native vegetation shall not exceed the threshold of 8.8 ha. • No clearing shall occur outside the approved boundary of CPS 9351/1 and 8758/1.	Avoid, minimise or reduce clearing of native vegetation as far as reasonably practicable	Post clearing assessment, as per condition 8 of CPS 8758/1 and condition 6 of CPS 9351/1.	Annual report provided to DWER, as per condition 9 of CPS 8758/1 and condition 7 of CPS 9351/1 Environmental incidents register	Construction and Operation
• Limit disturbance to the Project footprint and minimise disturbance within the Project footprint to the extent reasonably practicable. • Develop and implement a post Project rehabilitation plan, including but not limited to: ○ Removal and disposal of above ground infrastructure components, in compliance with applicable regulatory framework and best industry practice. ○ Management of infrastructure components that cannot be removed without significant disturbance in compliance with applicable regulatory framework and best industry practice. ○ Refill of excavated areas with clean compatible material. • Rehabilitation of compacted areas and implementation of vegetation reinstatement program, in agreement with land owners.	Rehabilitate site in accordance with the landscape plan.	As per Rehabilitation Plan	As per Rehabilitation Plan	Construction, Operation and Decom-missioning
• Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared.	Prevent introduction and spread of pests	Hygiene checklists. Weekly or ad hoc	Annual report provided to DWER, as per condition 9 of CPS 8758/1	Construction, Operation and Decommissio ning

Management Actions	Management targets	Monitoring	Reporting	Phase

• Ensure that no dieback or weed-affected soil, fill or other material is brought into the area to be cleared.
• Use site won vegetation to generate mulch.
• Restrict the movement of machines and other vehicles to the limits of the areas to be cleared
• Develop and implement robust weed management and monitoring procedures.
• Undertake landscaping and rehabilitation activities in accordance with the Landscape Management Report (**Appendix C**), including:
  ○ Weed control in revegetation areas will be undertaken at a minimum two weeks (if not four weeks) prior to revegetation to allow for follow-up spraying of any remaining weeds. Glyphosate Biactive should be used around the creeks to prevent impacts on frogs and other aquatic fauna. Spot control should be undertaken during the first year of seedling establishment.
  ○ Only pesticides registered for the treatment of pests and weeds in Western Australia can be used for the Works.
  ○ Plants to be used must be confirmed b the supplier to be true to the specified species, size and free from disease, pests and weeds
		inspections of vehicles		

5.1.9 Fauna

Condition 7 of the DA states:

"Prior to commencement of works the applicant shall submit and have approved by the local government, and thereafter implemented to the satisfaction of the local government, an 'Ecological Assessment / Management Plan'."

The Ecological Assessment is provided in **Appendix D**.

The actions, targets and monitoring and reporting requirements managing fauna are provided in **Table 14**.

Table 14 Fauna management

Management Actions	Management targets	Monitoring	Reporting	Phase
• All Black Cockatoo foraging habitat within the Project area is to be retained. • All Black Cockatoo habitat trees are to be retained, with the exception of 26 dead stag trees, which may be cleared for the Project.	Avoid clearing or negative impacts to Black Cockatoo foraging habitat	Post clearing assessment, as per condition 8 of CPS 8758/1	Annual report provided to DWER, as per condition 9 of CPS 8758/1. Environmental incidents register	Construction
• Implement speed restrictions for on-site traffic, in line with the Solar Farm Traffic Impact Assessment outcomes. • Undertake fauna management in compliance with requirements of the BC Act.	Avoid or minimise physical negative impacts on fauna as far as reasonably practicable	Audits and site inspections	Environmental incidents register	Construction, Operation and Decommissioning

5.1.10 Physical Environment including Erosion

The actions, targets and monitoring and reporting requirements for managing the physical environment are provided in **Table 15**.

Table 15 Physical Environment

Management Actions	Management targets	Monitoring	Reporting	Phase

• Limit Project works to footprint of the site.
• Implement excavation strategies minimising disturbance
• Implement best practice sediment and erosion management including
  ○ wind breaks or silt fencing (if appropriate)
  ○ strategic stockpile location selection
  ○ stabilisation of stockpiles
  ○ use of water or wetting agents to reduce dust generation
	Minimise soil and ground disturbance	Weekly inspections	Inspection reports	Construction, Operation and Decommissioning

Management Actions	Management targets	Monitoring	Reporting	Phase
• Ensure reinstatement and revegetation of disturbed areas as soon as reasonably practicable. • Manage speed limits flexibly in response to conditions • Activities related to the purpose of the clearing will commence within three (3) months of the clearing.				
• Maintain natural contours and drainage patterns where practicable. • Implement best industry practice for sediment and erosion management. • Revegetate disturbed areas as soon as reasonably practicable.	Minimise surface and ground water regime disturbance	N/A	N/A	Construction and Decommissioning

5.1.11 Waste

The actions, targets and monitoring and reporting requirements for managing waste are provided in **Table 16**.

Table 16 Waste management

Management Actions	Management targets	Monitoring	Reporting	Phase
• Minimise of chemicals used and stored on site. • Ensure storage infrastructure for onsite chemicals will be in accordance with relevant regulatory requirements standards and guidelines. • Develop site specific chemical storage, handling and emergency response procedures, in accordance with relevant regulatory requirements, standards and guidelines.	Prevent accidental release of hazardous chemicals as far as reasonably practicable	Weekly inspection of chemical storage	Inspection reports	Construction, Operation and Decommissioning
Where feasible, implement measures to minimise raw material use and excess, including specific purchasing and construction, operation and decommissioning techniques strategies.	Minimise raw material use	N/A	N/A	Construction, Operation and Decommissioning
Where feasible, implement measures to minimise waste generation including preference for material re-use, recycling and treatment, prior to disposal.	Minimise waste generation	N/A	N/A	Construction, Operation and Decommissioning
Where feasible, implement recycling and reuse measures for the Project, including waste disposal separation, utilisation of recyclable and reusable materials.	Maximise recycling and reuse	N/A	N/A	Construction, Operation and Decommissioning
Ensure provision of bins for adequate waste disposal. Utilise licensed waste contractor for waste disposal.	Ensure safe waste disposal in compliance with relevant legislation	License check for waste contractor	Inspection reports	Construction, Operation and Decommissioning

5.1.12 Stock

Condition 6 of DA states the Applicant must address livestock management to the satisfaction of the local government.

The actions, targets and monitoring and reporting requirements managing livestock are provided in Table 17.

Table 17 Stock Management

Management Actions	Management targets	Monitoring	Reporting	Phase
• Regulate animal access and grazing pressure through fencing. • Where practicable, implement a strategic farming system allowing sheep grazing around the PV panels as part of the project's maintenance program to control vegetation growth (AECOM 2019). • Restrict grazing at the onset of plants' annual growth cycle. • Manage intensity of grazing to ensure overgrazing is avoided. • Provide alternative sources of water	Regulating livestock access and grazing	Weekly inspections of fencing and water sources	Inspection reports	Construction and Operation

6.0 References

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Appendix A

Bushfire Management Plan

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lots 24 and 25 (981) Buller Road, Waroona

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 18 Month March Year 2024

Report author or reviewer: [redacted]

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☐ Level 3 practitioner ☑

If accredited please provide the following.

BPAD accreditation number: 27795 Accreditation expiry: Month February Year 2025

Bushfire management plan version number: 1.0

Bushfire management plan date: Day 6 Month May Year 2024

Client/business name: Frontier Energy Ltd

	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	✔	
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the bushfire protection criteria elements)?	✔	

Is the proposal any of the following (see SPP 3.7 for definitions)?	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)		✔
High risk land-use	✔	
Vulnerable land-use		✔

None of the above ☐

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The proposal includes a Solar Farm and decentralised Battery Energy Storage System which are considered a High Risk Land Use.
AS 3959 Method 2 has been used in calculating specific heat fluxes but not the BAL.
The proposed development cannot comply with A3.2a as it is on an existing one-way road.

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer [redacted]

Date 06/05/2024

BUSHFIRE PRONE PLANNING

Waroona Renewable Energy Project

Bushfire Management Plan (BMP)

Produced to meet the relevant requirements of STATE PLANNING POLICY 3.7 Planning in Bushfire Prone Areas & Guidelines

Lots 24 and 25 (981) Buller Road, Waroona

Shire of Waroona

Development Application - High Risk Land Use

6 May 2024

Job Reference No: 240179

BPP GROUP PTY LTD T/A BUSHFIRE PRONE PLANNING

ACN: 39 166 551 784 | ABN: 39 166 551 784

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DOCUMENT CONTROL

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Author:	J[redacted]	[redacted]
Reviewed:	[redacted]	

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Person	Email				
Amy Sullivan	[redacted]	1.0	1	☐	☒
		-		☐	☐

Limitations: *The protection measures that will be implemented based on information presented in this Bushfire Management Plan are minimum requirements and they do not guarantee that buildings or infrastructure will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating.*

This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the required protection measures (including bushfire resistant construction) and any other required or recommended measures, will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Prone Planning has no control.

All surveys, forecasts, projections and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Prone Planning at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations.

Notwithstanding anything contained therein, Bushfire Prone Planning will not, except as the law may require, be liable for any loss or other consequences whether or not due to the negligence of their consultants, their servants or agents, arising out of the services provided by their consultants.

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LIST OF FIGURES

THIS DOCUMENT – STATEMENT OF PURPOSE

The Bushfire Management Plan (BMP)

The BMP sets out the required package of bushfire protection measures to lessen the risks associated with a bushfire event. It establishes the responsibilities to implement and maintain these measures.

The BMP also identifies the potential for any negative impact on any environmental, biodiversity and conservation values that may result from the application of bushfire protection measures or that may limit their implementation.

Risks Associated with Bushfire Events

The relevant risks are the potential for loss of life, injury, or destroyed or damaged assets which results in personal loss and economic loss. For a given site, the level of that risk to persons and assets (the exposed elements) is a function of the potential threat levels generated by the bushfire hazard, and the level of exposure and vulnerability of the at risk elements to the threats.

Bushfire Protection Measures

The required package of protection measures is established by *State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7)*, its associated *Guidelines* and any other relevant guidelines or position statements published by the Department of Planning, Lands and Heritage. These measures are limited to those considered by the WA planning authorities as necessary to be addressed for the purpose of land use planning. They do not encompass all available bushfire protection measures as many are not directly relevant to the planning approval stage. For example:

- Protection measures to reduce the vulnerability of buildings to bushfire threats is primarily dealt with at the building application stage. They are implemented through the process of applying the Building Code of Australia (Volumes 1 and 2 of the national Construction Code) in accordance with WA building legislation and the application of construction requirements based on a building's level of exposure - determined as a Bushfire Attack Level (BAL) rating); or
- Protection measures to reduce the threat levels of consequential fire (ignited by bushfire and involving combustible materials surrounding and within buildings) and measures to reduce the exposure and vulnerability of elements at risk exposed to consequential fire, are not specifically considered.

The package of required bushfire protection measures established by the Guidelines includes:

- The requirements of the bushfire protection criteria which consist of:
  - Element 1: Location (addresses threat levels).
  - Element 2: Siting and Design of Development (addresses exposure levels of buildings).
  - Element 3: Vehicular Access (addresses exposure and vulnerability levels of persons).
  - Element 4: Water (addresses vulnerability levels of buildings).
  - Element 5: Vulnerable Tourism Land Uses (addresses exposure and vulnerability as per Elements 1-4 but in use specific ways and with additional considerations of persons exposure and vulnerability).
- The requirement to develop Bushfire Emergency Plans / Information for 'vulnerable' land uses for persons to prepare, respond and recover from a bushfire event (this addresses vulnerability levels).
- The requirement to assess bushfire risk and incorporate relevant protection measures into the site emergency plans for 'high risk' land uses (this addresses threat, exposure and vulnerability levels).

Compliance of the Proposed Development or Use with SPP 3.7 Requirements

The BMP assesses the capacity of the proposed development or use to implement and maintain the required 'acceptable' solutions and any additionally recommended bushfire protection measures - or its capacity to satisfy the policy intent through the justified application of additional bushfire protection measures as supportable 'alternative' solutions.

THE PROPOSED DEVELOPMENT/USE – BUSHFIRE PLANNING COMPLIANCE SUMMARY		
Environmental Considerations		**Assessment Outcome**
Will land with identified environmental, biodiversity and conservation values limit the full application of the required bushfire protection measures?		No
Will land with identified environmental, biodiversity and conservation values need to be managed in the implementation and maintenance of the bushfire protection measures - but not limit their application?		No
Required Bushfire Protection Measures The Acceptable Solutions of the Bushfire Protection Criteria (Guidelines)		**Assessment Outcome**
Element	The Acceptable Solutions	
1: Location	A1 Location	Fully Compliant
	A1.1 Development location	Fully Compliant
2: Siting and Design of Development	A2 Siting and Design of Development	Fully Compliant
	A2.1 Asset Protection Zone (APZ)	Fully Compliant
3: Vehicular Access	A3 Vehicular Access	Not Compliant
	A3.1 Public roads	Fully Compliant
	A3.2a Multiple access routes	Not Compliant
	A3.2b Emergency access way	N/A
	A3.3 Through-roads	N/A
	A3.4a Perimeter roads	N/A
	A3.4b Fire service access route	N/A
	A3.5 Battle-axe legs	N/A
	A3.6 Private driveways	Fully Compliant
4: Water	A4 Water	Fully Compliant
	A4.1 Identification of future water supply	Fully Compliant
	A4.2 Provision of water for firefighting purposes	Fully Compliant
Other Documents Establishing Bushfire Protection Measure Variations or Additions		**Assessment Outcome**
A 'Planning Approval' or a 'Notice of Determination' which contains 'Conditions' to be met.		N/A

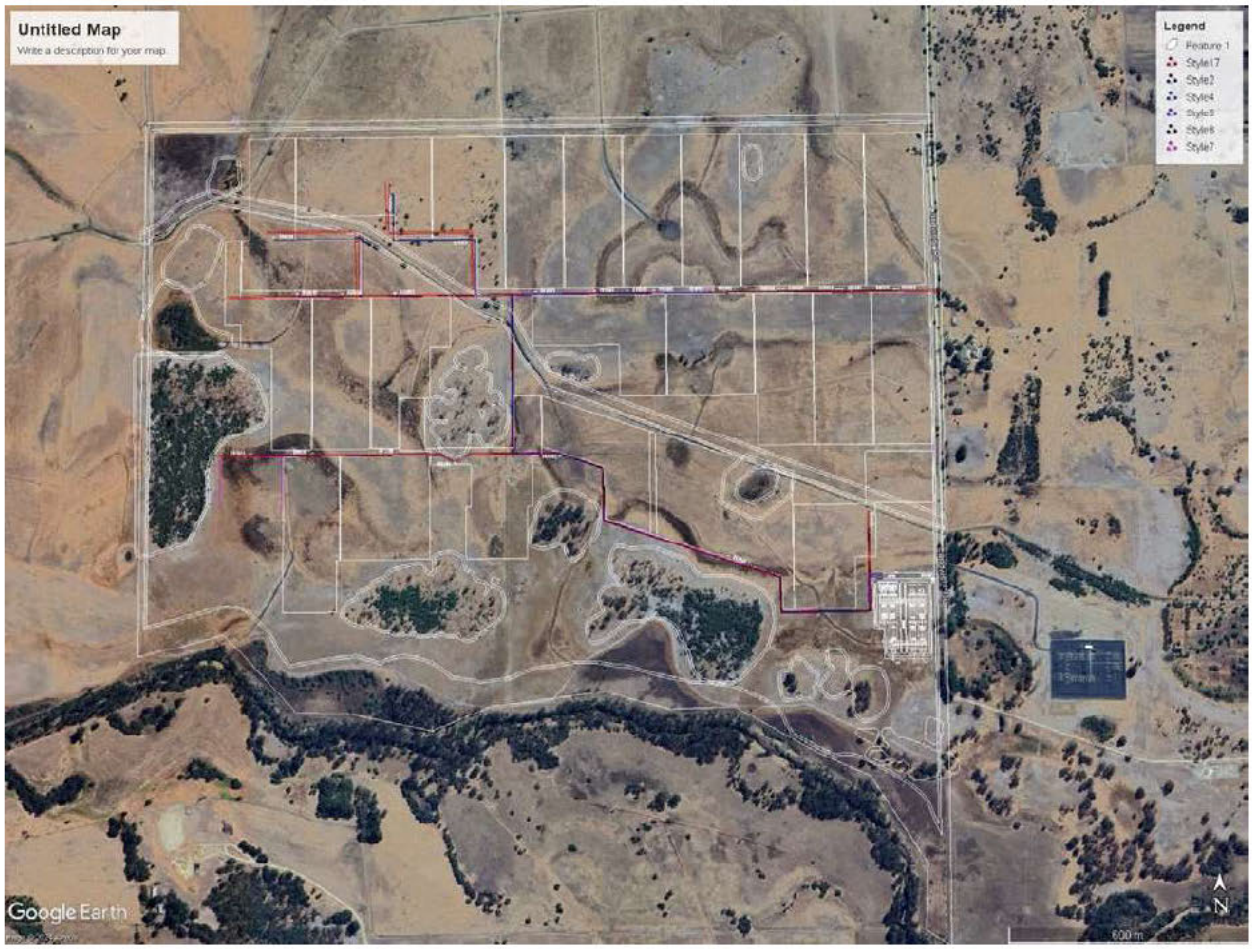
A DPLH/WAPC 'Position Statement'	N/A
Bushfire Management Plan Guidance for the Dampier Peninsula (DPLH 2021 Rev B)	N/A
Other 'Bushfire Planning' Documents to Be Produced This necessity for additional documents is determined by the proposed development/use type and the requirements established by SPP 3.7 and the associated Guidelines (as amended). They may be produced concurrently or subsequent to the BMP. Relevant actions will be identified within Section 6 'Responsibilities for Implementation of Bushfire Protection Measures.	**Required**
Bushfire Emergency Plan: An operational document presenting prevent, prepare, respond and recover procedures and associated actions. As necessary, supporting information to justify determinations is included.	No
Bushfire Emergency Information (Poster): As a concise response information poster for certain vulnerable land uses.	No
Bushfire Emergency Information (Content): As content for inclusion into the Site's Emergency Plan for certain high risk land uses:	Yes
Summary Statement: Information to be included within the site's Emergency Management Plan has been identified within the associated Bushfire Risk Report and provided in Section 5.7.	
Bushfire Risk Assessment and Management Report:	Yes
Summary Statement: The proposed development is considered a 'high-risk' land use as defined by SPP 3.7 and its associated Guidelines. This triggers the requirement, through the development of a Risk Assessment and Management Report to: • Identify the level of exposure and vulnerability of any onsite stored materials and liquids to bushfire attack mechanisms (threats); • Identify any potential source of ignition threat the use may present to adjoining and/or adjacent bushfire prone vegetation; and • Recommend protection measures that can be incorporated into the site operations emergency plan as necessary. The requirement for this report to be developed and any variation to content, can be decided by the planning approval decision maker (e.g., the local government). Otherwise, SPP 3.7 states it 'should' be produced.	

1 PROPOSAL DETAILS AND THE BUSHFIRE MANAGEMENT PLAN

1.1 The Proposed Development/Use Details, Plans and Maps

The Proposal's Planning Stage For which certain bushfire planning documents are required to accompany the planning application.		Development Application
The Subject Land/Site		Lots 24 and 25 (981) Buller Road, Waroona
Total Area of Subject Lot/Site		303 hectares
Number of Additional Lots Created		N/A
Primary Proposed Construction	**Type(s)**	Electricity generation
	NCC Classification	N/A
The 'Specific' Land Use Type for **Bushfire Planning** When applicable, this classification establishes a requirement to conduct assessments and develop documents that are additional to this Bushfire Management Plan.		High Risk Land Use
Factors Determining the 'Specific Bushfire Planning' Land Use Type		The land use will store combustible materials and/or flammable hazardous materials onsite that may be exposed and vulnerable to ignition from the direct attack mechanisms of bushfire (flame contact, radiant heat and embers). Business operations/activities may include those that are a potential source of ignition for onsite or offsite combustible/flammable materials, including bushfire prone vegetation.
Description of the Proposed Development/Use		
The proposed Waroona Renewable Energy Project includes a 120MW DC solar facility with decentralised Battery Energy Storage Systems (BESS) clusters of a total 80MW capacity integrated throughout the site. A substation will additionally be installed toward the south-eastern boundary to connect to the Landwehr Terminal to the east, connecting the development to the SWIS grid.		

Figure 1.1: Proposed development plan.



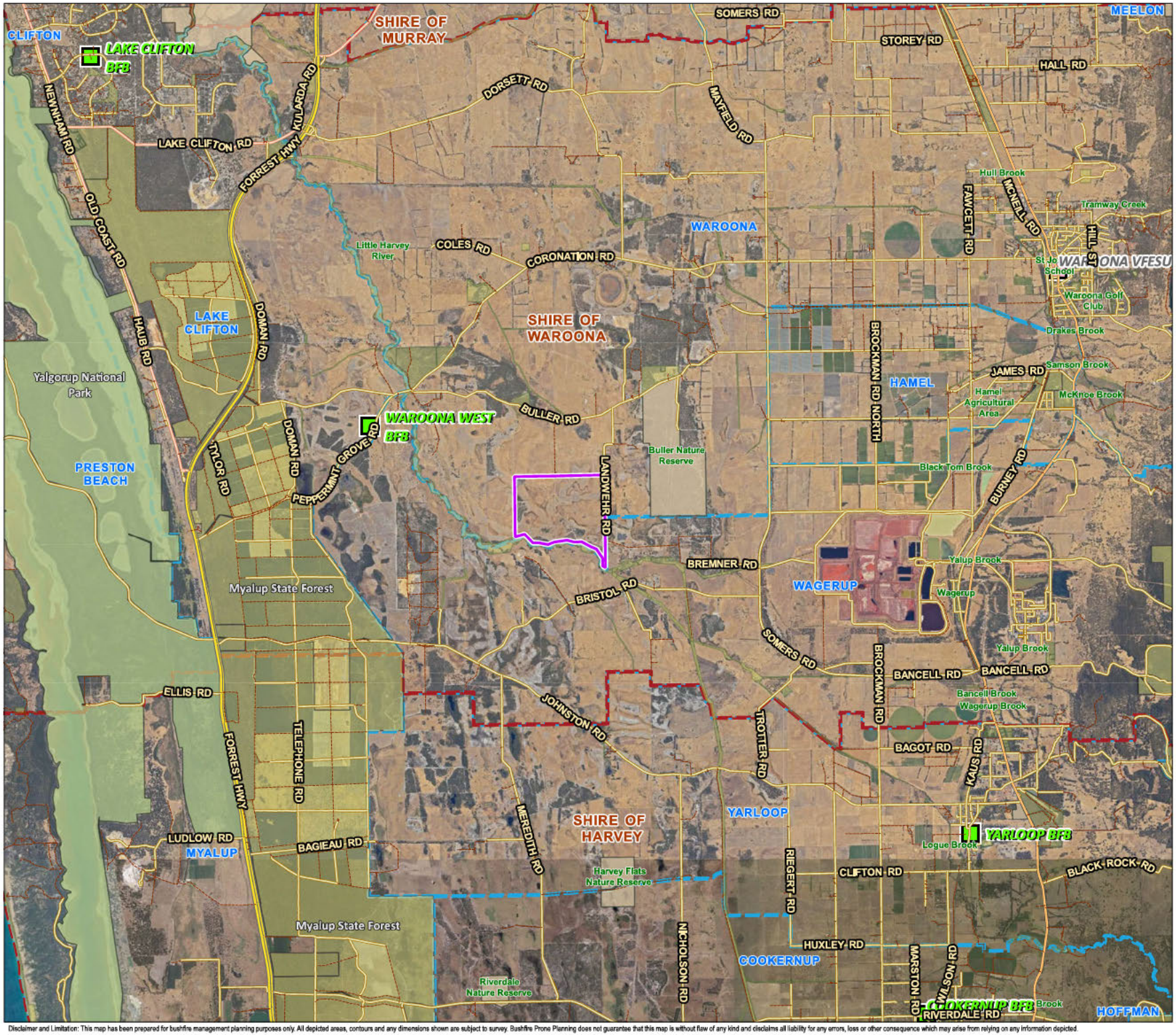


Figure 1.2

Location Map

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- Reserves
- Clearing Regulations

DBCA Legislated Lands and Waters

- Nature Reserve

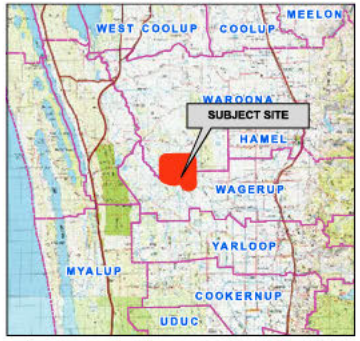
DFES Stations (DFES-023)

- Bush Fire Brigade
- Volunteer Fire & Emergency Service Unit
- LGA
- Suburbs

0 500 1,000 2,000

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: Joy 01-05-2024
SCALE (A3): 1 : 80000

BUSHFIRE PRONE PLANNING

WHERE SPP 3.7 AND THE GUIDELINES ARE TO APPLY – DESIGNATED BUSHFIRE PRONE AREAS

All higher order strategic planning documents, strategic planning proposals, subdivisions and development applications located in designated bushfire prone areas need to address SPP 3.7 and its supporting Guidelines. This also applies where an area is not yet designated as bushfire prone but is proposed to be developed in a way that introduces a bushfire hazard.

For development applications where only part of a lot is designated as bushfire prone and the proposed development footprint is wholly outside of the designated area, the development application will not need to address SPP 3.7 or the Guidelines. (Guidelines DPLH 2021 v1.4, s1.2).

For subdivision applications, if all the proposed lots have a BAL-LOW indicated, a BMP is not required. (Guidelines DPLH 2021 v1.4, s5.3.1).

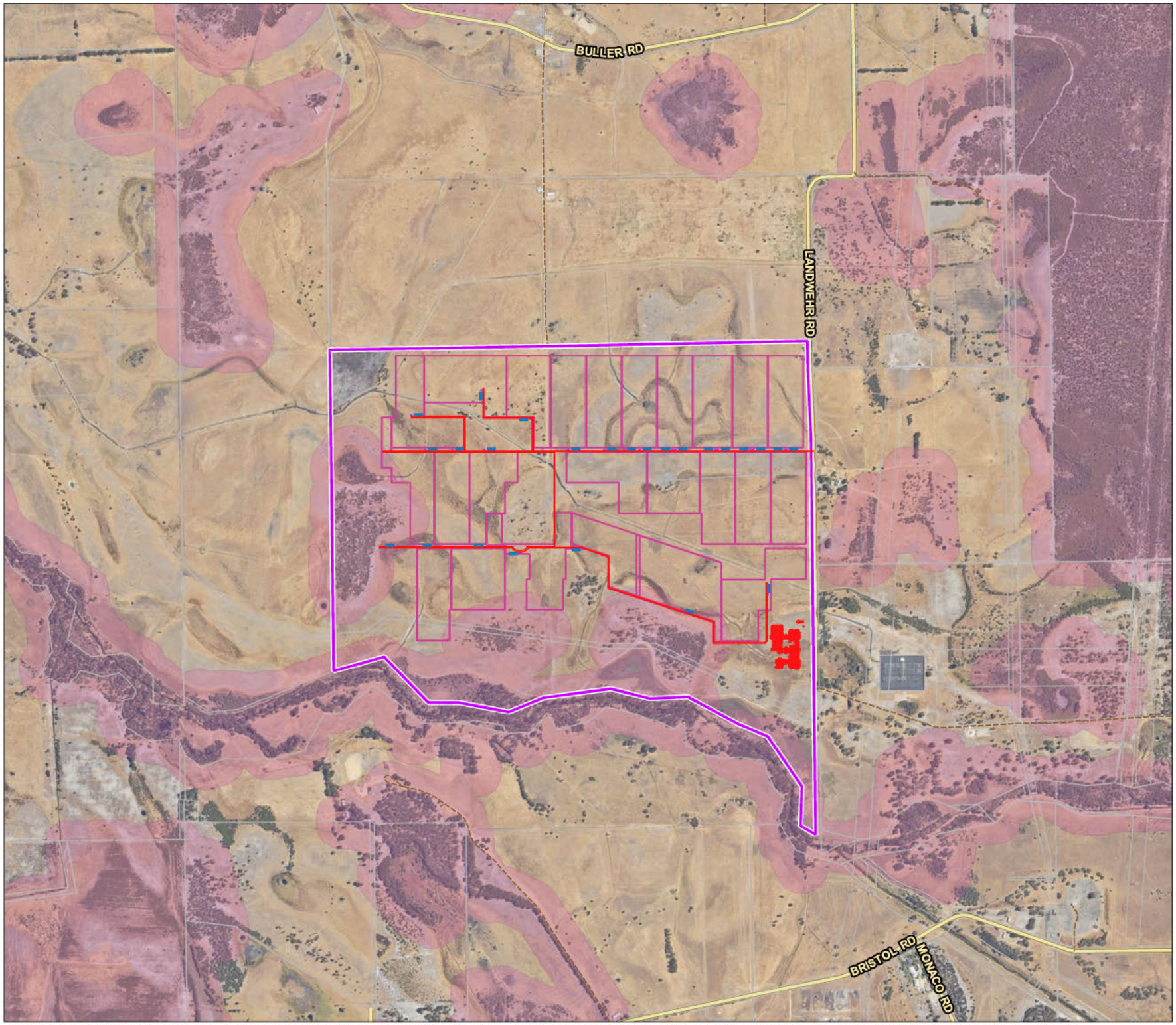


Figure 1.3

Bushfire Prone Area

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- Bushfire Prone Areas 2021

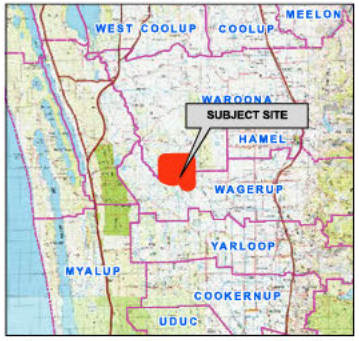
Layout

- Inverters
- Access Tracks
- Panel Clusters
- Switchyard
- Battery

0 150 300 450 600 750

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: Joy 01-05-2024
SCALE (A3): 1 : 15000

BUSHFIRE PRONE PLANNING

1.2 The Bushfire Management Plan (BMP)

1.2.1 Commissioning and Purpose

Landowner / proponent:	Frontier Energy Ltd
Bushfire Prone Planning commissioned to produce the BMP by:	[redacted]
Purpose of the BMP:	To assess the proposal's ability to meet all relevant requirements established by State Planning Policy 3.7: Planning in Bushfire Prone Areas (SPP 3.7), the associated 'Guidelines and any relevant Position Statements; and To satisfy the requirement for the provision of a Bushfire Management Plan to accompany the development application.
BMP to be submitted to:	WA Planning Commission (WAPC) and Shire of Waroona

1.2.1 Other Documents with Implications for Development of this BMP

This section identifies any known assessments, reports or plans that have been conducted and prepared previously, or are being prepared concurrently, and are relevant to the planned proposal for the subject. They potentially have implications for the assessment of bushfire threats and the identification and implementation of the protection measures that are established by this Bushfire Management Plan.

Table 1.4: Other relevant documents that may influence threat assessments and development of protection measures.

RELEVANT DOCUMENTS					
Document	Relevant	Currently Exists	To Be Developed	Copy Provided by Proponent / Developer	Title
Bushfire Risk Assessment and Management Report	Yes	Yes	No	N/A	240179 – Waroona Renewable Energy Project (BRR)v1.0 *Bushfire Prone Planning March 2024*
Implications for the BMP: The Bushfire Risk Report prepared alongside this BMP identifies the appropriate measures to reduce the risk of onsite and/or offsite ignition, asset damage, and harm to persons, environment, and community. Additional Bushfire Protection Measures are drawn from the BRR and provided in Section 5.7.					
Environmental Asset or Vegetation Survey	Yes	Yes	No	No	Unknown
Implications for the BMP: A previous environmental survey has been conducted at the site, which identified black cockatoo foraging habitat in treed areas around the site. The provided site plan (see Figure 1.1) includes Exclusion Zones from the areas with identified environmental values. The BMP and BRR assume that no vegetation management can occur within the identified areas.					

2 BUSHFIRE PRONE VEGETATION – ENVIRONMENTAL & ASSESSMENT CONSIDERATIONS

2.1 Environmental Considerations – 'Desktop' Assessment

This 'desktop' assessment must not be considered as a replacement for a full Environmental Impact Assessment. It is a summary of potential environmental values at the subject site, inferred from information contained in listed datasets and/or reports, which are only current to the date of last modification.

These data sources must be considered indicative where the subject site has not previously received a site-specific environmental assessment by an appropriate professional.

Many bushfire prone areas also have high biodiversity values. Consideration of environmental priorities within the boundaries of the land being developed can avoid excessive or unnecessary modification or clearing of vegetation. Approval processes (and exemptions) apply at both Commonwealth and State levels.

Any 'modification' or 'clearing' of vegetation to reduce bushfire risk is considered 'clearing' under the ***Environmental Protection Act 1986*** (EP Act) and requires a clearing permit under the ***Environmental Protection (Clearing of Native Vegetation) Regulations 2004*** (Clearing Regulations) – unless for an exempt purpose.

Clearing native vegetation is an offence, unless done under a clearing permit or the clearing is for an exempt purpose. Exemptions are contained in the EP Act or are prescribed in the Clearing Regulations (note: these do not apply in environmentally sensitive areas).

The ***Department of Water and Environmental Regulation*** (DWER) is responsible for issuing 'clearing' permits and the framework for the regulation of clearing. Approvals under other legislation, from other agencies, may also be required, dependent on the type of flora or fauna present.

Local Planning Policy or Local Biodiversity Strategy: Natural areas that are not protected by the above Act and Regulation (or any other National or State Acts) may be protected by a local planning policy or local biodiversity strategy. Permission from the local government will be required for any modification or removal of native vegetation in these Local Natural Areas (LNA's). Refer to the relevant local government for detail.

For further Information refer to Guidelines v1.4, the Bushfire and Vegetation Factsheet - WAPC, Dec 2021 and https://www.der.wa.gov.au/our-work/clearing-permits

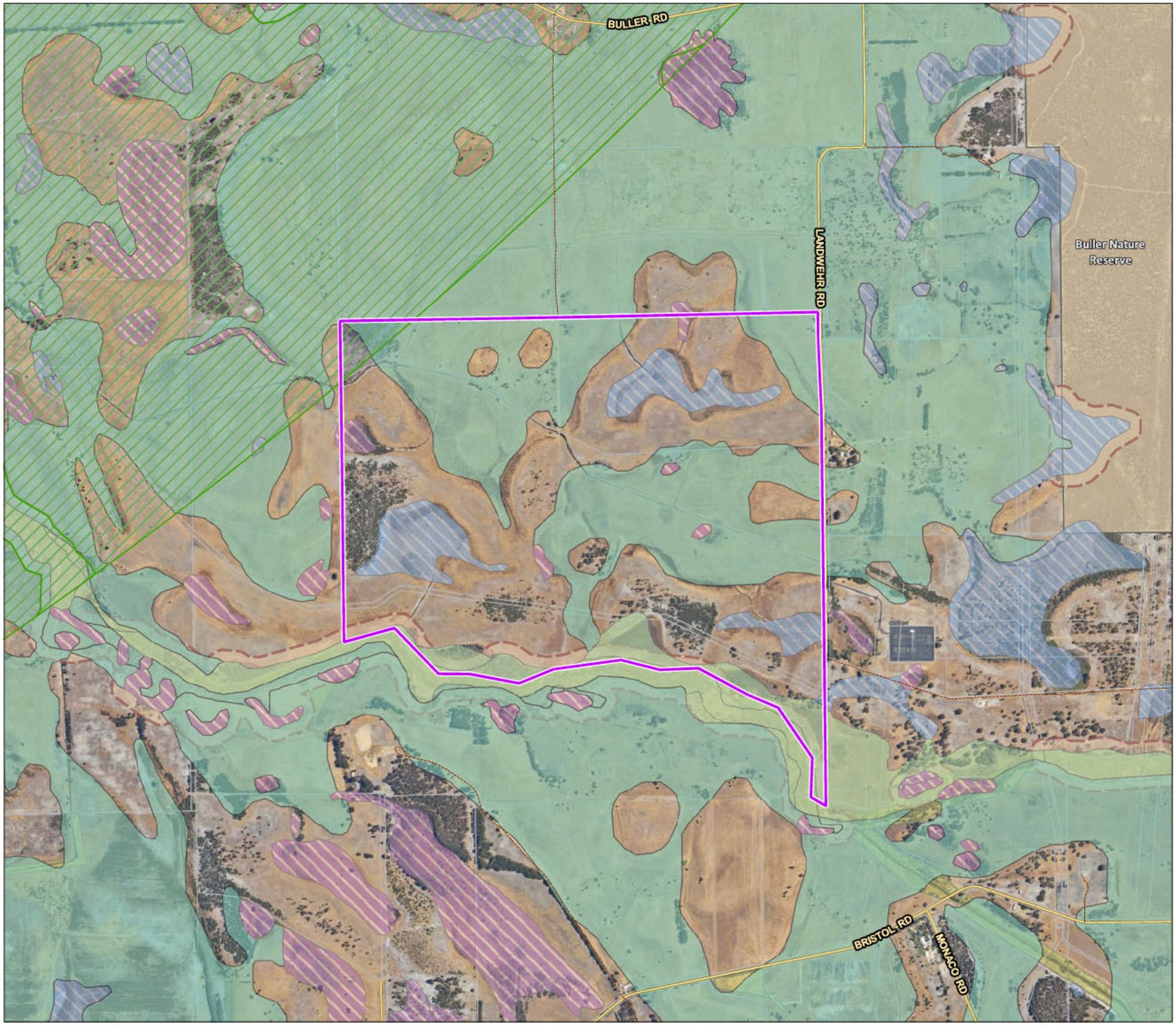


Figure 2.1

Environmental Considerations Map

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- Reserves
- Clearing Regulations

Environmentally Sensitive Areas
- Threatened Ecological Community

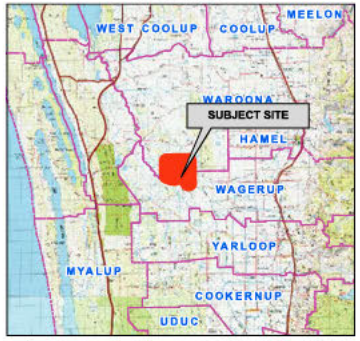
Geomorphic Wetlands Swan Coastal Plain
- Dampland
- Floodplain
- Palusplain
- Sumpland

DBCA Legislated Lands and Waters
- Nature Reserve

0 150 300 450 600 750

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

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Map by: Joy 01-05-2024
SCALE (A3): 1 : 15000

BUSHFIRE PRONE PLANNING

2.1.1 Declared Environmentally Sensitive Areas (ESA)

IDENTIFICATION OF RELEVANT ENVIRONMENTALLY SENSITIVE AREAS							
ESA Class	Relevant to Proposal	Influence on Bushfire Threat Levels and / or Application of Bushfire Protection Measures	Relevant Dataset	Information Source(s) Applied to Identification of Relevant Vegetation			Further Action Required
				Dataset	Landowner or Developer	Environmental Asset or Vegetation Survey	
Wetlands and their 50m Buffer (Ramsar, conservation category and nationally important)	Yes	No	DBCA-010 and 011, 019, 040, 043, 044	☒	☐	☐	None*
Bush Forever	No	No	DPLH-022, SPP 2.8	☒	☐	☐	None
Threatened and Priority Flora + 50m Continuous Buffer	Unknown	Unlikely	DBCA-036	Restricted Scale of Data Available (security)	☐	☐	Data not available - confirm with relevant agency
Threatened Ecological Community	Yes	Unlikely	DBCA-038		☐	☐	Confirm with relevant agency
Heritage Areas National / World	No	No	Relevant register or mapping	☒	☐	☐	None
Environmental Protection (Western Swamp Tortoise) Policy 2002	No	No	DWER-062	☒	☐	☐	None

DESCRIPTION OF THE IDENTIFIED ENVIRONMENTALLY SENSITIVE AREAS:

A previous environmental survey has been conducted at the site, which identified black cockatoo foraging habitat in treed areas around the site. These areas are to remain, and the development will be constructed around the identified areas of Cockatoo habitat.

Further consultation with relevant authority is required regarding accurate accounts of threatened and priority flora as well as threatened ecological communities within the site as this data has restricted access. As shown in Figure 2.1 of this report, there is an identified area containing a Threatened Ecological Community. Further data may be required to confirm presence within the lot.

*No further action is required in terms of implementing bushfire protection measures. Other design measures may need to be considered to accommodate for the identified environmental / Wetland areas.

2.1.2 Other Protected Vegetation on Public Land

IDENTIFICATION OF PROTECTED VEGETATION ON PUBLIC LAND							
Land with Environmental, Biodiversity, Conservation and Social Values	Relevant to Proposal	Influence on Bushfire Threat Levels and / or Application of Bushfire Protection Measures	Relevant Dataset	Information Source(s) Applied to Identification of Relevant Vegetation			Further Action Required
				Dataset	Landowner or Developer	Environmental Asset or Vegetation Survey	
Legislated Lands (tenure includes national park/reserve, conservation park, crown reserve and state forest)	Yes	No	DBCA-011	☒	☐	☐	None
Conservation Covenants	Unlikely	Unlikely	DPIRD-023	Only Available to Govt.	☐	☐	Data not available - confirm with relevant agency
National World Heritage Areas	No	No	-	☒	☐	☐	None
Designated Public Open Space	No	No	-	☐	☒	☐	None

DESCRIPTION OF THE IDENTIFIED AREA(S) OF VEGETATION

Proponent may require further consultation with relevant authorities to obtain specific site information regarding Conservation Covenants within the site.

2.1.3 Response of Proposed Development to Identified Environmental Limitations

Consideration of the implications that identified protected areas of vegetation (i.e., those with environmental and subject to conservation) have for the proposed development.

PROPOSED DEVELOPMENT RESPONSE TO IDENTIFIED 'PROTECTED' VEGETATION	
The existence of 'protected' areas of vegetation has implications for the ability of the proposed development to reduce potential bushfire impact through modification or removal of vegetation.	Yes
Application of Design and/or Construction Responses to Limit Vegetation Modification or Removal	
Modify the development location to reduce exposure by increasing separation distance.	Yes
Development areas have been designed to reduce exposure to radiant heat of retained environmentally significant vegetation within the lot.	
Redesign development, structure plan or subdivision.	No
Reduction of lot yield where this can increase available separation distances.	No
Cluster development to limit modification or removal of vegetation.	No
Construct building(s) to the requirements corresponding to higher BAL ratings to reduce required separation distances.	No

2.2 Bushfire Assessment Considerations

2.2.1 Planned Onsite Vegetation Landscaping

Identification of areas of the subject site planned to be landscaped, creating the potential for increased or decreased bushfire hazard for proposed development.

PLANNED LANDSCAPING	
Relevant to Proposal:	No

2.2.2 Planned / Potential Offsite Rehabilitation or Re-Vegetation

Identification of areas of land adjacent to the subject site on which re-vegetation (as distinct from natural re-generation) will or may occur and is likely to present a greater bushfire hazard for proposed development.

POTENTIAL RE-VEGETATION PROGRAMS		
Land with Environmental, Biodiversity, Conservation and Social Values	Relevant to Proposal	Description
Riparian Zones / Foreshore Areas	No	
Wetland Buffers	No	
Legislated Lands	No	
Public Open Space	No	
Road Verges	Yes	Revegetation will be conducted along Landwehr Road as a visual screening for the substation. This area will be 5m in width as indicated in Figure 3.1.1 within this report.
Other	No	

2.2.3 Identified Requirement to Manage, Modify or Remove Onsite or Offsite Vegetation

Identification of native vegetation subject to management, modification or removal.

REQUIREMENT TO MANAGE, MODIFY OR REMOVE NATIVE VEGETATION	
Has a requirement been identified to manage, modify or remove **onsite** native vegetation to establish the required bushfire protection measures on the subject site?	Yes
Refer to Figure 3.1: Classified Vegetation and Topography Map and Figure 3.2: Classified Vegetation and Topography Map (Post Development) for identified areas of vegetation that will be removed for this development.	
Is approval, from relevant state government agencies and/or the local government, to modify or remove **onsite** native vegetation required? (Note: if 'Yes' evidence of its existence should be provided in this BMP).	Yes
Approval may be required to manage and remove shrubland vegetation as indicated in Figure 3.1 and 3.1.1 of this report. The grassland area within the report will be managed through grazing livestock and does not need vegetation management approval.	
Has a requirement been identified to manage, modify or remove **offsite** native vegetation to establish the required bushfire protection measures on the subject site?	No

Is written approval required, from relevant state government agencies and/or the local government, that permits the landowner, or another identified party, to modify or remove **offsite** bushfire prone vegetation and/or conduct other works, to establish an identified bushfire protection measure(s)? If 'Yes', appropriate evidence of the approval or how it is to be established, shall be provided in this BMP as an addendum.	No
Is a written management agreement required that states the obligation of the landowner, or another responsible party, to manage defined areas of **offsite** bushfire prone vegetation, in perpetuity, to ensure the conditions of no fire fuels and/or low threat vegetation and/or vegetation managed in a minimal fuel condition, continue to be met? If 'Yes', appropriate evidence of the agreement or how it is to be established, shall be provided in this BMP as an addendum.	No

2.2.4 Variations to Assessed Areas of Classified Vegetation to be Applied

FOR THE PROPOSED DEVELOPMENT SITUATIONS TO BE ACCOUNTED FOR IN ASSESSING THE POTENTIAL BUSHFIRE IMPACT (BAL)	
Area(s) of land will be subject to future vegetation rehabilitation or re-vegetation that will require a change to a higher threat classification of vegetation on that land to. (Note: this is not regeneration to the mature natural state which is accounted for in the 'existing state' assessment in accordance with AS 3959:2018).	No
Refer to Figure 3.1.1 'Post Development Classified Vegetation' of where grassland vegetation will be re-vegetated to a Forest state as per the approved vegetation management plan for the development.	
Modification of existing area(s) of classified vegetation due to the implementation of the proposed development and/or prior to the site's occupancy or use. This modification will require a change to a lower threat classification (or exclusion from classification) for that area of vegetation.	Yes
Refer to Figure 3.1.1 'Post Development Classified Vegetation' and Appendix A1.2 for justification details supporting the change.	
Complete removal of existing area(s) of classified vegetation due to the implementation of the proposed development and/or prior to the site's occupancy or use. This modification will require an exclusion from classification for that area of vegetation.	Yes
Refer to Figure 1.1 'Proposed Development Site Plan' and Figure 3.1.1 'Post Development Classified Vegetation'	

3 BUSHFIRE ATTACK LEVEL (BAL) ASSESSMENT

BUSHFIRE ATTACK LEVELS (BAL) - UNDERSTANDING THE RESULTS

The potential transfer (flux/flow) of radiant heat from the bushfire to a receiving object is measured in kW/m^2. The AS 3959:2018 BAL determination methodology establishes the ranges of radiant heat flux that correspond to each bushfire attack level. These are identified as BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

The bushfire performance requirements for certain classes of buildings are established by the Building Code of Australia (Vol. 1 & 2 of the NCC). The BAL will establish the bushfire resistant construction requirements that are to apply in accordance with AS 3959:2018 - *Construction of buildings in bushfire prone areas* and the NASH Standard – *Steel framed construction in bushfire areas (NS 300 2021)*, whose solutions are deemed to satisfy the NCC bushfire performance requirements.

DETERMINED BAL RATINGS

A BAL Certificate can be issued for a determined BAL. A BAL can only be classed as 'determined' for an existing or future building/structure when:

1. It's final design and position on the lot are known and the stated separation distance from classified bushfire prone vegetation exists and can justifiably be expected to remain in perpetuity; or

2. It will always remain subject to the same BAL regardless of its design or position on the lot after accounting for any regulatory or enforceable building setbacks from lot boundaries as relevant and necessary (e.g., R-codes, restrictive covenants, defined building envelopes) or the retention of any existing classified vegetation either onsite or offsite.

If the BMP derives determined BAL(s), the BAL Certificate(s) required for submission with building applications can be provided, using the BMP as the assessment evidence.

INDICATIVE BAL RATINGS

A BAL Certificate cannot be issued for an indicative BAL. A BAL will be classed as 'indicative' for an existing or future building/structure when the required conditions to derive a determined BAL are not met.

This class of BAL rating indicates what BAL(s) could be achieved and the conditions that need to be met are stated.

Converting the indicative BAL into a determined BAL is conditional upon the currently unconfirmed variable(s) being confirmed by a subsequent assessment and evidential documentation. These variables will include the future building(s) location(s) being established (or changed) and/or classified vegetation being modified or removed to establish the necessary vegetation separation distance. This may also be dependent on receiving approval from the relevant authority for that modification/removal.

BAL RATING APPLICATION – PLANNING APPROVAL VERSUS BUILDING APPROVAL

1. **Planning Approval**: SPP.3.7 establishes that where BAL- LOW to BAL-29 will apply to relevant future construction (or existing structures for proposed uses), the proposed development may be considered for approval (dependent on the other requirements of the relevant policy measures being met). That is, BAL40 or BAL-FZ are not acceptable on planning grounds (except for certain limited exceptions).

   Because planning is looking forward at what can be achieved, as well as looking at what may currently exist, both determined and indicative BAL ratings are acceptable assessment outcomes on which planning decisions can be made (including conditional approvals).

2. **Building Approval:** The Building Code of Australia (Vol. 1 & 2 of the NCC) establishes that relevant buildings in bushfire prone areas must be constructed to the bushfire resistant requirements corresponding to the BAL rating that is to apply to that building. Consequently, a determined BAL rating and the BAL Certificate is required for a building permit to be issued - an indicative BAL rating is not acceptable.

3.1 BAL Assessment Summary (Contour Map Format)

INTERPRETATION OF THE BAL CONTOUR MAP

The BAL contour map is a diagrammatic representation of the results of the bushfire attack level assessment.

The map presents different coloured contours extending out from the areas of classified vegetation. Each contour represents a set range of radiant heat flux that potentially will transfer to an exposed element (building, person or other defined element), when it is located within that contour.

Each of the set ranges of radiant heat flux corresponds to a different BAL rating as defined by the AS 3959:2018 BAL determination methodology.

The width of each shaded BAL contour will vary dependant on both the BAL rating and the relevant parameters (calculation inputs) for the subject site. Their width represents the minimum and maximum vegetation separation distances that correspond to each BAL rating (refer to the relevant table below for these distances).

The areas of classified vegetation to be considered in developing the BAL contours, are those that will remain at the intended end state of the subject development once earthworks, clearing and/or landscaping and re-vegetation have been completed. Variations to this statement that may apply include:

- Both pre and post development BAL contour maps are produced; and/or
- Each stage of a development is assessed independently.

3.1.1 BAL Determination Methodology and Location of Data and Results

LOCATION OF DATA & RESULTS					
BAL Determination Methodology		Location of the Site Assessment Data			Location of the Results
AS 3959:2018	Applied to Assessment	Classified Vegetation and Topography Map(s)	Calculation Input Variables		Assessed Bushfire Attack Levels and/or Radiant Heat Levels
			Summary Data	Detailed Data with Explanatory and Supporting Information	
Method 1 (Simplified)	Yes	Figure 3.1	Table 3.2	Appendix A1	Table 3.1 Table 3.3 Figure 3.2
Method 2 (Detailed)	Yes	Figure 3.1	Table 3.2	Appendix A2	
Reasons for the Application of the Method 2 Procedure					
1.	A more specific result is sought.				

Identification of the specific issues associated with the site and/or proposed development that have necessitated the use of the Method 2 procedure:

The Guidelines for Planning in Bushfire Prone Areas require a BAL-29 APZ regardless of the vulnerability of the asset or its ability to comply with AS 3959 construction standards. A 10kW/m2 APZ has been applied as an appropriate maximum acceptable heat flux exposure for BESS cabinets and associated infrastructure.

A BAL-19 APZ has been applied as an appropriate maximum acceptable heat flux exposure has been applied to the Solar Arrays and HV Substation.

3.1.2 BAL Ratings Derived from the Contour Map

Table 3.1: Indicative and determined BAL(s) for identified assets.

BUSHFIRE ATTACK LEVEL FOR EXISTING/PLANNED BUILDINGS/STRUCTURE [1]			
Asset Description	Indicative BAL [2]	Determined BAL [2]	Radiant Heat Flux Stated as kW/m^2
HV Substation.	BAL-19	BAL-FZ	n/a
Solar Arrays and Associated Infrastructure.	BAL-19	BAL-FZ	n/a
BESS Cabinets and Associated Infrastructure.	BAL-12.5	BAL-FZ	<10kW/m2
Persons Onsite [3]	n/a	n/a	<2kW/m2

[1] The assessment data used to derive the BAL ratings is sourced from Table 3.1 and Figure 3.2 'BAL Contour Map'.

[2] Refer to the start of Section 3 for an explanation of indicative versus determined BAL ratings.

[3] No APZ is required to be installed specifically for Persons Onsite. This has only been provided to confirm that areas subject to <2kW/m2 radiant heat flux will be available onsite. See Figure 3.2.

3.1.3 Site Assessment Data Applied to Construction of the BAL Contour Map(s)

RELEVANT CLASSIFIED VEGETATION	
Identification of Classified Vegetation that is Relevant to the Production of the BAL Contour Map(s)	Relevant Vegetation Map
The relevant vegetation for the post-development BAL contour map will be any area of classified vegetation - both within the subject site (onsite) and external to the subject site (offsite) - that will remain at the intended end state of the subject development once earthworks, any clearing and/or landscaping and re-vegetation have been completed.	Figure No. 3.2
Supporting Assessment Details: None required.	

Table 3.2: Calculation inputs applied to deriving the vegetation separation distances corresponding to different levels of potential radiant heat transfer.

DATA APPLIED TO CALCULATE THE SITE SPECIFIC VEGETATION SEPARATION DISTANCES CORRESPONDING TO POTENTIAL RADIANT HEAT TRANSFER LEVELS [1]												
Applied BAL Determination Method	METHOD 1 - SIMPLIFIED PROCEDURE (AS 3959:2018 CLAUSE 2.2) AND METHOD 2 - DETAILED PROCEDURE (AS 3959:2018 APPENDIX B)											
The Calculation Input Variables - Corresponding to the Applied BAL Determination Method [2]												
Methods 1 and 2		Method 1	Method 2									
Vegetation Classification		FDI	Effective Slope		Site Slope	FFDI or GFDI	Flame Temp.	Elevation of Receiver	Flame Width	Fireline Intensity	Flame Length	Modified View Factor
			Applied Range	Measured								
Area	Class		degree range	degrees	degrees		K	metres	metres	kW/m	metres	% Reduction
1	(A) Forest	80	Upslope or flat 0	flat 0	flat 0	80	1090/1200 [3]	Default	Default	Default	Default	Default
2	(B) Woodland	80	Upslope or flat 0	flat 0	flat 0	80	1090/1200 [3]	Default	Default	Default	Default	Default
3	(C) Shrubland	80	Upslope or flat 0	flat 0	flat 0	80	1090/1200 [3]	Default	Default	Default	Default	Default
4	(D) Scrub	80	Upslope or flat 0	flat 0	flat 0	80	1090/1200 [3]	Default	Default	Default	Default	Default
5	(G) Grassland	80	d/slope >0-5	d/slope 5	flat 0	110	1090/1200 [3]	Default	Default	Default	Default	Default
6	(G) Grassland	80	Upslope or flat 0	flat 0	flat 0	110	1090/1200 [3]	Default	Default	Default	Default	Default

Note 1: The values used to indicate levels of potential radiant heat transfer (from fire in bushfire prone vegetation to exposed elements at risk), will be stated in subsequent tables as either as a bushfire attack level (BAL) and/or as kilowatts per square metre (kW/m2), as relevant to the application of the value and the type and use of the element at risk.

Note 2: All data and information supporting the determination of the classifications and values stated in this table is presented in Appendix A. Where the values are stated as 'default' these are either the values stated in AS 3959:2018, Table B1 or the values calculated as intermediate or final outputs through application of the equations of the AS 3959:2018 BAL determination methodology. They are not values derived by the assessor.

Note 3: 1090K has been applied for all constructed assets. 1200K has been applied in determining <2kW/m2 separation distances only.

Table 3.3: Vegetation separation distances corresponding to the stated levels of potential radiant heat transfer.

THE CALCULATED (SITE SPECIFIC) VEGETATION SEPARATION DISTANCES CORRESPONDING TO THE STATED LEVEL OF POTENTIAL RADIANT HEAT TRANSFER (METRES) [1]									
Vegetation Classification		Maximum Radiant Heat Transfer (Flux)							
		>40 kW/m²	40 kW/m²	29 kW/m²	19 kW/m²	12.5 kW/m²	N/A [2]	10 kW/m² (1090K)	2 kW/m² (1200K)
		Bushfire Attack Levels							
Area	Class	BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW		
1	(A) Forest	<16	16-<21	21-<31	31-<42	42-<100	>100	48.9	152
2	(B) Woodland	<10	10-<14	14-<20	20-<29	29-<100	>100	34.5	120
3	(C) Shrubland	<7	7-<9	9-<13	13-<19	19-<100	>100	23.5	92
4	(D) Scrub	<10	10-<13	13-<19	19-<27	27-<100	>100	32.9	116
5	(G) Grassland	<7	7-<9	9-<14	14-<20	20-<50	>50	24.6	95
6	(G) Grassland	<6	6-<8	8-<12	12-<17	17-<50	>50	21.2	87

Note 1: The calculated results are illustrated in Figure 3.2 as a BAL Contour Map and/ or additional defining lines as necessary. All applied calculation input variables are presented in Table 3.2. A copy of the radiant heat calculator output for each area of classified vegetation is presented in Appendix A2.

Note 2: The BAL-LOW rating does not represent a maximum level of radiant heat transfer. The rating is applied when the separation distance is at least 100m from all classified vegetation except Grassland, for which 50m applies.

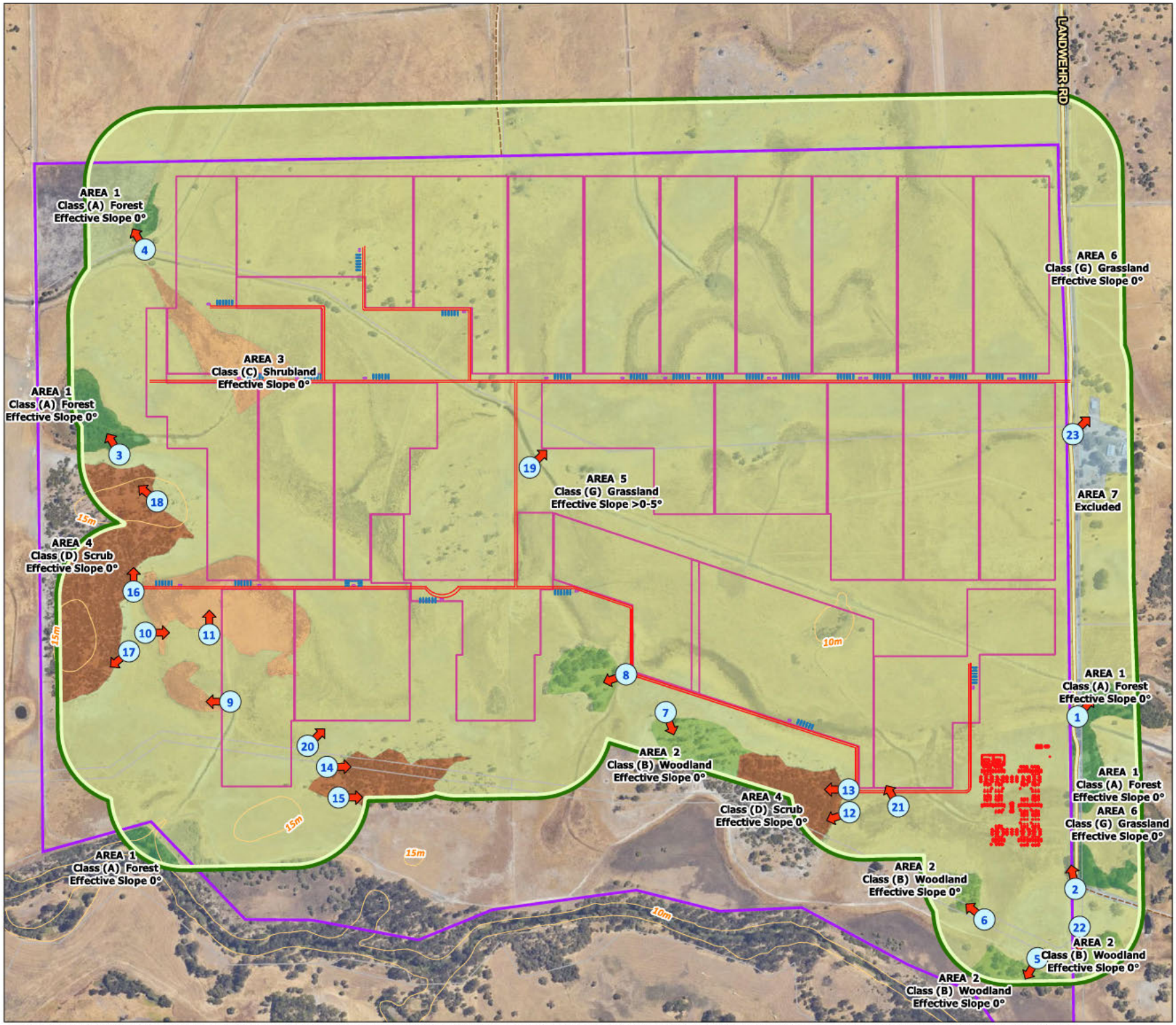


Figure 3.1

Classified Vegetation & Topography (Existing)

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- Photo and Direction
- 150m Assessment Area

Layout

- Inverters
- Access Tracks
- Panel Clusters
- Switchyard
- Battery

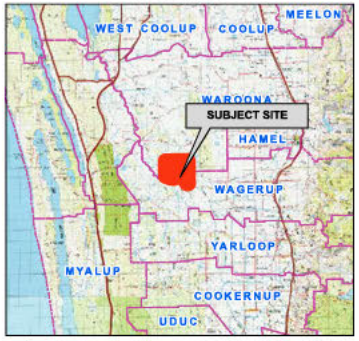
Classified Vegetation

- Class A - Forest
- Class B - Woodland
- Class C - Shrubland
- Class D - Scrub
- Class G - Grassland
- Exclusion 2.2.3.2

0 100 200 300 400

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: Joy 01-05-2024
SCALE (A3): 1 : 7000

BUSHFIRE PRONE PLANNING

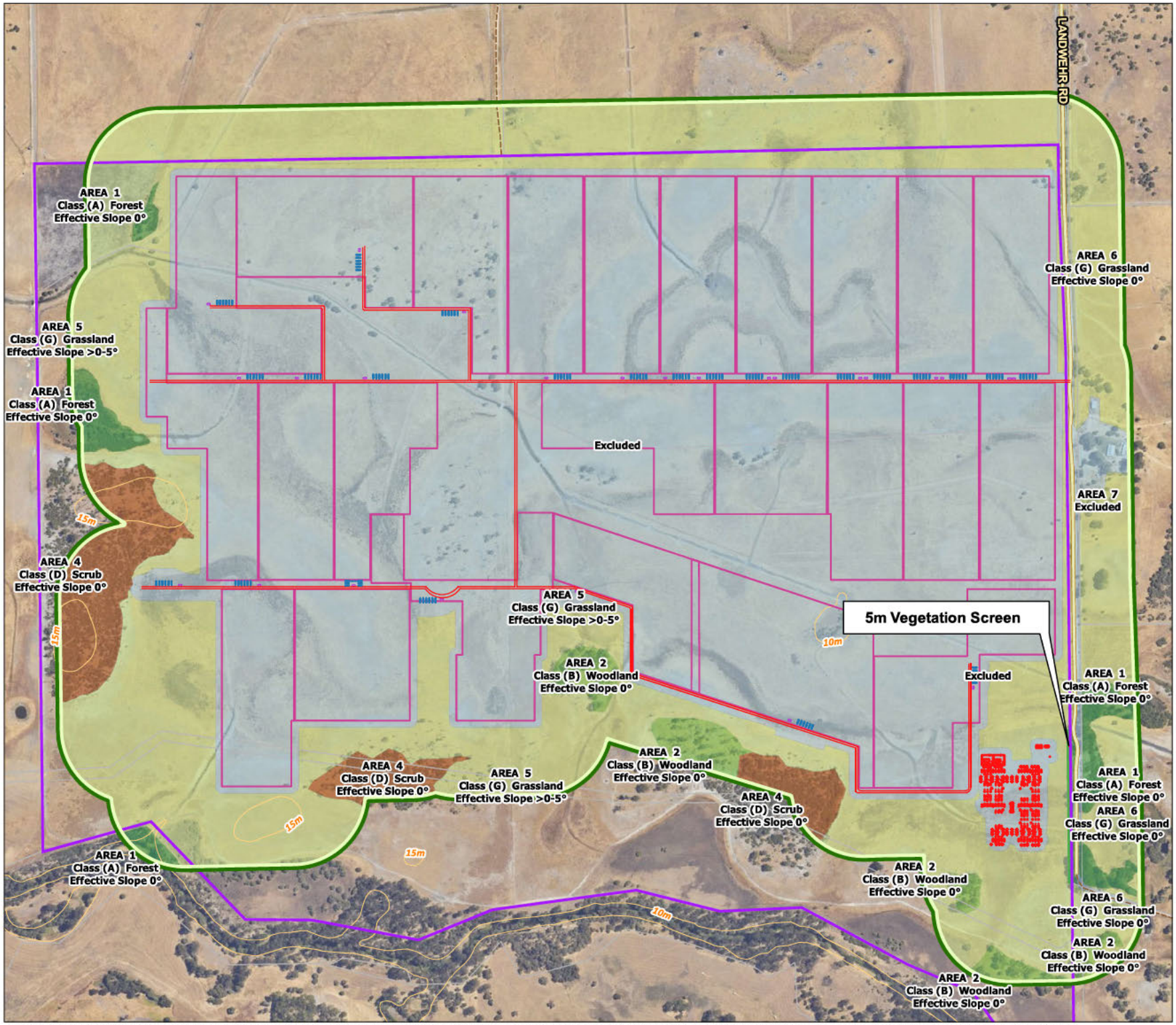


Figure 3.1.1

Classified Vegetation & Topography (Post Dev)

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- 150m Assessment Area

Layout

- Inverters
- Access Tracks
- Solar Array
- Switchyard
- Battery

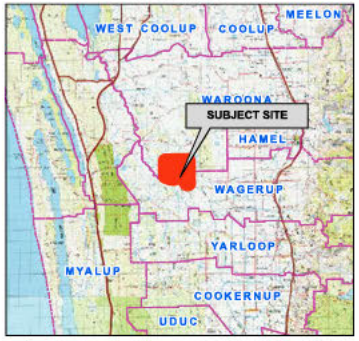
Classified Vegetation

- Class A - Forest
- Class B - Woodland
- Class C - Shrubland
- Class D - Scrub
- Class G - Grassland
- Exclusion 2.2.3.2

0 100 200 300 400

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: Joy 02-05-2024
SCALE (A3): 1 : 7000

BUSHFIRE PRONE PLANNING

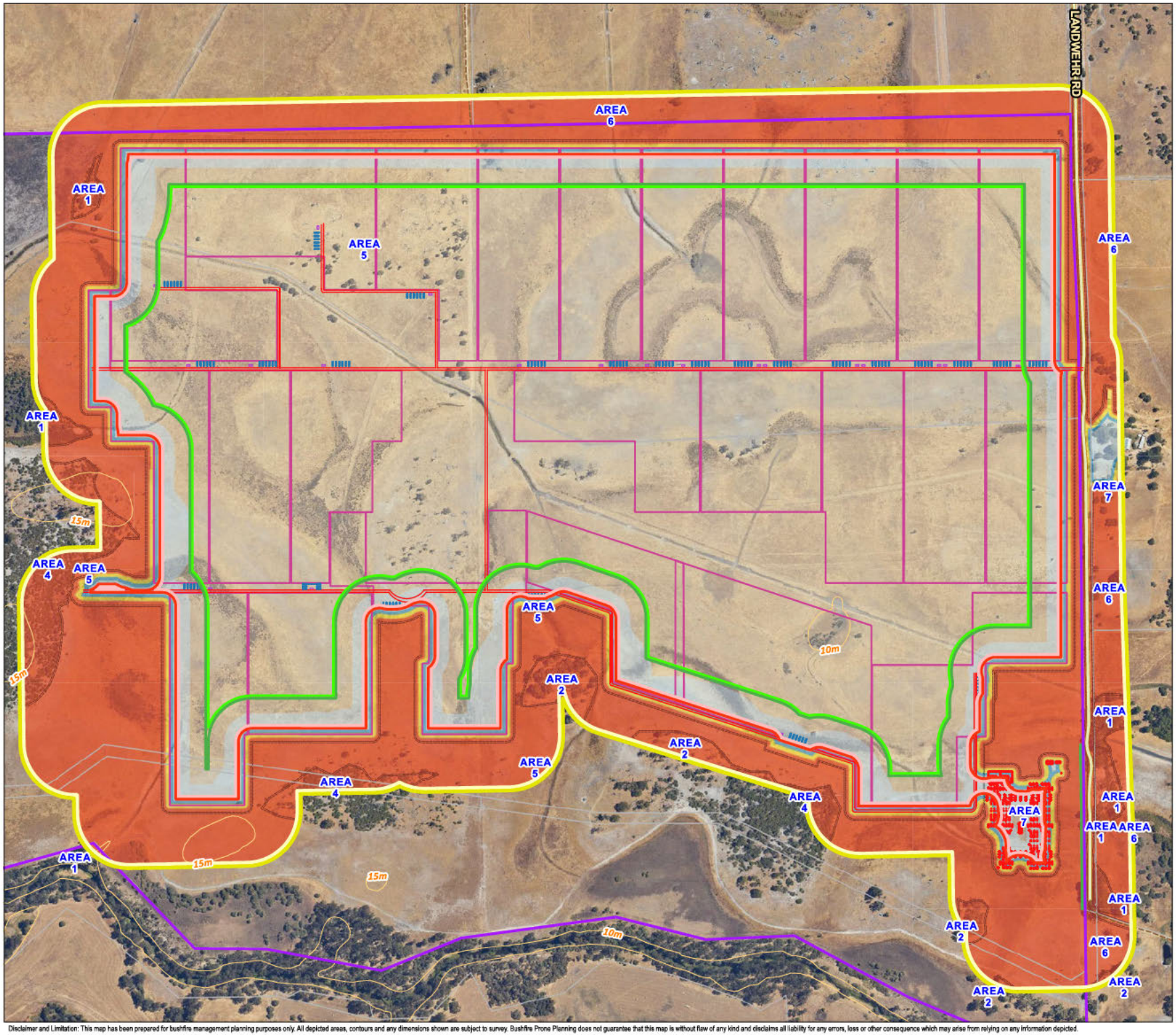


Figure 3.2

BAL Contour Map

Lot 45 & 25 on Plan 059266, Area: 87.8820 ha & 215.6412ha
981 Buller Road
WAROONA
SHIRE OF WAROONA

------ LEGEND ------

- Subject Site
- Cadastral
- 100m Assessment Area

Layout

- Inverters
- Access Tracks
- Panel Clusters
- Switchyard
- Battery

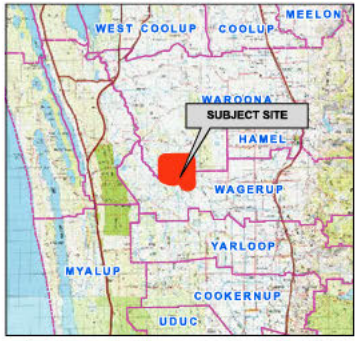
Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW
- 2kW APZ
- 10kW APZ

0 100 200 300 400

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: Joy 02-05-2024
SCALE (A3): 1 : 6500

BUSHFIRE PRONE PLANNING

4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

The Guidelines for Planning in Bushfire Prone Areas (WAPC 2021 v1.4), Appendix 5, establish that the application of this section of the BMP is intended to support ***strategic planning*** proposals. At the strategic planning stage there will typically be insufficient proposed development detail to enable all required assessments, including the assessment against the bushfire protection criteria.

Strategic Planning Proposals

For strategic planning proposals this section of the BMP will identify:

- Issues associated with the level of the threats presented by any identified bushfire hazard;
- Issues associated with the ability to implement sufficient and effective bushfire protection measures to reduce the exposure and vulnerability levels (of elements exposed to the hazard threats), to a tolerable or acceptable level; and
- Issues that will need to be considered at subsequent planning stages.

All Other Planning Proposals

For all other planning stages, this BMP will address what are effectively the same relevant issues but do it within the following sections:

- Section 2 – Bushfire Prone Vegetation - Environmental and Assessment Considerations: Assess environmental, biodiversity and conservation values;
- Section 3 – Potential Bushfire Impact: Assess the bushfire threats with the focus on flame contact and radiant heat; and
- Section 5 – Assessment Against the Bushfire Protection Criteria (including the guidance provided by the *Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2'):* Assess the ability of the proposed development to apply the required bushfire protection measures thereby enabling it to be considered for planning approval for these factors.

Is the proposed development a strategic planning proposal?	No

Comment: The assessment is not required for the subject proposal. However, bushfire hazard issues are comprehensively assessed within the associated Bushfire Risk Assessment for the High-Risk Land Use.

5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA (GUIDELINES V1.4)

5.1 Bushfire Protection Criteria Elements Applicable to the Proposed Development/Use

APPLICATION OF THE CRITERIA, ACCEPTABLE SOLUTIONS AND PERFORMANCE ASSESSMENT

The criteria are divided into five elements – location, siting and design, vehicular access, water and vulnerable tourism land uses. Each element has an intent outlining the desired outcome for the element and reflects identified planning and policy requirements in respect of each issue.

The example acceptable solutions (bushfire protection measures) provide one way of meeting the element's intent. Compliance with these automatically achieves the element's intent and provides a straightforward pathway for assessment and approval.

Where the acceptable solutions cannot be met, the ability to develop design responses (as alternative solutions that meet bushfire performance requirements) is an alternative pathway that is provided by addressing the applicable performance principles (as general statements of how best to achieve the intent of the element).

A merit based assessment is established by the SPP 3.7 and the Guidelines as an additional alternative pathway along with the ability of using discretion in making approval decisions (sections 2.5, 2.6 and 2.7). This is formally applied to certain development (minor and unavoidable – sections 5.4.1 and 5.7). Relevant decisions by the State Administrative Tribunal have also supported this approach more generally.

Elements 1 – 4 should be applied for all strategic planning proposals, subdivision or development applications, except for vulnerable tourism land uses which should refer to Element 5. Element 5 incorporates the bushfire protection criteria in Elements 1 – 4 but caters them specifically to tourism land uses. (Guidelines DPLH 2021v1.4)

The Bushfire Protection Criteria	Applicable to the Proposed Development/Use
Element 1: Location	Yes
Element 2: Siting and Design	Yes
Element 3: Vehicular Access	Yes
Element 4: Water	Yes
Element 5: Vulnerable Tourism Land Uses	No

5.2 Local Government Variations to Apply

Local governments may add to or modify the acceptable solutions to recognise special local or regional circumstances (e.g., topography / vegetation / climate). These are to be endorsed by both the WAPC and DFES before they can be considered in planning assessments. (Guidelines DPLH 2021v1.4).	
Do endorsed regional or local variations to the acceptable solutions apply to the assessments against the Bushfire Protection Criteria for the proposed development /use?	No

5.3 Assessment Statements for Element 1: Location

LOCATION	
Element Intent	To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⊘ Not relevant

E1 Location			**Compliant:**	Yes
A1.1 Development location	**Applicable:**	Yes	**Compliant:**	Yes

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES

☑ ☒ ⊘ The development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL-29 or below.

Supporting Assessment Details:

Each aspect of the proposed infrastructure will be subject to BAL-29 or below as shown in figure 3.1.1 and section 3 within this document.

ASSESSMENTS APPLYING THE GUIDANCE ESTABLISHED BY THE WAPC ELEMENT 1 & 2 POSITION STATEMENT (2019)

"Consideration should be given to the site context where 'area' is the land both within and adjoining the subject site. The hazards remaining within the site should not be considered in isolation of the hazards adjoining the site, as the potential impact of a bushfire will be dependent on the wider risk context, including how a bushfire could affect the site and the conditions for a bushfire to occur within the site."

Strategic Planning Proposals: Consider the threat levels from any vegetation adjoining and within the subject site for which the potential intensity of a bushfire in that vegetation would result in it being classified as an Extreme Bushfire Hazard Level (BHL). Identify any proposed design strategies to reduce these threats.

Structure Plans (lot layout known) and Subdivision Applications: As for strategic planning proposals but within the subject site the relevant threat levels to consider are the radiant heat levels represented by BAL-FZ and BAL-40 ratings.

The planning proposal is a development application, consequently the referenced position statement is not applicable to the Element 1 assessment.

5.4 Assessment Statements for Element 2: Siting and Design

SITING AND DESIGN OF DEVELOPMENT	
Element Intent	To ensure that the siting and design of development minimises the level of bushfire impact. (BPP Note: not building/construction design)
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⊘ Not relevant

E2 Siting and Design of Development			**Compliant:**	Yes
A2.1 Asset Protection Zone (APZ)	**Applicable:**	Yes	**Compliant:**	Yes

APZ DIMENSIONS – DIFFERENCES IN REQUIREMENTS FOR PLANNING ASSESSMENTS COMPARED TO IMPLEMENTATION

A key required bushfire protection measure is to reduce the exposure of buildings/infrastructure (as exposed vulnerable elements at risk), to the direct bushfire threats of flame contact, radiant heat and embers and the indirect threat of consequential fires that result from the subsequent ignition of other combustible materials that may be constructed, stored or accumulate in the area surrounding these structures. This reduces the associated risks of damage or loss.

This is achieved by separating buildings (and consequential fire fuels as necessary) from areas of classified bushfire prone vegetation. This area of separation surrounding buildings is identified as the Asset Protection Zone (APZ) and consists of no vegetation and/or low threat vegetation or vegetation continually managed to a minimal fuel condition. The required separation distances will vary according to the site specific conditions and local government requirements.

The APZ dimensions stated and/or illustrated in this Report can vary dependent on the purpose for which they are being identified.

> *Note: Appendix B 'Onsite Vegetation Management' provides further information regarding the different APZ dimensions that can be referenced, their purpose and the specifications of the APZ that are to be established and maintained on the subject lot.*

THE 'PLANNING BAL-29' APZ DIMENSIONS

Purpose: To provide evidence of the development or use proposal's ability to achieve minimum vegetation separation distances. To achieve 'acceptable solution' planning approval for this factor, it must be demonstrated that the minimum separation distances corresponding to a maximum level of radiant transfer to a building of 29 kW/m², either exist or can be implemented (with certain exceptions). These separation distances are the 'Planning BAL-29' APZ dimensions.

The 'Planning BAL-29' APZ is not necessarily the size of the APZ that must be physically implemented and maintained by a landowner. Rather, its sole purpose is to identify if an acceptable solution for planning approval can be met.

THE 'REQUIRED' APZ DIMENSIONS

Purpose: Establishes the dimensions of the APZ to be physically implemented by the landowner on their lot: These will be the minimum required separation distances from the subject building(s) to surrounding bushfire prone vegetation (identified by type and associated ground slope). These are established by:

A. The 'BAL Rating APZ' of the subject building(s) when distances are greater than 'B' below (except when 'B' establishes a maximum distance); or

B. The 'Local Government' APZ' derived from the Firebreak/Hazard Reduction Notice when distances are greater than 'A' above, other than when a maximum distance is established, in which case this will apply; or

C. A combination of 'A' and 'B'.

> *Within this Report/Plan it is the **'Planning BAL-29' APZ** that will be identified on maps, diagrams and in tables as necessary – unless otherwise stated.*
>
> *The **'Required' APZ** dimension information will be presented in Appendix B1.1 and on the Property Bushfire Management Statement, when required to be included for a development application.*

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES

☑ ☐ ☐	**APZ Width:** The proposed (or a future) habitable building(s) on the lot(s) of the proposed development - or an existing building for a proposed change of use – can be (or is) located within the developable portion of the lot and be surrounded by a 'Planning BAL-29' APZ of the required dimensions (measured from any external wall or supporting post or column to the edge of the classified vegetation), that will ensure their exposure to the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2.
☐ ☐ ⊘	**Restriction on Building Location:** It has been identified that the current developable portion of a lot(s) provides for the proposed future (or a future) building/structure location that will result in that building/structure being subject to a BAL-40 or BAL-FZ rating. Consequently, it may be considered necessary to impose the condition that a restrictive covenant to the benefit of the local government pursuant to section 129BA of the Transfer of Land Act 1893, is to be placed on the certificate(s) of title of the proposed lot(s) advising of the existence of a restriction on the use of that portion of land (refer to Code F3 of Model Subdivision Conditions Schedule, WAPC June 2021 and Guidelines s5.3.2).
☑ ☐ ☐	**APZ Location:** The required dimensions for a 'Planning BAL-29' APZ can be contained solely within the boundaries of the lot(s) on which the proposed (or a future) habitable building(s) - or an existing building(s) for a proposed change of use – is situated.
☐ ☐ ⊘	**APZ Location:** The required dimensions for a 'Planning BAL-29' APZ can be partly established within the boundaries of the lot(s) on which the proposed (or a future) habitable building(s) - or an existing building(s) for a proposed change of use – is situated. The balance of the APZ would exist on adjoining land that satisfies the exclusion requirements of AS 3959:2018 cl 2.2.3.2 for non-vegetated areas and/or low threat vegetation and/or vegetation managed in a minimal fuel condition.
☐ ☐ ⊘	**APZ Location:** It can be justified that any adjoining (offsite) land forming part of a 'Planning BAL-29' APZ will: • If non-vegetated, remain in this condition in perpetuity; and/or • If vegetated, be low threat vegetation or vegetation managed in a minimal fuel condition in perpetuity.

☑ ☐ ☐	**APZ Management:** The area of land (within each lot boundary), that is to make up the required 'Landowner' APZ dimensions (refer to Appendix B, Part B1), can and will be managed in accordance with the requirements of the Guidelines Schedule 1 'Standards for Asset Protection Zones' (refer to Appendix B).
☐ ☐ ⊘	**Staged Subdivision:** The subdivision proposes development in stages and each stage is to comply with the relevant bushfire protection criteria. A balance lot is created or classified vegetation within a subsequent stage will be removed and/or modified and/or be subject to ongoing management, to ensure that proposed lots within the current stage of the subdivision achieve a development site subject to 29 kW/m^2 or below. The planned approach for achieving the required outcome is described in the supporting assessment details below.
☑ ☐ ☐	**Firebreak/Hazard Reduction Notice:** Any additional requirements established by the relevant local government's annual notice to install firebreaks and manage fuel loads (issued under s33 of the Bushfires Act 1954), can and will be complied with.

Supporting Assessment Details:

The entire development is able to achieve a 'Planning BAL-29 APZ' within the lot boundary.

The proposed Waroona Renewable Energy Project can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2 (BAL-29). The required APZ specifications of width, location and management can be achieved. The minimum APZ dimensions applied exceed the minimum BAL-29 required for planning approval. See Section 5.8 Item 3.

The balance of the APZ will be managed in accordance with the technical requirements established by the Schedule 1: 'Standards for Asset Protection Zones (Guidelines). The APZ specifications are also detailed in Appendix B and the Shire of Waroona may have additional requirements established by their Firebreak Notice.

ASSESSMENTS APPLYING THE GUIDANCE ESTABLISHED BY THE WAPC ELEMENT 1 & 2 POSITION STATEMENT (2019)

Strategic Planning Proposals: "At this planning level there may not be enough detail to demonstrate compliance with this element. The decision-maker may consider this element is satisfied where A1.1 is met."

Structure Plans (lot layout known) and Subdivision Applications: "Provided that Element 1 is satisfied, the decision-maker may consider approving lot(s) containing BAL-40 or BAL-FZ under the following scenarios.

The planning proposal is a development application, consequently the referenced position statement is not applicable to the proposed development.

5.5 Assessment Statements for Element 3: Vehicular Access

VEHICULAR ACCESS	
Element Intent	To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use cannot comply with all applicable acceptable solutions. An alternative solution cannot be provided. The intent of the element cannot be achieved.
Pathway Applied to Provide an Alternative Solution	Bushfire Risk - Assessment and Management Report - is developed to demonstrate all possible bushfire protection measures that can be implemented and identify the subsequent residual risk levels applying to elements exposed to the bushfire hazard.

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

The technical construction requirements for access types and components, and for each firefighting water supply component, are also presented in Appendices C and D. The local government will advise the proponent where different requirements are to apply and when any additional specifications such as those for signage and gates are to apply (these are included in the relevant appendix if requested by the local government).

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⦸ Not relevant

E3 Vehicular Access			**Compliant:**	No
A3.1 Public roads	**Applicable:**	Yes	**Compliant:**	Yes

☑ ☐ ☐	The technical construction requirements of vertical clearance and weight capacity (Guidelines, Table 6) can and will be complied with (Refer also to Appendix C in this BMP).
☑ ☐ ☐	All other applicable technical requirements of trafficable width, gradients and curves, are required to be in "accordance with the class of road as specified in the IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Ausroad Standards and/or any applicable standard in the local government area" (Guidelines, Table 6 and E3.1. Refer also to Appendix C in this BMP). The assessment conducted for the bushfire management plan indicates that it is likely that the proposed development can and will comply with the requirements. However, the applicable class of road, the associated technical requirements and subsequent proposal compliance, will need to be confirmed with the relevant local government and/or Main Roads WA.
☑ ☐ ☐	A traversable verge is available adjacent to classified vegetation (Guidelines, E3.1), as recommended.

Supporting Assessment Details:

Landwehr Road was measured to be 5m in width at the narrowest point. This is likely to comply with the applicable class of road.

The bushfire consultant cannot confirm weight capacity of the road, however, battery cabinets exceed 15 tonnes (approximately 30 tonnes), so logically the road must comply with the required 15 tonne weight capacity.	
A3.2a Multiple access routes	**Applicable:** Yes **Compliant:** No
☐ ☒ ☐	For each lot, two-way public road access is provided in two different directions to at least two different suitable destinations with an all-weather surface.
☐ ☒ ☐	The two-way access is available at an intersection no greater than 200m from the relevant boundary of each lot, via a no-through road.
☐ ☒ ☐	The two-way access is not available at an intersection within 200m from the relevant boundary of each lot. However, the available no-through road satisfies the established exemption for the length limitation in every case. These requirements are: • Demonstration of no alternative access (refer to A3.3 below); • The no-through road travels towards a suitable destination; and • The balance of the no-through road that is greater than 200m from the relevant lot boundary is within a residential built-out area or is potentially subject to radiant heat levels from adjacent bushfire prone vegetation that correspond to the BAL-LOW rating (<12.5 kW/m^2).
Supporting Assessment Details: The only access road to the development is Landwehr Road. The proposed development is located at the end of Landwehr Road which is more than 2km from the nearest intersection (to Buller Road). There is an unofficial compacted dirt road connecting Landwehr Road to Bremmer Road which can provide access / exit in the case of an emergency. The road is wide and, in most places, meets the technical requirements, however, it is not a designated public road and can therefore not be used as an acceptable solution to this element. The development will have two access points onto Landwehr Road. See section 5.7 of this report for additional access recommendations.	
A3.2b Emergency access way	**Applicable:** No **Compliant:** N/A
☐ ☐ ⊘	The proposed or existing EAW provides a through connection to a public road.
☐ ☐ ⊘	The proposed or existing EAW is less than 500m in length and will be signposted and gated (remaining unlocked) to the specifications stated in the Guidelines and/or required by the relevant local government.
☐ ☐ ⊘	The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.2b. Refer also to Appendix C in this BMP), can and will be complied with.
☐ ☐ ⊘	The subdivision proposes development in stages and each stage is to comply with the relevant bushfire protection criteria. A temporary EAW is planned to facilitate the staging arrangements of a subdivision as an interim second access route until the required second access route is constructed as a public road in a subsequent stage. The planned approach for achieving the required outcome is described in the supporting assessment details below.
Supporting Assessment Details: An Emergency Access way cannot be used as an alternative to A3.2a as the subject lot does not boarder on any other public road.	

A3.3 Through-roads	Applicable:	No	Compliant:	N/A
☐ ☐ ⊘	A no-through public road is necessary as no alternative road layout exists due to site constraints.			
☐ ☐ ⊘	The no-through public road length does not exceed the established maximum of 200m to an intersection providing two-way access (Guidelines, E3.3).			
☐ ☐ ⊘	The no-through public road exceeds 200m but satisfies the exemption provisions of A3.2a as demonstrated in A3.2a above.			
☐ ☐ ⊘	The public road technical construction requirements (Guidelines, Table 6 and E3.1. Refer also to Appendix C in this BMP), can and will be complied with as established in A3.1 above.			
☐ ☐ ⊘	The turnaround area requirements (Guidelines, Figure 24) can and will be complied with.			
Supporting Assessment Details: None required.				
A3.4a Perimeter roads	**Applicable:**	**No**	**Compliant:**	**N/A**
☐ ☐ ⊘	The proposed greenfield or infill development consists of 10 or more lots (including those that are part of a staged subdivision) and therefore should have a perimeter road. This is planned to be installed.			
☐ ☐ ⊘	The proposed greenfield or infill development consists of 10 or more lots (including those that are part of a staged subdivision). However, it is not required on the established basis of: • The vegetation adjoining the proposed lots is classified Class G Grassland; • Lots are zoned rural living or equivalent; • It is demonstrated that it cannot be provided due to site constraints; or • All lots have existing frontage to a public road.			
☐ ☐ ⊘	The technical construction requirements of widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.4a) can and will be complied with.			
Supporting Assessment Details: None required.				
A3.4b Fire service access route	**Applicable:**	**No**	**Compliant:**	**N/A**
☐ ☐ ⊘	The FSAR can be installed as a through-route with no dead ends, linked to the internal road system every 500m and is no further than 500m from a public road.			
☐ ☐ ⊘	The technical construction requirements of widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.4b. Refer also to Appendix C in this BMP), can and will be complied with.			
☐ ☐ ⊘	The FSAR can and will be signposted. Where gates are required by the relevant local government, the specifications can be complied with.			
☐ ☐ ⊘	Turnaround areas (to accommodate type 3.4 fire appliances) can and will be installed every 500m on the FSAR.			

Supporting Assessment Details: None required.				
A3.5 Battle-axe access legs	**Applicable:**	No	**Compliant:**	N/A
☐ ☐ ⊘	A battle-axe leg cannot be avoided due to site constraints.			
☐ ☐ ⊘	The proposed development is in a reticulated area and the battle-axe access leg length from a public road is no greater than 50m. No technical requirements need to be met.			
☐ ☐ ⊘	The proposed development is not in a reticulated area. The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.5. Refer also to Appendix C in this BMP), can and will be complied with.			
☐ ☐ ⊘	Passing bays can and will be installed every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m.			
Supporting Assessment Details: None required.				
A3.6 Private driveways	**Applicable:**	Yes	**Compliant:**	Yes
☐ ☐ ⊘	The private driveway to the most distant external part of the development site is within a lot serviced by reticulated water, is accessed via a public road with a speed limit of 70 km/hr or less and has a length is no greater than 70m (measured as a hose lay). No technical requirements need to be met.			
☑ ☐ ☐	The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.6. Refer also to Appendix C in this BMP), can and will be complied with.			
☑ ☐ ☐	Passing bays can and will be installed every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m.			
☑ ☐ ☐	The turnaround area requirements (Guidelines, Figure 28, and within 30m of the habitable building) can and will be complied with.			
Supporting Assessment Details: Solar panel banks, decentralised BESS cabinet clusters, and the HV substation, should meet the same requirements as for a 'habitable building,' for the purposes of Element 3 A3.6 Private Driveways. All internal roads within the development area will comply with technical construction requirements as outlined in Table 6 of the Guidelines and Appendix C of this document. The internal roads will be looped around the site, with multiple loop designs as roads will run the perimeter of BESS clusters and solar arrays. Section 5.8 of this BMP includes: • Item 7 requires that internal access roads are constructed to have 6m trafficable clearance, and; • Item 8 requires that two access points to the property are installed.				

5.6 Assessment Statements for Element 4: Water

WATER	
Element Intent	To ensure water is available to enable people, property and infrastructure to be defended from bushfire.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

The technical construction requirements for access types and components, and for each firefighting water supply component, are also presented in Appendices C and D. The local government will advise the proponent where different requirements are to apply and when any additional specifications such as those for signage and gates are to apply (these are included in the relevant appendix if requested by the local government).

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⊘ Not relevant

E4 Water	**Compliant:**	Yes

A4.1 Identification of future firefighting water supply	**Applicable:**	No	**Compliant:**	N/A

☑ ☒ ⊘	It can be demonstrated that reticulated or sufficient non-reticulated water for firefighting can be provided at the subdivision and/or development application stage in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2.

Supporting Assessment Details:

None required.

A4.2 Provision of water for firefighting purposes	**Applicable:**	Yes	**Compliant:**	Yes

☐ ☐ ⊘	A reticulated water supply is available to the proposed development. The existing hydrant connection(s) are provided in accordance with the specifications of the relevant water supply authority.
☐ ☐ ⊘	A reticulated water supply will be available to the proposed development. Hydrant connection(s) can and will be provided in accordance with the specifications of the relevant water supply authority.
☑ ☐ ☐	A static water supply (tank) for firefighting purposes will be installed on the lot that is additional to any water supply that is required for drinking and other domestic purposes.
☐ ☐ ⊘	A strategic water supply (tank or tanks) for firefighting purposes will be installed within or adjacent to the proposed development that is additional to any water supply that is required for drinking and other domestic purposes. The required land will be ceded free of cost to the local government and the lot or road reserve where the tank is to be located will be identified on the plan of subdivision.

☐ ☐ ⊘	The strategic static water supply (tank or tanks) will be located no more than 10 minutes travel time from a subject site (at legal road speeds).
☑ ☐ ☐	The technical requirements (location, number of tanks, volumes, design, construction materials, pipes and fittings), as established by the Guidelines (A4.2, E4 and Schedule 2) and/or the relevant local government, can and will be complied with.

Supporting Assessment Details:

The *Guidelines for Planning in Bushfire Prone Areas* does not establish a firefighting water supply for non-habitable structures, including high-risk uses. Battery Energy Storage Systems and Solar Farms do not have an applicable firefighting water supply under state or national requirements. A supply of 50,000L would meet **intent** of planning requirements under SPP 3.7 and the *Guidelines for Planning in Bushfire Prone Areas* v1.4.

The Bushfire Risk Report prepared alongside this BMP, reviews the water supply and specifications for the proposed development. A reticulated water supply is not available, and thus a static water supply will be required.

The water supply will comply with the CFA Design Guidelines and Model Requirements for Renewable Energy Facilities (Victoria Country Fire Authority August 2023). See Section 6.1.1 Item 4.2.2 of the associated Bushfire Risk Report.

The entirety of all BESS cabinets must have a water tank sited within 120m. This will mean water tanks will be strategically sited throughout the site, and modifications to the location of BESS clusters may occur to ensure they can be positioned within this buffer. Each water tank must have a minimum capacity of 50,000L.

An additional 50,000L strategic water tank will be installed outside the property boundary, requested by and vested in the Shire of Waroona.

Water tanks will be installed within the development in accordance with the requirements established in the Bushfire Risk Report. These requirements have been outlined in Section 5.8 Item 18 of this BMP.

Refer to information contained in Appendix D for the firefighting water supply specifications and technical requirements established by the *Guidelines for Planning in Bushfire Prone Areas v1.4*.

5.7 Non-Compliance – Additional Assessments

5.7.1 Develop a Risk Assessment and Management Report

The intent of State Planning Policy No. 3.7: Planning in Bushfire Prone Areas (SPP 3.7) is "to implement effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure".

The application of all relevant acceptable solutions (i.e., protection measures), established by the Guidelines, are considered by the regulatory authorities in WA (within in the planning environment), to reduce risks associated with a bushfire event, to at least a tolerable level.

Where the acceptable solutions cannot be fully complied with, an appropriate risk assessment might be used to identify protection measure variations and additions that can be applied and better determine the risk level.

The risk presented by a natural hazard (such as a bushfire) is a consequence of the interaction between the potential threats associated with the hazard and the exposure and vulnerability of any elements at risk from those threats (the 'exposed elements').

The application of available protection measures will lower the risk by:

1. Reducing the number and/or level of the hazard threats; and/or
2. Reducing the level of exposure and/or vulnerability of the elements at risk.

A Bushfire Risk Assessment and Management Report will be produced as a separate document by Bushfire Prone Planning. Identified varied and additional bushfire protection measures that are recommended to be applied will be incorporated into this Bushfire Management Plan.

A Bushfire Risk Report has been prepared alongside this Bushfire Management Plan due to its classification as a High-Risk Land Use.

The Risk Assessment process includes an assessment of the internal and external road network and a detailed assessment of bushfire prone vegetation as the relevant hazard. The site is intended to be unstaffed. Any persons evacuating from the site will either be emergency services or staff/visitors/contractors, who must necessarily have a vehicle to reach and traverse the site. Any non-emergency services personnel will be familiar with the local area and will self-evacuate to a preferred location.

Most of the proposed development area will be subject to <2kW/m2 radiant heat flux (calculated at 1200K) in a bushfire. Where safe egress is no longer possible, persons can shelter onsite.

5.8 Additional Bushfire Protection Measures to be Implemented

The following bushfire protection measures are recommended to be implemented and maintained. They are additional to, or a variation of, those established by the relevant acceptable solutions applied to the proposed development/use within Sections 5 of this BMP (as applicable to the proposed development).

The intent of their application is to improve the bushfire performance of the proposed development/use and reduce residual risk levels to persons and property from a bushfire event.

The development of these additional and/or varied protection measures originates the following potential sources (not exhaustive):

1. Out of the relevant merit based assessment when the Section titled 'Non-compliance – Additional Assessments' has been used in this BMP;
2. Out of the relevant performance based assessment when Section titled 'Non-compliance – Additional Assessments' has been used in this BMP;
3. Out of the development of any other required bushfire planning documents. These include a Bushfire Emergency Plan and the Bushfire Risk Assessment and Management Report;
4. Out of any additional bushfire planning guidance documents or position statements issued by the WA Department of Planning, Lands and Heritage;
5. From any 'Conditions' which may be applied to a 'Planning Approval' or a 'Notice of Determination; or
6. As a recommendation from the bushfire consultant.

The following table summarises the requirements/recommendations with the detail provided in the following sections.

When necessary, the implementation responsibility for these additional protection measures will be stated in Section 6 of this BMP and included in other operational documents as relevant.

SUMMARY OF ADDITIONAL BUSHFIRE PROTECTION MEASURES TO BE IMPLEMENTED					
No.	Description of the Protection Measure to Apply to the Proposed Development	BRR Ref.	Risk Reducing Component Being Applied		Implementation Priority Rating
			Type	Protection Principle	
1	Contact Waroona West BFB, Waroona VFESU, Pinjarra VFRS, and Mandurah CFRS prior to commissioning and offer a familiarisation visit and explanation of emergency procedures, access, hazards, and fire detection and suppression systems. Contact DFES Built Environment Branch to determine if an Emergency Response Guide (FES-ERG) is required. A comprehensive Emergency Management Plan is to be prepared for the facility. This is to outline Prevention, Preparedness, Response, and Recovery (PPRR) procedures for potential emergencies, of which bushfire is one component. The following details have been identified for inclusion within the Emergency Management Plan (and/or the Site Operating Procedures, as appropriate to the document structure): **Details and Information** • A summary of fire hazards and risks to and from the site, specific to its location, infrastructure, activities and occupancy. • A facility description, including infrastructure details, operations, number of personnel, and operating hours. • A site plan depicting structures/built assets, operational areas, site access points and internal roads, firefighting infrastructure, drainage (as applicable), and neighbouring properties. • Up-to-date contact details for facility personnel, including for at least two persons who may be able to provide information or support during emergencies (24 hours a day). Update contact information when necessary. • Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eye-wash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid. • Contact information for 24/7/365 specialist technical support for the battery energy storage system.	1.9	Threat Reduction	Prevent bushfire ignition by controlling heat energy sources.	High

	• Specifications for safe operating conditions for temperature. • Schematics and technical data for battery energy storage system containers/enclosures, the number of containers/enclosures on-site, and the number of battery racks or modules within each container/enclosure. • Details of the hazards for the battery energy storage system, including thermal events/runaway, electrical safety hazards, explosion hazards, dangerous goods hazards (including off-gassing), and the effects of fire on the battery energy storage system (eg., explosion, release of toxic gases). • Details of all provided battery failure/safety and protective systems, including a description, the activation process/automatic trigger, and any hazards associated with these systems. **Procedures** **Prevention** • Smoking restrictions or designated smoking locations. • Procedures regarding vegetation management and accidental ignition prevention. • The specifications of Schedule 1 of the Guidelines for Planning in Bushfire Prone Areas and the Shire of Waroona Firebreak Notice can be achieved via livestock grazing. The vegetation must continue to be monitored for compliance with Schedule 1, and additional vegetation management works undertaken as required. • Heavy equipment is not to be operated where long grass (>100mm) or heavy leaf litter is present, particularly during the bushfire season (see the Local Government Prohibited Burning Period). • Servicing of battery energy storage systems should not take place on days of High, Extreme or Catastrophic Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour. The following procedures should be completed prior to the bushfire season (see the Local Government Prohibited Burning Period): • Scheduled maintenance to assets, emergency equipment, or fire detection/prevention systems. • The ongoing requirements outlined in the Bushfire Management Plan. • Scheduled housekeeping inspections including:				

	○ Hazard identification - ensuring that infrastructure, plant, equipment, vehicles and safety/warning signs show no signs of damage or dilapidation. ○ Facility access - ensuring all vehicle site access points, including emergency access points, are clear and accessible. ○ Fire protection systems and equipment – ensuring that all equipment is unobstructed, clearly identifiable, in-service and performing optimally. ○ Vegetation management - ensuring that any accumulation of combustible materials is cleared from infrastructure, buildings and fire breaks, and removed from the site. ○ Security measures - ensuring that fences, gates, and security cameras are inspected for damage, and that any damage is immediately actioned (eg., repaired or replaced). **Preparedness** • Evacuation and shelter-in-place triggers and procedures, unless included within a Bushfire Emergency Plan. • Procedures for review of the Emergency Management Plan, including the ongoing effectiveness of control measures. • An ongoing schedule of site familiarisation for Waroona West BFB, Waroona VFESU, Pinjarra VFRS, and Mandurah CFRS, to account for changing personnel, facility infrastructure and hazards. • The Emergency Management Plan and any Emergency Response Guide (FES-ERG) should contain procedures for isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities, and their advised triggers. • Visitors must provide mobile phone numbers to site management. Within the Emergency Management Plan, a key response will be to contact and advise all persons onsite. Both Telstra and Optus networks have coverage over the entirety of the site. • A bushfire monitoring procedure for the Restricted Burning Period (see Shire of Waroona Firebreak Notice), including: ○ Nominating a person/role in your Emergency Control Organisation to be responsible for identifying, responding to, and communicating Fire Danger Ratings in advance.				

	○ Identifying bushfire activity within 20km of the facility. ○ Communicating this information to everyone likely to be present on-site, and relevant off-site personnel. ○ An outline of site activities to be modified or cease as a response (if any). **Response** DFES Comcen should immediately be notified of: • Any shorts, faults, temperature increases above normal parameters (eg. precursor to thermal events/runaway). • Equipment failures with the potential to ignite or propagate fire. • Off-gassing, smoke or fire. • The monitoring personnel can determine if Emergency Services response is necessary. The notification is for awareness. Bushfire emergency response procedures must include: • A specific action to notify (or verify notification) the emergency services, at the earliest possible stage of the emergency. • The person or role responsible for making or verifying the notification. • The '000' number in the procedure. • Communicating with site personnel and supporting their physical relocation. • Ensuring all buildings and plant are adequately secured. • Initiating any bushfire protection measures such as sprinkler or deluge systems, or pre-emptive shut-down, prior to the arrival of the fire front. • Liaising with the emergency services where possible. Consider the following criteria for inclusion within the Emergency Management Plan. All criteria are for consideration only, being non-bushfire measures identified within The Design Guidelines and Model Requirements – Renewable Energy Facilities (CFA August 2023). • Emergency procedures based on identified risks and hazards of the battery energy storage system and related infrastructure, including but not limited to: i. Electrical infrastructure faults and fire.				

	ii. Battery energy storage system damage or faults, including battery monitoring faults, temperature increases above normal operating parameters, electrical faults, chemical spills or reactions, off-gassing, thermal events/runaway, smoke and fire. iii. The management of fire water runoff. • A plan for partial and full decommissioning of the battery energy storage system in the event of an emergency incident that renders the facility inoperable or unsafe, prior to its anticipated end-of-life. • The shut down and/or isolation procedures if the batteries are involved in fire, and appropriate personnel contact details for verifying that the battery enclosure/container system has been isolated/shut-down and de-energised during emergencies.				
2	A minimum of one emergency muster point should be located within an area subject to <2kW/m2 radiant heat flux for persons onsite during a bushfire event, where evacuation is no longer safe. The area subject to <2kW/m2 radiant heat flux and a potential (example only) muster point location is provided in Figure 3.2 of the Bushfire Management Plan.	2.5	Exposure Reduction – Persons	Separation from Bushfire Threats	Lowest
3	<u>Class 1-10 Buildings</u> If the building type/design is not required to or cannot construct to AS 3959, they should be sited to ensure radiant heat flux exposure does not exceed 10kW/m2 radiant heat flux. Buildings can otherwise be constructed to meet their assessed BAL. Any future Class 1-10 buildings should be sited within previously cleared, managed areas to reduce the requirement for ongoing management. <u>BESS</u> The APZ for BESS cabinets and associated infrastructure will ensure exposure to the bushfire hazard threat of radiant heat will be limited to a maximum radiant heat flux of 10 kW/m2 (calculated with an assumed flame temperature of 1090K) by providing the required separation distances from the bushfire hazard. The 10m portion of the APZ immediately around the BESS, PCUs, and substations must be entirely and permanently non-vegetated (sealed, compacted limestone, gravel, mineral earth etc). BESS cabinets are recommended to be sited on concrete slabs or other sealed, non-combustible surface. <u>Solar Panels</u>	4.3 6.3 7.3 8.3	Exposure Reduction – Structures/Assets	Separation from Bushfire Threats	Highest

	A 10kW/m2 APZ should be applied where possible to ensure cabling is not exposed to its critical threshold. BAL-19 has been adopted as site constraints limit the installation of a 10kW/m2 APZ. It must be therefore recognised that exposed cabling (not shielded or buried underground) positioned within 10kW<19kW buffer may be damaged/destroyed in a bushfire event and require replacement, and PV panels will not ignite but may suffer damage. <u>Substation</u> A BAL-19 APZ is required for the HV substation. Exposed cabling (not shielded or buried underground) positioned within 12kW<19kW buffer may be damaged/destroyed in a bushfire event and require replacement. The 10m portion of the APZ around the substation must be entirely non-vegetated. The substation footprint should be entirely and permanently non-vegetated (sealed, compacted limestone, gravel, mineral earth etc).				
4	Any future Landscape Management Plan should be reviewed by the Bushfire Consultant to provide additional advice on vegetation location, demographics, and structure.	6.4 7.4	Exposure Reduction – Structures/Assets	Separation from Bushfire Threats	Medium
5	All non-structural combustible materials are to be removed within 10m of assets. This includes but is not limited to; waste, leaf litter, machinery, grasses, vehicles, fuel, furniture, and timber. When storage of flammable items or materials are stored on site temporarily (for maintenance etc), separation distances must be complied with. This requirement is to be included in the Site Operating Procedures document. Where the manufacturer specification does not specify a distance between BESS cabinets and other structures, Class 1-10 buildings and solar arrays should be sited a minimum of 15m from BESS cabinets.	4.7 6.7 7.7	Exposure Reduction – Structures/Assets	Separation from Bushfire Threats	High
6	Cabling and plumbing subject to >10kW/m2 (not within the <10kW/m2 setback), or beyond footprint of buildings or constructed assets, are recommended to be installed underground, or shielded with non-combustible material (or enclosed) where practical.	4.12 6.12 7.12 8.12	Exposure Reduction – Structures/Assets	Shielding from Bushfire Threats	High
7	Internal access roads should be constructed to be 6m wide to ensure unrestricted two-way traffic.	10.1	Vulnerability Reduction - Persons	Lower risk road construction (design and materials)	Medium

8	Multiple access points to Landwehr Road are currently installed. A minimum of two access points are required, with these sited within 200m of the north-eastern and the south-eastern extent of the development area along Landwehr Road. An additional central access point is recommended but not required. These are likely to be gated but should be openable in the same manner (the same key, keycard, access code, remote etc). Access points are to comply, at a minimum, with the specifications for Private Driveways within Table 6 of the *Guidelines for Planning in Bushfire Prone Areas v1.4*.	10.7	Vulnerability Reduction - Persons	Lower risk road construction (design and materials)	High
9	Any proposed or future Class 1-9 buildings should be constructed to their assessed BAL to a minimum of BAL-12.5 under AS3959 to reduce the vulnerability to ember attack, even if subject to BAL-LOW. This does not apply to Class 10 buildings which cannot comply with AS3959.	11.1	Vulnerability Reduction – Structures/Assets	Construction design and materials	Medium
10	<u>Class 1-10 Buildings</u> For any future Class 1-10 buildings, include non-combustible structural elements where practical. In particular, avoid: polycarbonate (sheeting and skylights), softwoods (<650 kg/m3 density at 12% moisture content), and fibrous materials. <u>BESS</u> Review compliance against NFPA 855 - Standard for the Installation of Stationary Energy Storage Systems (2023) for additional measures applicable to the development, noting that as a North American planning standard, all requirements may not be applicable. This will include consideration of UL 9540. If the system is unable to comply with the standards due to a given issue, a statement should be provided on specific concern (as the product complies with other industry standards).	11.3 13.3 14.3 15.3	Vulnerability Reduction – Structures/Assets	Construction design and materials	Medium
11	It is recommended non-combustible elements are used for structural and supporting/associated constructions wherever practical. This includes sheds, lean-tos, verandas, shade screening, lattice, garden edging, fencing etc.	11.4 13.4 14.4 15.4	Vulnerability Reduction – Structures/Assets	Construction design and materials	Medium
12	Where electrical cabling, or gas or liquid piping, contacts the ground or any arrangement of associated structures creates a 'pocket' for accumulation of debris, this should be rectified by design or filling with non-combustible material such as mineral earth. Consideration should be given to making the arrangement self-cleaning through wind action to the greatest extent possible. These measures will reduce accumulation and/or make the management (clearing) of accumulated debris easier. E.g. cable raking to be 100mm above ground.	13.8 14.8 15.8	Vulnerability Reduction – Structures/Assets	Construction design and materials	Lowest

13	Any subfloor cavities must have exposed subfloor spaces enclosed, sealed with non-combustible material, or be ember screened. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	11.11 13.11 15.11	Vulnerability Reduction – Structures/Assets	Construction design and materials	Lowest
14	The detailed design of any Class 1-10 Buildings should be reviewed to ensure it is possible for them to be fully enclosed.	11.12	Vulnerability Reduction – Structures/Assets	Construction design and materials	Lowest
15	<u>Class 1-10 Buildings</u> Any Class 1-10 buildings (including non-habitable structures) must have ember screening/sealants installed on any gaps, penetrations, and external glazed elements. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium. <u>BESS</u> The manufacturer or appropriate engineers should be contacted to enquire if it is possible to apply ember screening to intake/exhaust/air conditioning vents and other paths of entry to the interior cavity or accessing any combustible elements of BESS cabinets. This ember screening would be applicable to the exterior of the battery cabinet, not internal components. The intention is to prevent both ember ingress and debris accumulation. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium. <u>Substation</u> Consider application of ember screening to the external vent interface of the control room, switchroom, terminal boxes etc. The intention is to prevent both ember ingress and debris accumulation. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	11.13 13.13 15.13	Vulnerability Reduction – Structures/Assets	Construction design and materials	High
16	External doors (if present) should be self-closing. Doors should be tightly fitting against the frame.	13.15 15.15	Vulnerability Reduction – Structures/Assets	Construction design and materials	Lowest
17	Review *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems* for additional measures applicable to the development.	13.16	Vulnerability Reduction – Structures/Assets	Construction design and materials	Lowest

18	The following requirements apply to the firefighting water supply. The specifications will be confirmed at the detailed design stage. <u>Access</u> Firefighting water access points (hydrants, hard suction, or drafting) must be clearly identifiable, visible from internal roads, and unobstructed. The primary vehicle access points from Landwehr Road (north-eastern and south-eastern) must have signage clearly visible indicating the direction of the nearest water tank. An all-weather hardstand turnaround area meeting the requirements of the *Guidelines for Planning in Bushfire Prone Areas v1.4* (Explanatory Note E3.3) must be provided within 4 metres static water storage tank(s) and any independent hard suction points (hydrants). Site Operating Procedures must include that access routes must be unobstructed at all times. <u>Siting</u> Water tanks must be positioned >10m from BESS cabinets, solar panels, PCUs, inverters, etc. The water tank(s) should apply a BAL-29 APZ at a minimum. It is possible to locate the tank within the 10kW/m2 APZ applied to BESS infrastructure such that additional vegetation management/clearing is not required. The entirety of all BESS cabinets must have a water tank sited within 120m. This will mean water tanks will be strategically sited throughout the site, and modifications to the location of BESS clusters may occur to ensure they can be positioned within this buffer. <u>Construction</u> Each water tank must have a minimum capacity of 45,000L. To align with the Guidelines for Planning in Bushfire Prone Areas v1.4, the volume applied will be 50,000L. The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel. An external water level indicator must be installed on static water storage tank(s) and be visible from internal roads and the adjoining turnaround area. Signage indicating 'FIRE WATER' and the tank capacity must be fixed to each tank. The hard-suction point must be protected from mechanical damage (eg. bollards) where vehicle contact is possible. Couplings at hard suction points are required to be 125mm Storz fittings (*Guidelines v1.4* s2.2.2.1). DFES Built Environment and the local emergency services should be contacted for input on appropriate couplings and adaptors.	11.16 13.17 14.17 15.17	Vulnerability Reduction – Structures/Assets	Availability of a firefighting response capability	Highest

19	Two suitable fire extinguishers should be provided within 20m of each PCU.	13.18	Vulnerability Reduction – Structures/Assets	Availability of a firefighting response capability	Lowest
20	Automatic fire detection and suppression systems should be installed and maintained, as appropriate to the BESS details and recommended by the manufacturer. Consider the potential for arc flash due to smoke from a bushfire.	13.19 14.19 15.19	Vulnerability Reduction – Structures/Assets	Availability of a firefighting response capability	High
21	As soon as practical before the arrival of the fire front, preparation systems/procedures should be engaged. Such systems/procedures should be determined in consultation with the manufacturer, but may include: • Orienting PV panels to the maximum vertical plane (estimated 55 degrees from the horizontal). • Orienting PV panels away from the sun (to reduce residual energy generation post-shutdown). • Disconnecting solar arrays from the electrical grid. • Engaging any appropriate automatic fire suppression systems.	11.19 13.20 14.20	Vulnerability Reduction – Structures/Assets	Availability of a firefighting response capability	High
22	A watercourse runs east-west through the lot. Crossings should be installed and maintained at an appropriate location near the eastern and western limits of the development extent, to allow for continuous perimeter access. These crossings must meet the minimum requirements of A3.6 Private Driveways within the *Guidelines for Planning in Bushfire Prone Areas* v1.4.	11.20 13.21 14.21 15.21	Vulnerability Reduction – Structures/Assets	Availability of a firefighting response capability	High
23	The decision maker should note that multiple international standards and guidelines exist, and full compliance with all may not be achievable. Australia lacks a guiding standard, as discussed in the *Battery Energy Storage Systems Guidance Report* (GHD March 2023, prepared for the Australian Energy Council). The decision maker may choose to review this report for an overview of context, concerns, and outcomes, for the construction and installation of BESS proposals. Ongoing requirements established in this Risk Assessment and Section 5.7 of the associated Bushfire Management Plan, must be included in operational documents. Site Operating Procedures must include the following information:	11.21 13.22 14.22 15.22	Vulnerability Reduction – Structures/Assets	Manage and maintain effectiveness of applied protection measures	Highest

	Maintenance • Maintenance intervals. Scheduling can be detailed within a supporting document. • Assigned responsibilities of staff. • Maintenance procedures and servicing to manufacturer's specifications. • Testing procedures of the firefighting water supply and equipment. Inspections • Inspection intervals. Frequency of inspections are recommended to be increased during the bushfire season (see the Local Government Prohibited Burning Period) where practical. • Inspection triggers, including extreme weather events or seismic activity. • Established inspection criteria, including: o Accumulation of debris and vegetative material within 10m of battery modules. o Mechanical damage to exterior elements. o Vegetation regrowth within the Asset Protection Zone, particularly immediately prior to and during bushfire season (see the Local Government Prohibited Burning Period). o Obstruction of access routes including the northern firebreak. o Volume of the firefighting water supply.				

6 RESPONSIBILITY CHECKLISTS FOR THE IMPLEMENTATION AND MANAGEMENT OF BUSHFIRE PROTECTION MEASURES

The following sections and their associated tables establish:

- The bushfire protection measures that shall be initially implemented and those requiring ongoing maintenance to the stated requirements;
- The persons responsible for the implementation and maintenance of the required bushfire protection measures; and
- The persons responsible and the timing for compliance certification when required.

The necessity for the BMP to contain this information is established by the *Guidelines for Planning in Bushfire Prone Areas* (Version 1.4, WAPC 2021) in Appendices 3 and 5.

6.1 Developer / Landowner / Operator Responsibilities Prior To Commencement of Operation

TABLE 6.2(A) REQUIRED BUSHFIRE PROTECTION MEASURES - IMPLEMENTATION ACTIONS (SUBJECT TO COMPLIANCE CHECK TO BE CONDUCTED BY A BUSHFIRE CONSULTANT)	
1	Prior to occupancy/operation establish the 'Required' Asset Protection Zone (APZ) around habitable buildings (and other structures as required) to satisfy: • The minimum required dimensions established in Appendix B1; and • The standards established by the *Guidelines for planning in bushfire prone areas,* DPLH, 2021 v1.4, Schedule 1; or • The standards established for an Asset Protection Zone (APZ) by the relevant local government's requirements set out in a section 33 notice under the Bush Fires Act 1954 (annual firebreak/fuel load notice); or • An alternative standard in a gazetted local planning scheme; or • As specified in any Landscape Management Plan. If native vegetation is required to be modified or removed, ensure that approval has been received from the relevant authority (refer to the applicable local government for advice).
2	Prior to operation, construct the private driveways to comply with the technical requirements referenced in the BMP.
3	Prior to operation, install the required firefighting static water supply to comply with the technical requirements stated in the BMP.
4	Prior to operation, install the required firefighting strategic water supply tank of 50,000L outside of the lot boundary along Landwer Road.
4	Prior to operation, for the proposed high risk land use, there is an outstanding obligation, created by this Bushfire Management Plan, for site and use specific, prevent, prepare, respond and recover bushfire procedures (and

	associated actions) to be incorporated into the operation's Site Emergency Plan that is a required document to address all potential emergencies and developed by the operator.
5	For the 'high risk land use' there is an outstanding obligation, created by Guidelines and consequently this Bushfire Management Plan, for a 'Bushfire Risk Assessment and Management Report' to be produced. Additional protection measures that have been identified in the Report, are to be incorporated into the operation's site emergency plan (produced by the operator to address all potential emergencies).
6	Implement the additional bushfire protection measures that have been established within Section 5.7.1 of this BMP as measures additional to those established by the acceptable solutions.

TABLE 6.2(B) REQUIRED BUSHFIRE PROTECTION MEASURES - IMPLEMENTATION ACTIONS (SUBJECT TO COMPLIANCE BEING ESTABLISHED BY THE WAPC AND/OR LOCAL GOVERNMENT)	
1	[Relevant when stated as a condition of planning approval] The landowner/proponent is to register a notification onto the certificate of title and deposited plan (with the required wording stated by the local government). This will be done pursuant to *Section 70A Transfer of Land Act 1893 (as amended) as per 'Factors affecting use and enjoyment of land, notification on title'*. This is to notify owners and prospective purchasers of the land that: 1. The land is in a designated bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner; 2. The land is subject to a Bushfire Management Plan that establishes certain protection measures to manage bushfire risk that are to be implemented and continue to be applied at the owner's cost; and 3. That additional planning and building requirements may apply to development on this land.

TABLE 6.2(C) REQUIRED BUSHFIRE PROTECTION MEASURES - IMPLEMENTATION ACTIONS (NOT SUBJECT TO COMPLIANCE CHECK)	
1	Prior to relevant building work, inform the builder of the existence of this approved Bushfire Management Plan (BMP). The plan identifies that the development site is within a designated bushfire prone area and states the indicative (or determined) BAL rating(s) that may (or will) be applied to buildings/structures. A BAL assessment report may be required to confirm determined ratings and will be required when ratings are indicative. BAL certificates will need to be issued to accompany building applications. The BMP may also establish, as an additional bushfire protection measure, that construction requirements to be applied will be those corresponding to a specified higher BAL rating. Compliance with the Building Code of Australia (Volumes 1 and 2 of the National Construction Code), will require certain bushfire resistant construction requirements be applied to residential buildings in bushfire prone areas (i.e., Class 1, 2 and 3 and associated Class 10a buildings and decks). Other classes of buildings may also be required to comply with these construction when established by the relevant authority or if identified as an additional bushfire protection measure within the BMP. The deemed to satisfy solutions that will meet the relevant bushfire performance requirements are found in AS 3959 – Construction of Building in Bushfire Prone Areas (as amended) and the NASH Standard - Steel Framed Construction in Bushfire Areas (as amended).
2	Each property owner on sale of the allotment is provided with a copy of the BMP and informed of their responsibilities. A copy of the approved BMP should be attached to all contracts of sale for the lot.

6.2 Landowner / Operator Responsibilities – Ongoing Management

TABLE 6.3 REQUIRED BUSHFIRE PROTECTION MEASURES – ONGOING MANAGEMENT ACTIONS	
1	Maintain the 'Required' Asset Protection Zone (APZ) around habitable buildings (and other structures as required) to satisfy: • The minimum required dimensions established in Appendix B1; and • The standards established by the *Guidelines for planning in bushfire prone areas*, DPLH, 2021 v1.4, Schedule 1; or • The standards established for an Asset Protection Zone (APZ) by the relevant local government's requirements set out in a section 33 notice under the Bush Fires Act 1954 (annual firebreak/fuel load notice); or • An alternative standard in a gazetted local planning scheme; or • As specified in any Landscape Management Plan.
2	Maintain any areas nominated to be revegetated in accordance with the vegetation classification and management standards as specified in the BMP and/or Landscape Management Plan.
3	Comply with the Shire of Waroona Firebreak Notice issued under s33 of the Bush Fires Act 1954. Check the notice annually for any changes.
4	Maintain vehicular access routes within the lot to comply with the technical requirements referenced in the BMP and the relevant local government's annual firebreak / hazard reduction notice.
5	Maintain the static firefighting water supply tank within the development site and associated pipes/fittings/pump and vehicle access and hardstand in good working condition. Checking couplings and water levels (which are to remain full at all times).
6	Ensure that builders engaged to construct dwellings/additions and/or other relevant structures on the lot, are aware of the existence of this approved Bushfire Management Plan (BMP). The plan identifies that the development site is within a designated bushfire prone area and states the indicative (or determined) BAL rating(s) that may (or will) be applied to buildings/structures. A BAL assessment report may be required to confirm determined ratings and will be required when ratings are indicative. BAL certificates will need to be issued to accompany building applications. Compliance with the Building Code of Australia (Volumes 1 and 2 of the National Construction Code), will require certain bushfire resistant construction requirements be applied to residential buildings in bushfire prone areas (i.e., Class 1, 2 and 3 and associated Class 10a buildings and decks). The deemed to satisfy solutions that will meet the relevant bushfire performance requirements are found in AS 3959 – Construction of Building in Bushfire Prone Areas (as amended) and the NASH Standard - Steel Framed Construction in Bushfire Areas (as amended). As an additional bushfire protection measure, other classes of buildings may also be required to comply with these construction requirements when established by the relevant authority or if identified as an additional bushfire protection measure within the BMP. The BMP may also establish that construction requirements to be applied will be those corresponding to a specified higher BAL rating. When applicable, these requirements will be identified in Section 5.7.

7	Ensure all future buildings the landowner has responsibility for, are designed and constructed in full compliance with: • The bushfire resistant construction requirements of the Building Code of Australia (Volumes 1 and 2 of the National Construction Code), as established by the Building Regulations 2012 (WA Building Act 2011); and • Any additional bushfire protection measures this Bushfire Management Plan has established are to be implemented.
8	Maintain the bushfire protection measures that have been established within Section 5.8 of this BMP as measures additional to those established by the acceptable solutions.
9	The bushfire specific content of the operation's Site Emergency Plan must be reviewed annually, relevant information updated and ensure all bushfire related preparation procedures are carried out.
10	Ensure the ongoing implementation of the BMP, including providing successive landowners with a copy of the BMP and making them aware of the responsibilities it contains.

6.3 cvLocal Government Responsibilities – Ongoing Management

TABLE 6.4 REQUIRED BUSHFIRE PROTECTION MEASURES – ONGOING MANAGEMENT ACTIONS	
1	To be aware of the potential consequences of any significant changes in the local government's management of land, of which they have vested control (including re-vegetation), that could have an adverse impact on the determined BAL ratings that apply to adjacent existing or future buildings and where: • The determined BAL ratings have been established by an existing BMP or a BAL Assessment; and • The BAL has been correctly determined with appropriate consideration of what might reasonably be expected to potentially change in the future with regards to the classification of the vegetation being altered and/or management of the relevant area of vegetation.
2	Maintain the 50,000L strategic water supply tank outside of the development boundary site and associated pipes/fittings/pump and vehicle access and hardstand in good working condition.

APPENDIX A: DETAILED BAL ASSESSMENT DATA AND SUPPORTING INFORMATION

A1: BAL Assessment Inputs Common to the Method 1 and Method 2 Procedures

A1.1: FIRE DANGER INDICES (FDI/FDI/GFDI)

When using Method 1 the relevant FDI value required to be applied for each state and region is established by AS 3959:2018, Table 2.1. Each FDI value applied in Tables 2.4 – 2.7 represents both the Forest Fire Danger Index (FFDI) and a deemed equivalent for the Grassland Fire Danger Index (GFDI), as per Table B2 in Appendix B. When using Method 2, the relevant FFDI and GFDI are applied.

The values may be able to be refined within a jurisdiction, where sufficient climatological data is available and in consultation with the relevant authority.

Relevant Jurisdiction:	WA	Region:	Whole State	Method 1	Applied FDI:	80
				Method 2	Applied FFDI:	80
					Applied GFDI:	80

A1.2: VEGETATION ASSESSMENT AND CLASSIFICATION

Vegetation Types and Classification

In accordance with AS 3959:2018 Clauses 2.2.3 and C2.2.3.1, all vegetation types within 100 metres of the 'site' (defined as "the part of the allotment of land on which a building stands or is to be erected"), are identified and classified. Any vegetation more than 100 metres from the site that has influenced the classification of vegetation within 100 metres of the site, is identified and noted. The maximum excess distance is established by AS 3959: 2018 Clause 2.2.3.2 and is an additional 100 metres.

Classification is also guided by the Visual Guide for Bushfire Risk Assessment in WA (WA Department of Planning February 2016) and any relevant FPA Australia practice notes.

Modified Vegetation

The vegetation types have been assessed as they will be in their natural mature states, rather than what might be observed on the day. Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its expected re-generated mature state. Modified areas of vegetation can be excluded from classification if they consist of low threat vegetation or vegetation managed in a minimal fuel condition, satisfying AS 3959:2018 Clause 2.2.3.2(f), and there is sufficient justification to reasonable expect that this modified state will exist in perpetuity.

The Influence of Ground Slope

Where significant variation in effective slope exists under a consistent vegetation type, these will be delineated as separate vegetation areas to account for the difference in potential bushfire behaviour, in accordance with AS 3959:2018 Clauses 2.2.5 and C2.2.5.

THE INFLUENCE OF VEGETATION GREATER THAN 100 METRES FROM THE SUBJECT SITE	
Vegetation area(s) within 100m of the site whose classification has been influenced by the existence of bushfire prone vegetation from 100m – 200m from the site:	None
Assessment Statement:	No vegetation types exist close enough, or to a sufficient extent, within the relevant area to influence classification of vegetation within 100 metres of the subject site.

VEGETATION AREA 1						
Classification	**A. FOREST**					
Types Identified	Open forest A-03					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	30-70%	Shrub/Heath Height	1-2m	Tree Height	Up to 30m	
Justification Comments	Native forest composition with throughout the site and surrounds. Varying in species composition between dense smooth barked Eucalyptus with a grassy understorey to large, old Marri trees with minimal understorey, to low, dense forest with a dense shrub layer.					
Post Development Assumptions:	N/A					

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VEGETATION AREA 2						
Classification	**B. WOODLAND**					
Types Identified	Woodland B-05					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	10-30%	Shrub/Heath Height	-	Tree Height	Up to 30m	
Justification Comments	Scattered, tall trees with no understorey. Dry, grassy ground cover. Many standing, dead trees.					
Post Development Assumptions:	N/A					

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VEGETATION AREA 3						
Classification	**C. SHRUBLAND**					
Types Identified	Low shrubland C-12					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	-	Shrub/Heath Height	1-2m	Tree Height	-	
Justification Comments	Native wetland sedges scattered patches across site.					
Post Development Assumptions:	N/A					

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VEGETATION AREA 4						
Classification	**D. SCRUB**					
Types Identified	Closed scrub D-13					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	10-30%	Shrub/Heath Height	>2m	Tree Height	Up to 30m	
Justification Comments	Dense shrubs not exceeding 6m in height with scattered dead trees on dry, saline soil.					
Post Development Assumptions:	N/A					

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VEGETATION AREA 5						
Classification	**G. GRASSLAND**					
Types Identified	Open tussock G-23		Sown pasture G-26			
Exclusion Clause	N/A					
Effective Slope	Determined	d/slope 5 degrees	Applied Range (Method 1)		Downslope >0-5 degrees	
Foliage Cover of Tallest Plant Layer	N/A	Shrub/Heath Height	1-2m	Tree Height	N/A	
Justification Comments	Pasture landscape used for grazing cattle. The area has been classified with a 5 degree slope to account for any overall slope for the entire assessment site.					
Post Development Assumptions:	The grassland within the development area and surrounding the infrastructure as indicated on figure 3.1.1 within this document, is to be managed in perpetuity to a low threat state. This can be achieved through livestock grazing or slashing when necessary.					

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VEGETATION AREA 6						
Classification	G. GRASSLAND					
Types Identified	Open tussock G-23 Sown pasture G-26					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	<30%	Shrub/Heath Height	1-2m	Tree Height	Up to 30m	
Justification Comments	Paddocks or grassland used for livestock grazing or road verges. Some areas are private land with some scattered trees.					
Post Development Assumptions:	N/A					

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A1.3: EFFECTIVE SLOPE

EXPLAINING THE ASSESSMENT METHODOLOGY APPLIED BY BUSHFIRE PRONE PLANNING

DEFINITION: Effective slope is "the slope under that classified vegetation which most influences the bushfire attack" (AS 3959:2018, Clause 1.5.11).

"The effective slope under the classified vegetation is not the same as the average slope for the land surrounding the site of the proposed building. The effective slope is that slope which most significantly influences bushfire behaviour" (AS 3959:2018, Clause CB4).

The slope is described as upslope, flat or downslope when viewed from an exposed element (e.g., building) and looking towards the vegetation. It is measured in degrees.

[Note: Additional relevant guidance provided by AS 3959:2018 and NSW RFS, Planning for Bushfire Protection (2019) is incorporated into the applied assessment methodology and is presented at the end of this explanation.]

COMPOUND SLOPES UNDER VEGETATION AND DETERMINING SLOPE SIGNIFICANCE

Non-Linear Slopes: When the slope of ground under the vegetation out to the distance to be assessed (100 m or further if necessary), is not a straight line or nearly straight line slope, then it is made up of several different slopes i.e., it is a compound slope. The different slope angles and lengths must be factored into the determination of the effective slope value to be applied. Different slopes will potentially influence the bushfire rate of spread and intensity, both increasing and decreasing it.

Significant Slope: The AS 3959:2018 bushfire attack level determination methodology, with default inputs, models a fully developed bushfire. Therefore, a 'significant' slope is one that will significantly influence bushfire behaviour. To be 'significant' the length of the slope must be 'sufficient' to support a fully developed fire on that slope. The angle of a significant slope could be the determined effective slope for the area of classified vegetation if it is the one that 'most influences the bushfire attack'.

Sufficient Slope Length: Is a slope that will, as a minimum, allow the entire flame depth (flaming zone) of a fully developed fire (100m flame width) to exist on that slope.

The expected flame depth of a fully developed bushfire is a function of the length of time the flaming phase will exist on a section of the fuel bed (the 'residence time') and the bushfire's 'rate of spread'. For a given rate of spread, longer residence times result in greater flame depths. Greater flame depths are correlated with greater flame temperatures and greater flows of radiant heat.

The primary factors that will increase the residence time are:

- Heavier fine fuel loads of grass, leaf litter, twigs, bark etc less than 6mm in width and existing within the surface and near surface layers (and elevated fuel layers when contiguous with the base layers); and
- A greater percentage of larger fine fuels within the fuel load.

The primary factors that increase the rate of spread (apart from fire weather factors), include finer fuels, drier fuels, horizonal continuity of fuel and steeper upward ground slope in the direction of fire travel.

Example values:

- Residence Time: Grassfire 5 – 15 seconds, Forest fire 25 -50 seconds.
- Rate of Spread: Grassfires of a few km/hr are considered fast moving, 5-10 km/hr is common and fastest in the order of 25km/hr. Forest fire typically recorded in metres/hour with 1-1.5 km/hr being considered fast moving and fastest in the order of 3–4 km/hr.
- Flame Depth: More typically, a few metres for grasses to tens of metres for forest fires.

An Isolated Slope: For scenarios where there is a single significant slope (based on the above criteria) additional consideration would need to be given to the time and distance consumed by a bushfire still in its 'developing' phase. This will require due consideration be given to how it is potentially ignited i.e., from a single or multiple points, as this will influence the time and distance required to fully develop. For such scenarios, a normally significant slope may not be sufficiently long. It may be necessary to determine the potential bushfire impact more accurately by

justifying the application of a lesser effective slope, or a lower threat vegetation classification, or calculating a reduced head fire width (using short fire run modelling).

Determined Effective Slope: Only a 'significant' slope can potentially be the effective slope by itself. In which case, for a defined area of classified vegetation area, the worst significant slope under that vegetation is to apply.

The table below presents Bushfire Prone Planning's considerations applied to assessing short and/or compound slopes in determining the effective slope.

Slope Length (m)	Considered a Significant Slope	Considerations in Determining the Effective Slope
< 5	No	Where these short slopes exist as part of a compound slope under an area of classified vegetation, they can be ignored as they will not influence the fire behaviour in that vegetation.
5-20	No	These slopes will have a range of influence on fire behaviour from very little to a degree of influence that must be accounted for to some extent by the determined effective slope that is applied (i.e., with a greater length apply to a greater extent). But the actual slope of these shorter slopes is likely not to be applied as it is not a 'significant' length.
20-30	Maybe	The same considerations applied to the 5-20m slope lengths should be applied here. However, more justification would need to be presented to support their assessment as not being 'significant' slopes. For these slope lengths, consideration must be given more broadly to the potential level of risks associated with a bushfire event in this location. The risk level will be a function of the bushfire hazard threat levels (direct attack mechanisms) within the immediate and broader assessment area as influenced by local topography, vegetation extents and types and the exposure and vulnerability of persons and/or buildings/structures to these threats. Higer risk levels require greater precaution meaning these slopes should be considered 'significant', and vice versa. Consider the potential for a bushfire on adjoining or nearby land be a source of ignition and/or pre-heating to vegetation on the subject slope. Consider if vegetation on the slope is likely be ignited by a single ignition point or is multipoint ignition possible from bushfire an adjoining slopes or the surrounding area. Single point ignition will require a fire to travel further before being fully developed (DFES considers less than 100m fire runs may be considered a short fire run for forest, woodland and scrub vegetation classifications, RFS NSW applies 150m). Isolated slopes of this length are less likely to be considered significant as compared to when part of a compound slope.
>30	Yes	Likely to always be a significant slope unless isolated (i.e., exists alone) – in which case, justifying the application of a lesser effective slope, or a lower threat vegetation classification, or calculating a reduced head fire width, are approaches that may need to be applied.

BPP Approach - Slope Variation Within Areas of Vegetation

When multiple 'significant' slope lengths with large differences in degrees of effective slope (or different applicable slope ranges when AS 3959:2018 Method 1 is applied), exists under a single vegetation classification, these will be delineated as separate vegetation areas of classified vegetation to account for the difference in potential bushfire behaviour and impact, in accordance with AS 3959:2018 clauses 2.2.5 and C2.2.5.

Effective Slope Variation Due to Multiple Development Sites

When the effective slope, under a single area of bushfire prone vegetation, will vary significantly relative to multiple proposed development sites (exposed elements), then the effective slopes corresponding to each of the different

locations, are separately identified. The relevant (worst case) effective slope is determined in the direction corresponding to the potential directions of fire spread towards the subject building(s).

AS 3959:2018 EFFECTIVE SLOPE DETERMINATION - GUIDANCE

The Standard presents a broad set of guidance statements that indicate the intent of deriving an effective slope value for use in calculations, rather than detailing the 'in the field' determination process. These include:

- Highlighting the importance of the value by stating "The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the severity of the fire and the ultimate level of radiant heat flux" (Clause C2.2.5). [Note: A common rule of thumb is that for every 10 degrees of upslope, a fire will double its rate of spread if moving in the direction of the prevailing wind].
- It may be necessary to consider the slope under the classified vegetation for distances greater than 100 m in order to determine the effective slope for that vegetation classification.
- "Where there is more than one slope within the classified vegetation, each slope shall be individually assessed, and the worst case Bushfire Attack Level shall apply" (Clause 2.2.5).

NSW RFS 2019, PLANNING FOR BUSHFIRE PROTECTION - APPENDIX A1.5 - ADDITIONAL DETERMINATION GUIDANCE

- "In identifying the effective slope - it may be found that there are a variety of slopes covering different distances within the vegetation. The effective slope is considered to be the slope under the vegetation which will most significantly influence the bushfire behaviour for each aspect. This is usually the steepest slope. In situations where this is not the case, the proposed approach must be justified".
- "Vegetation located closest to an asset may not necessarily be located on the effective slope".

SITE ASSESSMENT DETAILS - EXPLANATION & JUSTIFICATION

The effective slopes determined from the site assessment are recorded in Table 3.2 of this Bushfire Management Plan.

The underlying slope of all vegetation areas is either upslope or flat relative to the development location.

As the site is large-scale, slight undulations exist. As a precautionary measure, a 5-degree slope has been applied to Class G Grassland areas in establishing the appropriate APZs.

A1.4: SEPARATION DISTANCE

Measuring

The separation distance is the distance in the horizontal plane between the receiver (building/structure or area of land being considered) and the edge of the classified vegetation (AS 3959:2018, clause 2.2.4)

The relevant parts of a building/structure from which the measurement is taken is the nearest part of an external wall or where a wall does not exist, the supporting posts or columns. Certain parts of buildings are excluded including eaves and roof overhangs.

The edge of the vegetation, for forests and woodlands, will be determined by the unmanaged understorey rather than either the canopy (drip line) or the trunk (AS 3959:2018, clause C2.2.5).

Measured Separation Distance as a Calculation Input

If a separation distance can be measured because the location of the building/structure relative to the edge of the relevant classified vegetation is known, this figure can be entered into the BAL calculation. The result is a determined BAL rating.

Assumed Separation Distance as a Calculation Input

When the building/structure location within the lot is not known, an assumed building location may be applied that would establish the closest positioning of the building/structure relative to the relevant area of vegetation.

The assumed location would be based on a factor that puts a restriction on a building location such as:

- An established setback from the boundary of a lot, such as a residential design code setback or a restrictive covenant; or
- Within an established building envelope.

The resultant BAL rating would be indicative and require later confirmation (via a Compliance Report) of the building/structure actual location relative to the vegetation to establish the determined BAL rating.

Separation Distance as a Calculation Output

With the necessary site specific assessment inputs and using the AS 3959:2018 bushfire modelling equations, the range of separation distances that will correspond to each BAL rating (each of which represents a range of radiant heat flux), can be calculated. This has application for bushfire planning scenarios such as:

- When the separation distance cannot be measured because the exact location of the exposed element (i.e., the building, structure or area), relative to classified vegetation, is yet to be determined.

  In this scenario, the required information is the identification of building locations onsite that will correspond to each BAL rating. That is, indicative BAL ratings can be derived for a variety of potential building/structure locations; or

- The separation distance is known for a given building, structure or area (and a determined BAL rating can be derived), but additional information is required regarding the exposure levels (to the transfer of radiant heat from a bushfire), of buildings or persons, that will exist at different points within the subject site.

The calculated range of separation distances corresponding to each BAL rating can be presented in a table and/or illustrated as a BAL Contour Map – whichever is determined to best fit the purpose of the assessment.

For additional information refer to the information boxes in Section 3 'Bushfire Attack Levels (BAL) - Understanding the Results and Section 3.2. 'Interpretation of the BAL Contour Map'.

SITE ASSESSMENT DETAILS - EXPLANATION & JUSTIFICATION

Measured and assumed separation distances determined from the site assessment are recorded in Section 3, Table 3.1.

A2: BAL Assessment Inputs Applied Using the Method 2 Procedure

STATING AND JUSTIFYING THE METHOD 2 CALCULATION INPUT VARIABLES APPLIED

As 3959:2018 Bal Determination Procedures: AS 3959:2018 establishes the official methodology to determine the radiant heat flux (RHF) a receiver (e.g., a building, structure, person or specified location), will potentially be exposed to from a fully developed bushfire within any adjacent classified vegetation. The methodology accounts for the configuration of a specific site and its surrounds.

The model calculations are complex. Consequently, AS 3959:2018 establishes two pathways to apply the methodology - a simplified procedure (Method 1) and a detailed procedure (Method 2).

Method 1: This procedure has limitations to both its scope and the degree to which site specific conditions can be applied. However, it requires minimal site assessment inputs and provides a standardised output that is satisfactory for many situations.

A moderate level of justification for some of the assessed inputs applied is required. This will demonstrate how the procedure detailed within AS 3959:2018 for Method 1 (Section 2) has been followed.

Method 2: This procedure is used when the site conditions are out of the scope of Method 1 or when it is necessary to produce a more specific result. Higher levels of justification will be required for many of the input variables that are able to be modified using Method 2 (AS 3959:2018 Appendix B).

Section A2.1 below identifies the input variables that have been assessed for the proposed development and indicates the level of justification required for their application. The information contained within this Appendix will provide this justification information to the degree necessary.

A2.1: SUMMARY OF CALCULATION INPUTS APPLIED AND THE LEVEL OF JUSTIFICATION REQUIRED

AS 3959:2018 BUSHFIRE ATTACK LEVEL (BAL) DETERMINATION PROCEDURES INPUT VARIABLES FOR THE FIRE BEHAVIOUR AND RADIATION MODELS							
✓ Indicates which site specific variables have been assessed and applied to the assessment of the proposed development/use.		**IDENTIFICATION OF THE CALCULATION INPUT VARIABLES ASSESSED AND/OR MODIFIED FOR THE PROPOSED DEVELOPMENT/USE**					
Indicates an AS 3959 methodology or jurisdiction default variable (or a methodology calculated variable in the case of EOR or flame angle). No justification required.							
Indicates a variable that either must or can have an assessor value applied. Requires justification.							
Indicates a variable that can have an assessor value applied. Requires detailed justification.		Using Method 1		Using Method 2			
ASSESSOR QUALIFICATION REQUIRED [1]		BPAD Level 1		BPAD Level 3			
LEVEL OF JUSTIFICATION REQUIRED TO APPLY [2]		None	Moderate	None	Moderate	High	
Fire weather	Fire danger index (FDI/FFDI/GFDI)						
	Wind speed						
	Ambient temperature						
	Relative humidity						
Bushfire Prone Vegetation and slope of the land it grows on	Vegetation classification [3]						
	Effective slope						
	Understorey and total fuel loads [4]						
	Vegetation height						
	Fuel age						
	Fuel moisture						
Receiver (building) positioning parameters	Site slope						
	Separation distance				✓		
	Elevation of the receiver (EOR).						
Bushfire flame parameters	Flame temperature [5]			✓			
	Flame width						
	Flame angle						
	Flame emissivity						
	Heat of combustion						
INTERMEDIATE OUTPUT FROM THE FIRE BEHAVIOUR AND RADIATION MODELS							
Rate of Spread - derived from fuel loads, fuel type, fuel height, FDI, effective slope and wind speed.							
Fire Intensity – derived from fuel loads, rate of spread and heat of combustion [6]							
Path Length – derived from flame angle and separation distance.							
Transmittance – derived from ambient temperature and relative humidity.							
View Factor – derived from flame length, flame width, flame angle, separation distance, elevation of receiver and site slope.							
FINAL OUTPUT OF THE FIRE BEHAVIOUR AND RADIATION MODELS							
Flame Length – derived from fuel loads, ROS (for Forest, Woodland) and fire intensity (for Scrub, Shrubland, Grassland) [6]							
Radiant Heat Flux and the Corresponding Bushfire Attack Level (BAL) – derived from view factor, flame emissivity, flame temperature, transmittance and corresponding to the worst possible flame angle.							
TABLE NOTES (see next page)							

[1] **Authority to Use Method 2:** Within WA, use of this procedure is restricted to bushfire practitioners who hold the BPAD Level 3 accreditation as issued by the Fire Protection Association Australia (FPAA) through their Bushfire Planning and Design Accreditation Scheme (BPAD Scheme) that complies with the Western Australian Bushfire Accreditation Framework.

[2] **Level of Justification Required in Applying Method 2:** AS 3959:2018 Appendix B establishes the detailed procedure for the Method 2 determination of BAL(s) as consisting of 10 steps. When justification is required for an assessed variable value to be applied, the required level of justification can vary. The level definitions used in this table are:

Moderate: Requires the provision of readily available and understood argument and evidence such as when:

1. The methodology step requires or allows for an input variable to be a site assessed value; or
2. A methodology step requires a jurisdictionally determined value which the relevant authority may change for different land use scenarios; or

High: Requires a detailed argument, appropriate evidence and justification when:

1. The variable is derived from the methodology step that applies an AS 3959:2018 default value or determines an intermediate output value (i.e. the result of applying a step's equations).

[3] **Applying a Different Vegetation Classification:** This approach may be justified when certain characteristics of the site's local vegetation complex align with the broad based descriptions of AS 3959:2018, but expert knowledge identifies characteristics that would result in the applied AS 3959 bushfire behaviour model not being properly representative of a fire in the local vegetation. This potential outcome is in part due to the ecological classification of vegetation that is used in AS 3959 rather than a classification more aligned with fuel structure/fire behaviour.

The justification of using a different classification is predicated on the fact that the intent of classifying vegetation in the BAL determination methodology of AS 3959:2018, is to identify the most appropriate fire behaviour model equations to apply.

For example, with respect to contribution to potential fire behaviour, it is often more important to consider vegetation structure rather than canopy cover, yet canopy cover is a key classification factor applied in AS 3959:2018.

Also findings from more recent bushfire behaviour research is not yet incorporated into the current version of the Standard. Certain currently applied bushfire behaviour models within As 3959:2018 are outdated and may under or over predict radiant heat flux and flame length.

[4] **Modifying Fuel Loads:** Potential steady state maximum fuel loads at a specific site for a given vegetation classification may vary significantly (above and below) from those that are to be applied as the default values in AS 3959:2018.

The Standard only provides the single set of ecological descriptors and corresponding fuel loads that are to be applied to vegetation complexes across Australia, hence its accuracy for all situations will be questionable. The relevant authority for a jurisdiction can establish different fuel loads to be applied.

However, fuel loads for the purposes of determining expected fire behaviour have not currently been determined to the degree necessary in WA, which results in the default values both over and underestimating fuel loads for WA vegetation types. WA DFES in providing advice to decision makers, will currently not accept any assessment and subsequent variation of the default fuel loads. If any variation was to be applied in an assessment, it would need to be argued for based on appropriate evidence and the development of a merit based case to the satisfaction of the decision maker.

The one circumstance where Bushfire Prone Planning will reduce fuel loads is in the calculations associated with a short fire run in forest type vegetation – in which the developing fire will not crown. Therefore, most bark and all canopy fuels can justifiably be excluded from total fuel load.

Note [5] - Flame Temperature: The Guidelines (DPLH 2021, v1.4) Section 5.5.3.1.3 and the relevant acceptable solutions within the bushfire protection criteria, establish that the higher flame temperature of 1200 K is to be applied when determining the availability of suitable onsite sheltering options for tourism vulnerable land uses.

Note [6] – Fireline Intensity and Flame Length: These values are determined as intermediate and final outputs of the AS 3959:2018 modelling. Changing these values would not be a valid use of the methodology for a fully developed fire. However, for the circumstance of a developing fire in small patches or corridors of vegetation, there may be justification when an authoritative source is identified to provide an override value.

A3: BAL Calculator – Copy of Input/Output Values

DETERMINING 10 kW/m² SEPARATION DISTANCES

FLAMESOL
FPA AUSTRALIA

Calculated March 26, 2024, 1:28 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.4 km/h
Vegetation classification	Forest	Flame length	19.8 m
Understorey fuel load	25 t/ha	Flame angle	52 °, 61 °, 69 °, 73 °, 74 ° & 81 °
Total fuel load	35 t/ha	Elevation of receiver	7.8 m, 8.65 m, 9.24 m, 9.460000000000001 m, 9.51 m & 9.77 m
Vegetation height	n/a	Fire intensity	43,400 kW/m
Effective slope	0 °	Transmissivity	0.863, 0.841, 0.8110000000000001, 0.786, 0.773 & 0.716
Site slope	0 °	Viewfactor	0.6085, 0.4531, 0.3066, 0.2086, 0.1696 & 0.0458
Flame width	100 m	Minimum distance to < 40 kW/m²	16.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	21.5 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	30.6 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	41.9 m
		Minimum distance to < 10 kW/m²	48.9 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class A Forest

FLAMESOL
FPA AUSTRALIA

Calculated May 1, 2024, 3:47 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	1.43 km/h
Vegetation classification	Woodland	Flame length	12.35 m
Understorey fuel load	15 t/ha	Flame angle	53 °, 63 °, 71 °, 76 °, 78 ° & 83 °
Total fuel load	25 t/ha	Elevation of receiver	4.93 m, 5.5 m, 5.84 m, 5.99 m, 6.04 m & 6.13 m
Vegetation height	n/a	Fire intensity	18,599 kW/m
Effective slope	0 °	Transmissivity	0.875, 0.859, 0.836, 0.8110000000000001, 0.797 & 0.732
Site slope	0 °	Viewfactor	0.5992, 0.4424, 0.2986, 0.2026, 0.1645 & 0.0448
Flame width	100 m	Minimum distance to < 40 kW/m²	10.2 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	13.8 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	20.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	28.9 m
		Minimum distance to < 10 kW/m²	34.5 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class B Woodland

FLAMESOL
FPA AUSTRALIA

Calculated May 1, 2024, 3:48 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.86 km/h
Vegetation classification	Shrubland	Flame length	7.73 m
Understorey fuel load	15 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	15 t/ha	Elevation of receiver	3.13 m, 3.47 m, 3.7 m, 3.78 m, 3.81 m & 3.85 m
Vegetation height	m	Fire intensity	22,207 kW/m
Effective slope	0 °	Transmissivity	0.886, 0.874, 0.856, 0.835, 0.823 & 0.75
Site slope	0 °	Viewfactor	0.5861, 0.4341, 0.2914, 0.1967, 0.1593 & 0.0437
Flame width	100 m	Minimum distance to < 40 kW/m²	6.5 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	8.800000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	13.1 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	19.3 m
		Minimum distance to < 10 kW/m²	23.5 m

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class C Shrubland

FLAMESOL
FPA AUSTRALIA

Calculated May 1, 2024, 3:49 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	4.16 km/h
Vegetation classification	Scrub	Flame length	11.62 m
Understorey fuel load	25 t/ha	Flame angle	53 °, 63 °, 72 °, 76 °, 78 ° & 83 °
Total fuel load	25 t/ha	Elevation of receiver	4.64 m, 5.18 m, 5.52 m, 5.64 m, 5.68 m & 5.77 m
Vegetation height	m	Fire intensity	53,815 kW/m
Effective slope	0 °	Transmissivity	0.878, 0.862, 0.838, 0.8139999999999999, 0.8 & 0.735
Site slope	0 °	Viewfactor	0.5988, 0.4419, 0.2962, 0.2016, 0.1638 & 0.0446
Flame width	100 m	Minimum distance to < 40 kW/m²	9.6 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	13 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	19.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	27.5 m
		Minimum distance to < 10 kW/m²	32.9 m

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class D Scrub

FLAMESOL
FPA AUSTRALIA

Calculated May 6, 2024, 2:48 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	2.78 m, 3.08 m, 3.28 m, 3.36 m, 3.38 m & 3.42 m
Vegetation height	n/a	Fire intensity	33,247 kW/m
Effective slope	0 °	Transmissivity	0.887, 0.877, 0.861, 0.841, 0.829 & 0.755
Site slope	0 °	Viewfactor	0.5823, 0.4291, 0.29, 0.1946, 0.158 & 0.0434
Flame width	100 m	Minimum distance to < 40 kW/m²	5.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	7.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	11.7 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	17.3 m
		Minimum distance to < 10 kW/m²	21.2 m

Rate of Spread - Noble et al. 1980
Flame length - Purton, 1982
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class G Grassland

FLAMESOL
FPA AUSTRALIA

Calculated May 1, 2024, 3:50 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	20.19 km/h
Vegetation classification	Grassland	Flame length	8.16 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	3.3 m, 3.67 m, 3.9 m, 3.99 m, 4.02 m & 4.06 m
Vegetation height	n/a	Fire intensity	46,945 kW/m
Effective slope	5 °	Transmissivity	0.885, 0.872, 0.854, 0.832, 0.82 & 0.748
Site slope	0 °	Viewfactor	0.5915, 0.4337, 0.2918, 0.1968, 0.1599 & 0.0438
Flame width	100 m	Minimum distance to < 40 kW/m²	6.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.300000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	13.8 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	20.3 m
		Minimum distance to < 10 kW/m²	24.6 m

Rate of Spread - Noble et al. 1980
Flame length - Purton, 1982
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class G Grassland (5-degree downslope)

DETERMINING 2 kW/m² SEPARATION DISTANCES

FLAMESOL
FPA AUSTRALIA

Calculated May 3, 2024, 1:26 pm (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.4 km/h
Vegetation classification	Forest	Flame length	19.8 m
Understorey fuel load	25 t/ha	Flame angle	83 °
Total fuel load	35 t/ha	Panel height	19.65 m
Vegetation height	n/a	Elevation of receiver	9.82 m
Effective slope	0 °	Fire intensity	43,400 kW/m
Site slope	0 °	Transmissivity	0.702
Distance to vegetation	152 m	Viewfactor	0.0256
Flame width	100 m	Radiant heat flux	2 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class A Forest

FLAMESOL
FPA AUSTRALIA

Calculated May 3, 2024, 1:28 pm (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	1.43 km/h
Vegetation classification	Woodland	Flame length	12.35 m
Understorey fuel load	15 t/ha	Flame angle	85 °
Total fuel load	25 t/ha	Panel height	12.31 m
Vegetation height	n/a	Elevation of receiver	6.15 m
Effective slope	0 °	Fire intensity	18,599 kW/m
Site slope	0 °	Transmissivity	0.722
Distance to vegetation	120 m	Viewfactor	0.0246
Flame width	100 m	Radiant heat flux	1.98 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class B Woodland

FLAMESOL
FPA AUSTRALIA

Calculated May 3, 2024, 1:33 pm (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.86 km/h
Vegetation classification	Shrubland	Flame length	7.73 m
Understorey fuel load	15 t/ha	Flame angle	86 °
Total fuel load	15 t/ha	Panel height	7.72 m
Vegetation height	1.5 m	Elevation of receiver	3.86 m
Effective slope	0 °	Fire intensity	22,207 kW/m
Site slope	0 °	Transmissivity	0.739
Distance to vegetation	92 m	Viewfactor	0.0246
Flame width	100 m	Radiant heat flux	2.03 kW/m²
Windspeed	45 km/h	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class C Shrubland

FLAMESOL
FPA AUSTRALIA

Calculated May 3, 2024, 1:39 pm (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	90	Rate of spread	4.16 km/h
Vegetation classification	Scrub	Flame length	11.62 m
Understorey fuel load	25 t/ha	Flame angle	85 °
Total fuel load	25 t/ha	Panel height	11.58 m
Vegetation height	3 m	Elevation of receiver	5.79 m
Effective slope	0 °	Fire intensity	53,815 kW/m
Site slope	0 °	Transmissivity	0.724
Distance to vegetation	116 m	Viewfactor	0.0246
Flame width	100 m	Radiant heat flux	1.99 kW/m²
Windspeed	45 km/h	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class D Scrub

FLAMESOL
FPA AUSTRALIA

Calculated May 6, 2024, 11:36 am (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Understorey fuel load	4.5 t/ha	Flame angle	86 °
Total fuel load	4.5 t/ha	Panel height	6.85 m
Vegetation height	n/a	Elevation of receiver	3.42 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	0 °	Transmissivity	0.742
Distance to vegetation	87 m	Viewfactor	0.024
Flame width	100 m	Radiant heat flux	1.99 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Noble et al. 1980
Flame length - Purton, 1982
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class G Grassland

FLAMESOL
FPA AUSTRALIA

Calculated May 3, 2024, 1:42 pm (BALc v.4.9)

Bushfire Attack Level calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	20.19 km/h
Vegetation classification	Grassland	Flame length	8.16 m
Understorey fuel load	4.5 t/ha	Flame angle	86 °
Total fuel load	4.5 t/ha	Panel height	8.140000000000001 m
Vegetation height	n/a	Elevation of receiver	4.07 m
Effective slope	5 °	Fire intensity	46,945 kW/m
Site slope	0 °	Transmissivity	0.737
Distance to vegetation	95 m	Viewfactor	0.0245
Flame width	100 m	Radiant heat flux	2.02 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Noble et al. 1980
Flame length - Purton, 1982
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Class G Grassland (5-degree downslope)

APPENDIX B: ADVICE - ONSITE VEGETATION MANAGEMENT - THE APZ

THE ASSET PROTECTION ZONE (APZ) – DESCRIPTION AND OBJECTIVES

Description: The asset protection zone (APZ) is the area of land surrounding a building or structure on which any combustible materials will be located and/or managed to reduce the potential impact of the direct and indirect attack mechanisms (threats) of bushfire, and therefore reduce the associated risks of building/structure damage or loss, to acceptable levels.

When cultivated and/or natural vegetation exists within the zone it must present low potential threat levels from the direct fire attack mechanisms of flame contact, radiant heat and ember attack and fire driven wind, and the indirect attack mechanisms of debris accumulation, surface fire, tree strike and consequential fire.

The required low threat levels will be achieved as the result of factors that include persistent higher fuel moisture contents, lower flammability and/or minimal fuel loads, due to either limiting the existence of these fuels through removal and/or modification, and the subsequent ongoing management (reduction) of fuel loads.

When a bushfire attack level (BAL) is required to be determined for a building/structure to establish its bushfire construction requirements, the condition of the vegetation within the APZ must satisfy the requirements established by *clause 2.2.3.2 of AS 3959:2018 Construction of buildings in bushfire prone areas* - to be excluded from classification.

For other combustible structures/materials within the APZ, lower threat levels will be the result of factors such as their appropriate use, lowered vulnerability and location relative to the primary building/structure to be protected.

Objectives: The primary objectives of establishing a low threat area surrounding buildings/structures are to create that performs the following functions:

1. To establis an APZ of specified dimensions ensure the building is sufficiently separated from the identified bushfire hazard to limit the impact of its direct attack mechanisms. The required dimensions of the APZ must:
    - Remove the potential for direct flame contact on the building;
    - Reduce the level of radiant heat to which the building is exposed. The APZ dimensions should ensure that the potential level of radiant heat impact corresponds to the level of vulnerability of the building/structure - as determined by the degree to which bushfire resistant construction has been applied (or not). For example, when constructed to the requirements corresponding to its determined exposure to radiant heat (measured as a bushfire attack level) in accordance with AS 3959 or the NASH Standard.
    - Ensure some reduction in the threat level of the ember/burning debris attack mechanism when higher threat vegetation types are present in the vicinity. Note, the reduction in some scenarios will be minimal given the produced quantity, type, survival time and consequent distance that certain embers/burning debris can travel.

      Be aware of that research has identified that consequential fire, ignited by embers, is the primary cause (>80%) of building loss in past Australian bushfire events. In bushfire prone areas, the importance of applying protection measures to prevent ember entry to buildings/structures and minimising the existence of consequential fire fuels cannot be overstated.
2. To ensure any combustible fuels (debris and structures) or trees that remain within the APZ will be managed and located to limit the potential impact of the indirect attack mechanisms of bushfire by:
    - Minimising the accumulation of debris on, within and around buildings/structures to limit this source of fuel for consequential fires that will result in the direct fire attack mechanisms of flames and greater radiant heat existing closer to the buildings/structures, even though the bushfire hazard exists at a greater distance away;
    - To prevent surface fire moving through the APZ and closer to buildings/structures than the fire in the bushfire hazard itself can;

- Prevent fire weakened or windblown trees/branches impacting buildings/structures and allowing ember/burning debris entry;

- To ensure other combustible materials that can result in a consequential fire ignited by embers/burning debris), within both the APZ and parts of the building, are eliminated, minimised and/or appropriately located or protected (the explanatory notes in the Guidelines provide some guidance for achieving this objective and other sources are available); and

3. To provide a defendable space for firefighting activities.

B1: Asset Protection Zone (APZ) Dimensions

APZ DIMENSIONS – DIFFERENCES IN REQUIREMENTS FOR PLANNING ASSESSMENTS COMPARED TO IMPLEMENTATION

THE 'PLANNING BAL-29' APZ DIMENSIONS

The 'Planning BAL-29' APZ is not necessarily the size of the APZ that must be physically implemented and maintained by a landowner. Rather, its purpose is to identify if an acceptable solution for planning approval can be met i.e., can a specified minimum separation distance from bushfire prone vegetation exist.

An assessment against the Bushfire Protection Criteria is conducted for planning approval purposes. To satisfy 'A2.1: Asset Protection Zone', it must be demonstrated that certain minimum separation distances between the relevant building/structure and different classes of bushfire prone vegetation, either exist or can be created and will remain in perpetuity. These minimum separation distances determine the 'Planning BAL-29' APZ dimensions.

Dimensions: The minimum dimensions are those that will ensure the potential radiant heat impact on subject buildings does not exceed 29 kW/m^2. These dimensions will vary dependent on the vegetation classification, the slope of the land they are growing on and certain other factors specific to the subject site.

Note: For certain purposes associated with vulnerable land uses, the 'Planning BAL-29' APZ may be replaced with dimensions corresponding to radiant heat impact levels of 10 kW/m^2 and 2 kW/m^2 and calculated using 1200K flame temperature.

Location: The identified 'Planning BAL-29' APZ must not extend past lot boundaries onto land the landowner has no control over either now or potentially at some point in the future. Limited exceptions include:

- When adjoining land is not vegetated (e.g., built out, roads, carparks, drainage, rock, water body etc.);
- When adjoining land currently or, will in the short term, contain low threat vegetation and or vegetation managed in a minimal fuel condition as per AS 3959:2018 cl. 2.2.3.2. It must be reasonable (justifiable) to expect this low threat vegetation and/or level of management will continue to exist or be conducted in perpetuity and require no action from the owner of the subject lot.

  Such areas of land include formally managed areas of vegetation (e.g., public open space / recreation areas / services installed in a common section of land). For specific scenarios, evidence of the formal commitment to manage these areas to a certain standard may be required and would be included in the BMP.

  These areas of land can also be part of the required APZ on a neighbouring lot for which the owner of that lot has a recognised responsibility to establish and maintain; and
- When there is a formalised and enforceable capability and responsibility created for the subject lot owner, or any other third party, to manage vegetation on land they do not own in perpetuity. This would be rare, and evidence of the formal authority would be included in the BMP.

The bushfire consultant's 'Supporting Assessment Detail', that is presented in the assessment against the acceptable solution A2.1, will identify and justify how any adjoining land within the 'Planning BAL-29 APZ will meet the APZ standards. Or otherwise, explain how this condition cannot be met.

THE 'BAL RATING' APZ DIMENSIONS

The applicable BAL rating will have been stated in the BAL Assessment Data section of the BAL Assessment Report or BMP (as relevant). The BAL rating can be assessed as 'determined' or 'indicative' or be 'conditional', dependent of the specific conditions associated with the site and the stage of assessment or planning. It is the eventual assessment of the 'Determined' BAL that will establish both the BAL rating that is to apply and its corresponding 'BAL Rating' APZ dimensions.

Dimensions: The minimum dimensions of the 'BAL Rating' APZ to be established and maintained will be those that correspond to the determined BAL rating for the subject building/structure that has accounted for surrounding vegetation types, the slope of the land they are growing on and certain other factors specific to the subject site and surrounding land.

Establishing the 'BAL Rating' APZ will ensure that the potential radiant heat exposure of the building/structure will be limited to the level that the applied construction requirements are designed to resist when that building/structure is required to be constructed to the standard corresponding to the Determined BAL.

> *Note: For certain purposes associated with vulnerable land uses, the 'BAL Rating' APZ dimensions may be replaced with dimensions corresponding to the specific radiant heat impact levels of 10 kW/m² and 2 kW/m² and calculated using 1200K flame temperature.*

Location: The same conditions will apply as for the 'Planning BAL-29' APZ.

THE 'LOCAL GOVERNMENT' APZ DIMENSIONS

Some Local Government's establish the dimensions of the APZ that must be established surrounding buildings in their annual Firebreak/Hazard Reduction Notice. Or for a specific site they may establish a maximum allowable dimension (typically that corresponding to BAL-29). When established, the landowner will need to be comply with these.

THE 'REQUIRED' APZ DIMENSIONS

This is the APZ that is to be established and maintained by the landowner within the subject lot and surrounding the subject building(s). It will be identified on the Property Bushfire Management Statement when it is required to be included in this Report/Plan.

Dimensions: The 'Required APZ' dimensions are the minimum (or maximum when relevant) distances away from the subject building(s) that the APZ must extend. These distances will not necessarily be the same all around the building(s). They can vary and are dependent on the different vegetation types (and their associated ground slope) that can exist around the building(s), and specific local government requirements. The dimensions to implement are determined by:

A. The 'BAL Rating APZ' of the subject building(s) when distances are greater than 'B' below (except when 'B' establishes a maximum distance); or

B. The 'Local Government' APZ' derived from the Firebreak/Hazard Reduction Notice when distances are greater than 'A' above, other than when a maximum distance is established, in which case this will apply; or

C. A combination of 'A' and 'B'.

Location: The same conditions will apply as for the 'Planning BAL-29' APZ.

B1.1: THE APZ DIMENSIONS REQUIRED TO BE IMPLEMENTED BY THE LANDOWNER

DETERMINATION OF THE 'REQUIRED' APZ DIMENSIONS TO BE IMPLEMENTED AND MAINTAINED BY LANDOWNER WITHIN THEIR LOT										
Relevant Buildings(s)	Vegetation Classification [Refer to Fig 3.1]		Minimum Required Separation Distances from Building to Vegetation (metres)							
			Established by the 'BAL Rating' APZ Dimension					Established by the "Local Government' APZ Dimension		The 'Required' APZ Dimensions [see note]
			Determined Radiant Heat Impact	Stated 'Indicative' or 'Conditional' BAL				Firebreak / Hazard Reduction Notice	Maximum Allowed	
	Area	Class		BAL-29	BAL-19	BAL-12.5	BAL-LOW			
BESS Cabinets and Associated Infrastructure	1	(A) Forest	10 kW/m2	21-<31	31-<42	42-<100	>100	None stated	N/A	49
	2	(B) Woodland		14-<20	20-<29	29-<100	>100			35
	3	(C) Shrubland		9-<13	13-<19	19-<100	>100			24
	4	(D) Scrub		13-<19	19-<27	27-<100	>100			33
	5	(G) Grassland		4-<14	14-<20	20-<50	>50			25
	6	(G) Grassland		8-<12	12-<17	17-<50	>50			25
Solar Arrays and HV Substation	1	(A) Forest	BAL-19	21-<31	31-<42	42-<100	>100	None stated		31
	2	(B) Woodland		14-<20	20-<29	29-<100	>100			20
	3	(C) Shrubland		9-<13	13-<19	19-<100	>100			13
	4	(D) Scrub		13-<19	19-<27	27-<100	>100			19
	5	(G) Grassland		4-<14	14-<20	20-<50	>50			14
	6	(G) Grassland		8-<12	12-<17	17-<50	>50			12
Note: The 'Required' APZ Dimension corresponding to each area of vegetation is the greater of the 'BAL Rating' or the 'Firebreak/Hazard Reduction Notice' APZ dimensions - unless a local government maximum distance(s) is established as a result of their environmental assessment of the subject site. The area of the APZ will also be limited to the										

subject lot boundary unless otherwise justified in this Report/Plan. Final determination of the dimensions will require that any indicative or conditional BAL becomes a 'Determined' BAL.
Comments: Specific required APZs for this development are outlined in Figure 3.1.1 within this report.

B2: The Standards for the APZ as Established by the Guidelines (DPLH, v1.4)

Within the Guidelines (source: https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas), the management Standards are established by:

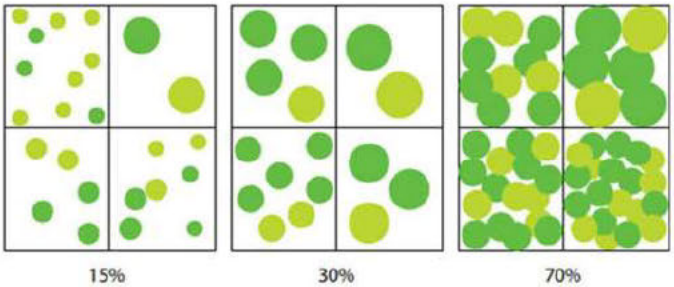
- Schedule 1: Standards for Asset Protection Zones (see extract below) established by the Guidelines; and
- The associated explanatory notes (Guidelines E2) that address (a) managing an asset protection zone (APZ) to a low threat state (b) landscaping and design of an asset protection zone and (c) plant flammability.

ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ.

Figure 19: Tree canopy cover – ranging from 15 to 70 per cent at maturity



Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

B3: The Standards for the APZ as Established by the Local Government

Refer to the firebreak / hazard reduction notice issued annually (under s33 of the Bushfires Act 1954) by the relevant local government. It may state Standards that vary from those established by the Guidelines and that have been endorsed by the WAPC and DFES as per Section 4.5.3 of the Guidelines.

A copy of the applicable notice is not included here as they are subject to being reviewed and modified prior to issuing each year. Refer to ratepayers notices and/or the local government's website for the current version.

B4: Vegetation and Areas Excluded from Classification - Ensure Continued Exclusion

AS 3959:2018 establishes the methodology for determining a bushfire attack level (BAL). The methodology includes the classification of the subject site's surrounding vegetation according to their 'type' and the application of the corresponding relevant bushfire behaviour models to determine the BAL.

Certain vegetation can be considered as low threat or managed in a minimal fuel condition and can be excluded from classification. Where this has occurred in assessing the site, the extract from AS3959:2018 below states the requirements that must continue to exist for the vegetation on those areas of land to be excluded from classification (including the size of the vegetation area if relevant to the assessment).

2.2.3.2 *Exclusions—Low threat vegetation and non-vegetated areas*

The following vegetation shall be excluded from a BAL assessment:

(a) Vegetation of any type that is more than 100 m from the site.

(b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.

(c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified vegetation.

(d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

(e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

(f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.

NOTES:

1 Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

2 A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees.

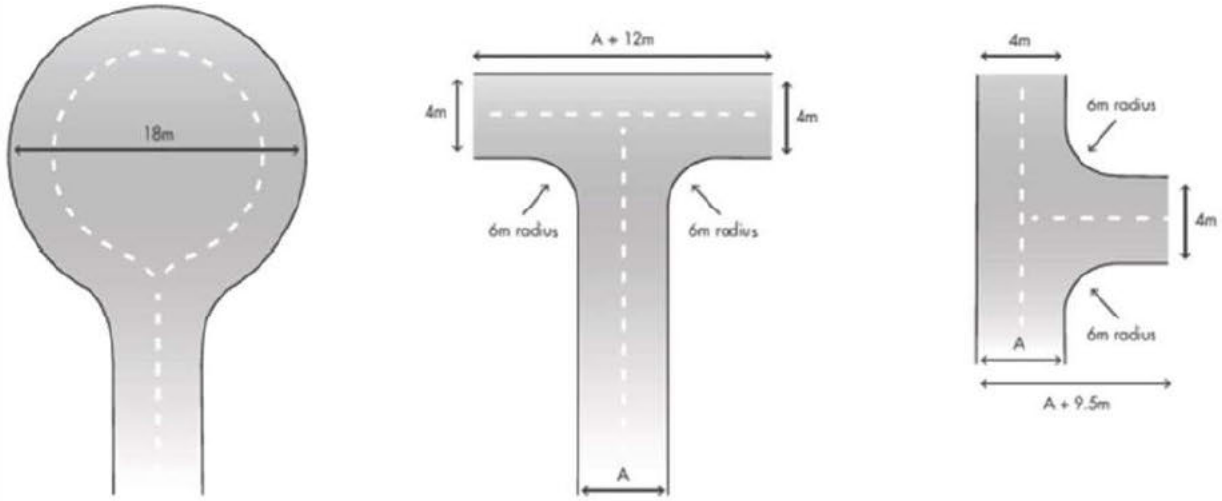
APPENDIX C: TECHNICAL REQUIREMENTS FOR VEHICULAR ACCESS

The design/layout requirements for access are established by the acceptable solutions of the Guidelines (DPLH, 2021 v1.4) Element 3 and vary dependent on the access component, the land use and the presence of 'vulnerable' persons. Consequently, the best reference source are the Guidelines. The technical requirements that are fixed for all components and uses are presented in this appendix.

GUIDELINES TABLE 6, EXPLANATORY NOTES E3.3 & E3.6 AND RELEVANT ACCEPTABLE SOLUTIONS

Technical Component	Vehicular Access Types / Components			
	Public Roads	Emergency Access Way [1]	Fire Service Access Route [1]	Battle-axe and Private Driveways [2]
Minimum trafficable surface (m)	In accordance with A3.1	6	6	4
Minimum Horizontal clearance (m)	N/A	6	6	6
Minimum Vertical clearance (m)	4.5			
Minimum weight capacity (t)	15			
Maximum Grade Unsealed Road [3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%)		
Maximum Grade Sealed Road [3]		1:7 (14.3%)		
Maximum Average Grade Sealed Road		1:10 (10%)		
Minimum Inner Radius of Road Curves (m)		8.5		

Turnaround Area Dimensions for No-through Road, Battle-axe Legs and Private Driveways [4]



Passing Bay Requirements for Battle-axe leg and Private Driveway

When the access component length is greater than the stated maximum, passing bays are required every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m (i.e. the combined trafficable width of the passing bay and constructed private driveway to be a minimum 6m).

Emergency Access Way – Additional Requirements

Provide a through connection to a public road, be no more than 500m in length, must be signposted and if gated, gates must be open the whole trafficable width and remain unlocked.

[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5% or 7.1 degree) entry and exit angle.

[4] The turnaround area should be within 30m of the main habitable building.

D2: Non-Reticulated Areas – Static Supply

For specified requirements, refer to the Guidelines Element 4: Water – Acceptable Solution A4.2 , Explanatory Notes E4 (that provide water supply establishment detail under the headings of water supply; independent water and power supply; strategic water supplies, alternative water sources and location of water tanks) and the technical requirements established by Schedule 2 (reproduced below).

SCHEDULE 2: WATER SUPPLY DEDICATED FOR BUSHFIRE FIREFIGHTING PURPOSES

2.1 Water supply requirements

Water dedicated for firefighting should be provided in accordance with Table 7 below, and be in addition to water required for drinking purposes.

Table 7: Water supply dedicated for bushfire firefighting purposes

PLANNING APPLICATION	NON-RETICULATED AREAS
Development application	10,000L per habitable building
Structure Plan / Subdivision: Creation of 1 additional lot	10,000L per lot
Structure Plan / Subdivision: Creation of 3 to 24 lots	10,000L tank per lot **or** 50,000L strategic water tank
Structure Plan / Subdivision: Creation of 25 lots or more	50,000L per 25 lots or part thereof Provided as a strategic water tank(s) or 10,000L tank per lot

2.2 Technical requirements

2.2.1 Construction and design

An above-ground tank and associated stand should be constructed of non-combustible material. The tank may need to comply with AS/NZS 3500.1:2018.

Below ground tanks should have a 200mm diameter access hole to allow tankers or emergency service vehicles to refill direct from the tank, with the outlet location clearly marked at the surface. The tank may need to comply with AS/NZS 3500.1:2018. An inspection opening may double as the access hole provided that the inspection opening meets the requirements of AS/NZS 3500.1:2018. If the tank is required under the BCA as part of fire hydrant installation, then the tank will also need to comply with AS 2419.

Where an outlet for an emergency service vehicle is provided, then an unobstructed, hardened ground surface is to be supplied within four metres of any water supply.

2.2.2 Pipes and fittings

All above-ground, exposed water supply pipes and fittings should be metal. Fittings should be located away from the source of bushfire attack and be in accordance with the applicable section below, unless otherwise specified by the local government.

2.2.2.1 Fittings for above-ground water tanks:

- Commercial land uses: 125mm Storz fitting; or
- Strategic water tanks: 50mm or 100mm (where applicable and adapters are available) male camlock coupling with full flow valve; or
- Standalone water tanks: 50mm male camlock coupling with full flow valve; or
- Combined water tanks: 50mm male camlock coupling with full flow valve or a domestic fitting, being a standard household tap that enables an occupant to access the water supply with domestic hoses or buckets for extinguishing minor fires.

2.2.2.2 Remote outlets

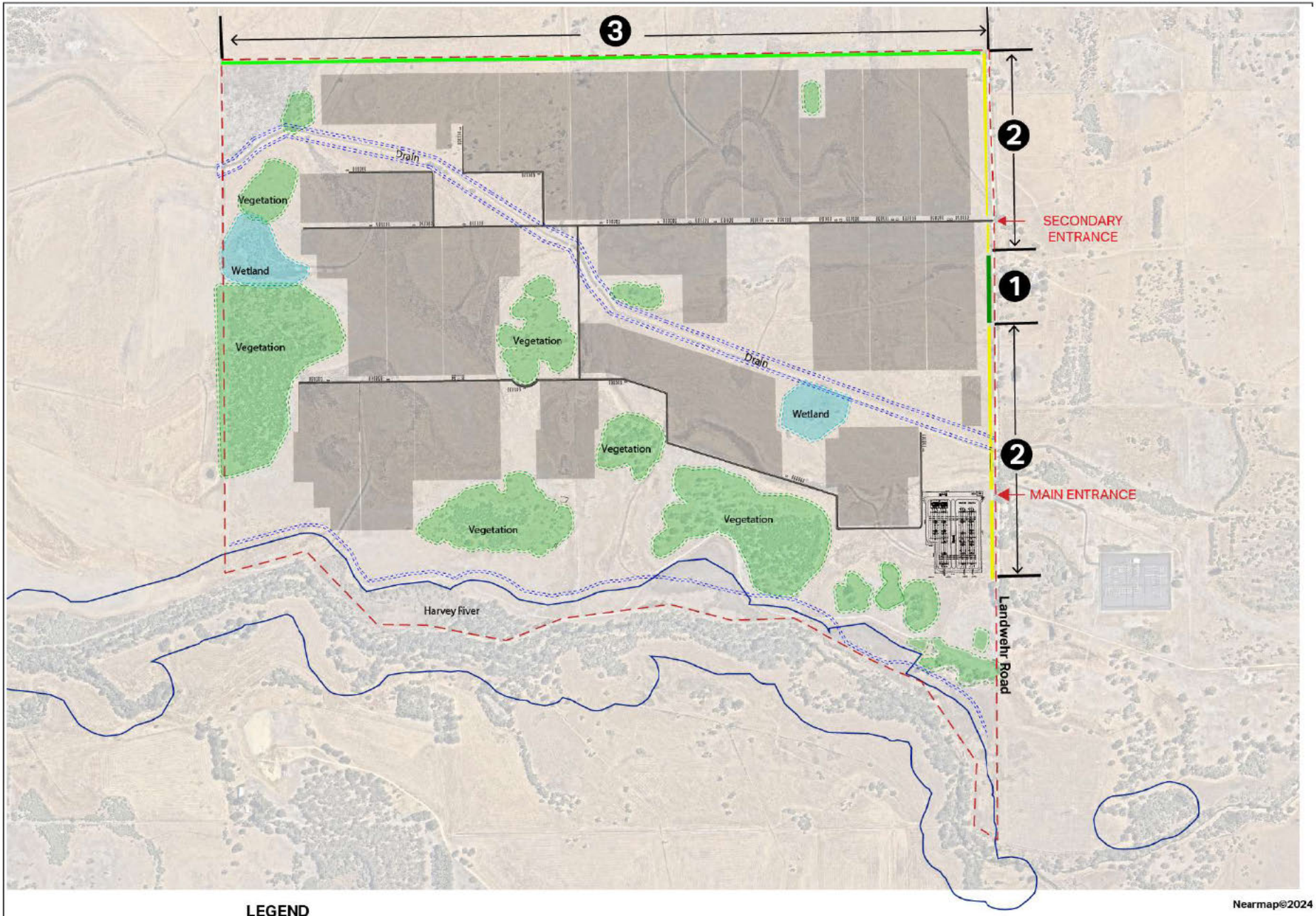
In certain circumstances, it may be beneficial to have the outlet located away from the water supply. In such instances in which a remote outlet is to be used, the applicant should consult the local government and DFES on their proposal.

EXAMPLE CONSTRUCTION AND FITTINGS	
	
Strategic 47,000 Litre Concrete Tank & Protected Fittings	
	
10,000 Litre Concrete Tank	Storz and Camlock Couplings
	
Full Flow 50mm Ball Valve	Full Flow 50mm Gate Valve and Male Camlock

Appendix B

Landscape Plan

ISO A1 594mm x 841mm



LEGEND

- DEVELOPMENT BOUNDARY
- WETLAND BUFFER
- VEGETATION EXCLUSION ZONE
- WETLAND EXCLUSION ZONE
- WATERCOURSE EXCLUSION ZONE
- ACCESS TRACK
- BATTERY CONTAINER
- INDICATIVE SOLAR ARRAY AREA

NOTE:
-Dimensions on this plan are indicative only.
-Provide clearance for Bushfire Management acess and setback requirement.

1. 10M WIDE, 150M LONG PROPERTY FRONT BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING DETAIL
2. 5M WIDE EASTERN BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING DETAIL
3. 5M WIDE NORTHERN BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING DETAIL

Nearmap©2024

0 50 100 150 200 400m

1:10000@A3

AECOM

PROJECT
WAROONA
SOLAR FARM
CONCEPT DESIGN

WAROONA
Western Australia

CLIENT
SE Waroona
Development Pty Ltd
Level 20, 140 St Georges Terrace,
Perth WA 6000

CONSULTANT
AECOM Australia Pty Ltd
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PROJECT NUMBER
60729404

SHEET TITLE
WAROONA SOLAR FARM
LANDSCAPE PLAN

PROJECT NUMBER
60729404-SHT-LD-001

ISO A1 594mm x 841mm

PLANT SCHEDULE

Botanical Name	Common Name	WA Native (Yes/No)	Height (m)	Spread (m)	Installation size	Installation Location and Rate	Proportion	Approx.
Trees								
Allocasuarina fraseriana	Western Sheoak	Y	10	6	30lt	Planting Area 1 & 3	50% in Other Mixes	223
Casuarina obesa	Swamp Sheoak	Y	15	8	30lt	Planting Area 1 & 3	50% in Other Mixes	223
Melaleuca rhaphiophylla	Swamp Paperbark	Y	6	3	30lt	ALL	50% in Melaleuca Mixes	503
Melaleuca osullivanii	O'Sullivan's Melaleuca	Y	3.5	2	30lt	ALL	50% in Melaleuca Mixes	503
						Density refer drawing detail		
Shrubs								
Acacia pycnantha	Golden Wattle	Y	8	2	130mm	Planting Area 1 and 2	20%	300
Astartea scoparia	Common Astartea	Y	2	0.5	130mm	Planting Area 1 and 2	30%	450
Kunzea glabrescens	Spearwood	Y	1.5 to 4	2 to 3	130mm	Planting Area 1 and 2	50%	750
						Density refer drawing detail		
Proteaceous species								
Banksia sphaerocarpa	Round-fruit Banksia	Y	1 to 2	1	130mm	ALL	40%	14000
Banksia sessilis	Parrot Bush	Y	6	2	130mm	ALL	20%	7000
Hakea ruscifolia	Candle Hakea	Y	0.5 to 3	1.5 to 2	130mm	ALL	40%	14000
						Density refer drawing detail		

Note: 1. Plant selection is based on plants that are growing in the area or part of the Swan Coastal Plain Vegetation complex.
2. The plant schedule is subject to further review and confirmation on the appropriate species for the local conditions.

PLANT IMAGES


Casuarina obesa


Allocasuarina fraseriana


Melaleuca rhaphiophylla


Astartea scoparia


Acacia lasiocarpa

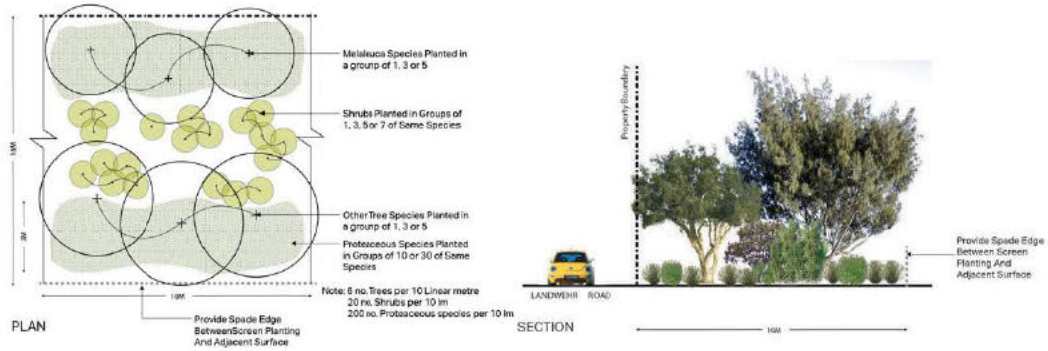

Kunzea glabrescens


Banksia sphaerocarpa

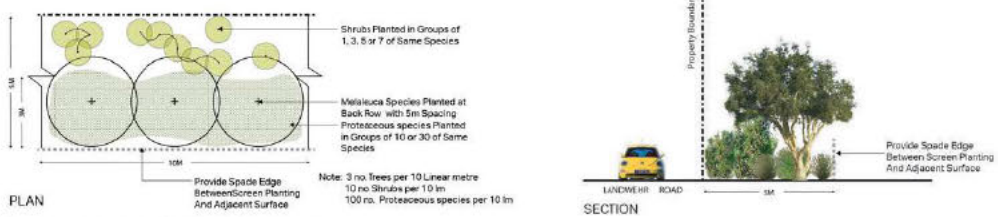

Banksia sessilis


Hakea ruscifolia

TYPICAL PLANTING DETAILS



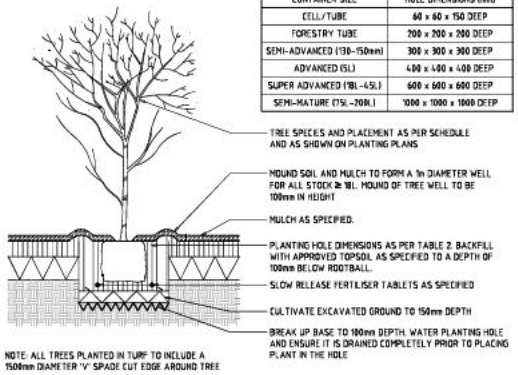
1 TYPICAL PLANTING DETAIL 1 - Property Front (Approx. 150m)



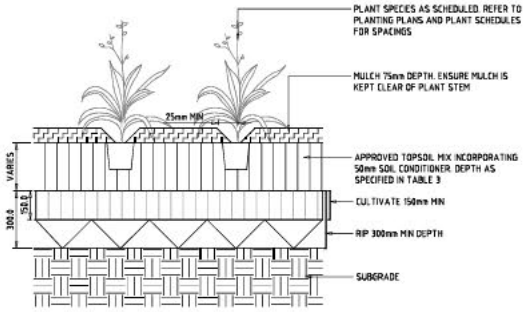
2 TYPICAL PLANTING DETAIL 2 - Eastern Boundary

3 TYPICAL PLANTING DETAIL 3 - Northern Boundary

TABLE 2 - PLANTING HOLE DIMENSIONS	
CONTAINER SIZE	HOLE DIMENSIONS (mm)
CELL/TUBE	60 x 60 x 150 DEEP
FORESTRY TUBE	200 x 200 x 200 DEEP
SEMI-ADVANCED (130-150mm)	300 x 300 x 300 DEEP
ADVANCED (5L)	400 x 400 x 400 DEEP
SUPER ADVANCED (18L-45L)	600 x 600 x 600 DEEP
SEMI-MATURE (75L-200L)	1000 x 1000 x 1000 DEEP



TYPICAL TREE PLANTING DETAILS



TYPICAL CONTAINER STOCK PLANTING DETAILS

AECOM

PROJECT
WAROONA SOLAR FARM CONCEPT DESIGN
WAROONA
Western Australia

CLIENT
SE Waroona Development Pty Ltd
Level 20, 140 St Georges Terrace,
Perth WA 6000

CONSULTANT
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PROJECT NUMBER
60729404

SHEET TITLE
WAROONA SOLAR FARM
PLANT SCHEDULE, IMAGES AND DETAILS

PROJECT NUMBER
60729404-SHT-LD-002

Appendix C

Landscape and Visual Impact Assessment

AECOM Imagine it. Delivered.

Waroona Solar Farm
SE Waroona Development Pty Ltd
08-Jul-2019

Landscape and Visual Impact Assessment

Waroona Solar Farm

08-Jul-2019
Prepared for – SE Waroona Development Pty Ltd – ABN: 627 427 169

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Landscape and Visual Impact Assessment

Waroona Solar Farm

Client: SE Waroona Development Pty Ltd

ABN: 627 427 169

Prepared by

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AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

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Date	08-Jul-2019
Prepared by	[redacted]
Reviewed by	[redacted]

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			Name/Position	Signature
A	8-July-2019	For Internal Review	[redacted]	
B	29-Jul-2019	Final Report (Revised)	[redacted]	
O	05-Aug-2019	For Planning Submission (Final Report)	[redacted]	
01	14-Aug-2019	For Planning Submission (Revised Masterplan)	[redacted]	

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Glossary

Term	Definition
Amenity	The pleasantness of a place as conveyed by desirable attributes including views, noise, odour etc.
Character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, and often conveys a distinctive 'sense of place'.
DEM	Digital Elevation Model – a computer simulation of topography.
Effect	The landscape or visual outcome of a proposed change. It may be the combined result of sensitivity together with the magnitude of the change.
GIS	Geographic Information System
Impact	The categorisation of effects. Surrounding context should be considered in defining 'impacts' and their significance.
Landscape	Landscape is an all-encompassing term that refers to areas of the earth's surface at various scales. It includes those landscapes that are: urban, peri-urban, rural, and natural; combining bio-physical elements with the cultural overlay of human use and values.
Landscape Character Zones (LCZ)	These are distinct zones of the landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Photomontage	A visual representation of a proposal from a particular receptor viewpoint, on a photographic base.
Magnitude of change	The extent of change that will be experienced by receptors. This change may be adverse or beneficial. Factors that could be considered in assessing magnitude are: the proportion of the view / landscape affected; extent of the area over which the change occurs; the size and scale of the change; the rate and duration of the change; the level of contrast and compatibility.
Mitigation	Measures to avoid, reduce and manage identified potential adverse impacts.
Receptor	A place, route, viewer audience or interest group which may receive an effect and require assessment.
Scenic amenity	A measure of the relative contribution of each place to the collective appreciation of the landscape. The term scenic amenity has a specific meaning and application in GIS mapping (a combination of visual exposure and scenic preference)
Sensitivity	Capacity of a landscape or view to accommodate change without losing valued attributes. Includes the value placed on a landscape or view by the community through planning scheme protection.
Values	Any aspect of landscape or views considered to be important. Landscape and visual values may be reflected in planning regulations, other published documents or be established through community consultation and engagement, or as professionally assessed.
View	Any sight, prospect or field of vision as seen from a place.
Viewpoint	The specific location of a view, typically used for assessment purposes.

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Executive Summary

Background

Client	SE Waroona Development Pty Ltd
Property Address	Lot 24 on Plan 59266 (Land ID 3800596) and Lot 25 on Plan 59266 (Land ID 3800597)
Formal Property Description	Pastoral land in Waroona, approximately 8 km west of Wagerup
Total Site Area	303.52 hectares
Council	Shire of Waroona

Relevant planning provisions

Planning Policy Framework	State Planning Framework 2017
Local Planning Policy Framework	Peel Region Scheme (PRS) and Shire of Waroona District Planning Scheme No.7
Zone	Rural 1 – General Farming
Area of Aboriginal Cultural Heritage Sensitivity	None

Summary
This report provides an overview of the potential Landscape and Visual Impacts and required mitigation associated with the development of the Waroona Solar Farm.

Potential landscape impacts
The report findings generally show that the proposed Waroona Solar Farm has the potential to result in:

- **Moderate to low** direct impacts to the open rural landscape character of the Pinjarra System of the Swan Coastal Plain character type within which the Project is located
- **Low** to negligible direct impacts to the bushland rural character type to which the Project is adjacent
- **Moderate** direct impacts to the farmhouse rural character type to which the Project is adjacent.

Potential visual impacts
Potential visual impacts of the proposed Waroona Solar Farm have been assessed from 14 representative public viewpoint locations ranging from **Low** impact through to **High-moderate** impact. The visual impact ratings for each viewpoint are based on a consideration of the sensitivity of the visual receptors and the magnitude of expected visual change. The greatest levels of impact are expected from the viewpoints closest to the Project, where the solar panels themselves will form discernible elements within a given view.

Mitigation measures
The following mitigation is recommended to minimise impacts on the landscape and visual character:

- Further refine the design and layout during detailed design to reduce bulk and height of proposed structures.
- Review materials and colour finishes for selected components including the use of non-reflective finishes to structures where possible.
- Avoid or minimise impacts to the native vegetation including the isolated trees in paddock and riparian vegetation; minimise tree removal and rehabilitate disturbed areas.
- Carry out the proposed mitigations as described the in the Landscape Concept Plan.

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- Continuously maintain and repair the constructed elements to maintain the visual appearance of the Project.
- Provide long term maintenance (and replacement as necessary) of screen planting within the Project to maintain visual filtering and screening of external views where appropriate.

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1.0 Introduction

1.1 Overview

SE Waroona Development Pty Ltd (the Client) is considering development of a solar farm at a site near Waroona, approximately 100 km south of Perth in Western Australia (Figure 1) (Waroona Solar Farm, or the Project). This site is located within a 303.52 ha parcel of pastoral land identified as Lot 24 on Plan 59266 (Land ID 3800596) and Lot 25 on Plan 59266 (Land ID 3800597) (Project Area). The land is currently zoned as Rural 1 – General Farming. AECOM Australia Pty Ltd (AECOM) was engaged to prepare this Landscape and Visual Impact Assessment (LVIA) for the Client as part of the planning phase for the proposed solar farm development.

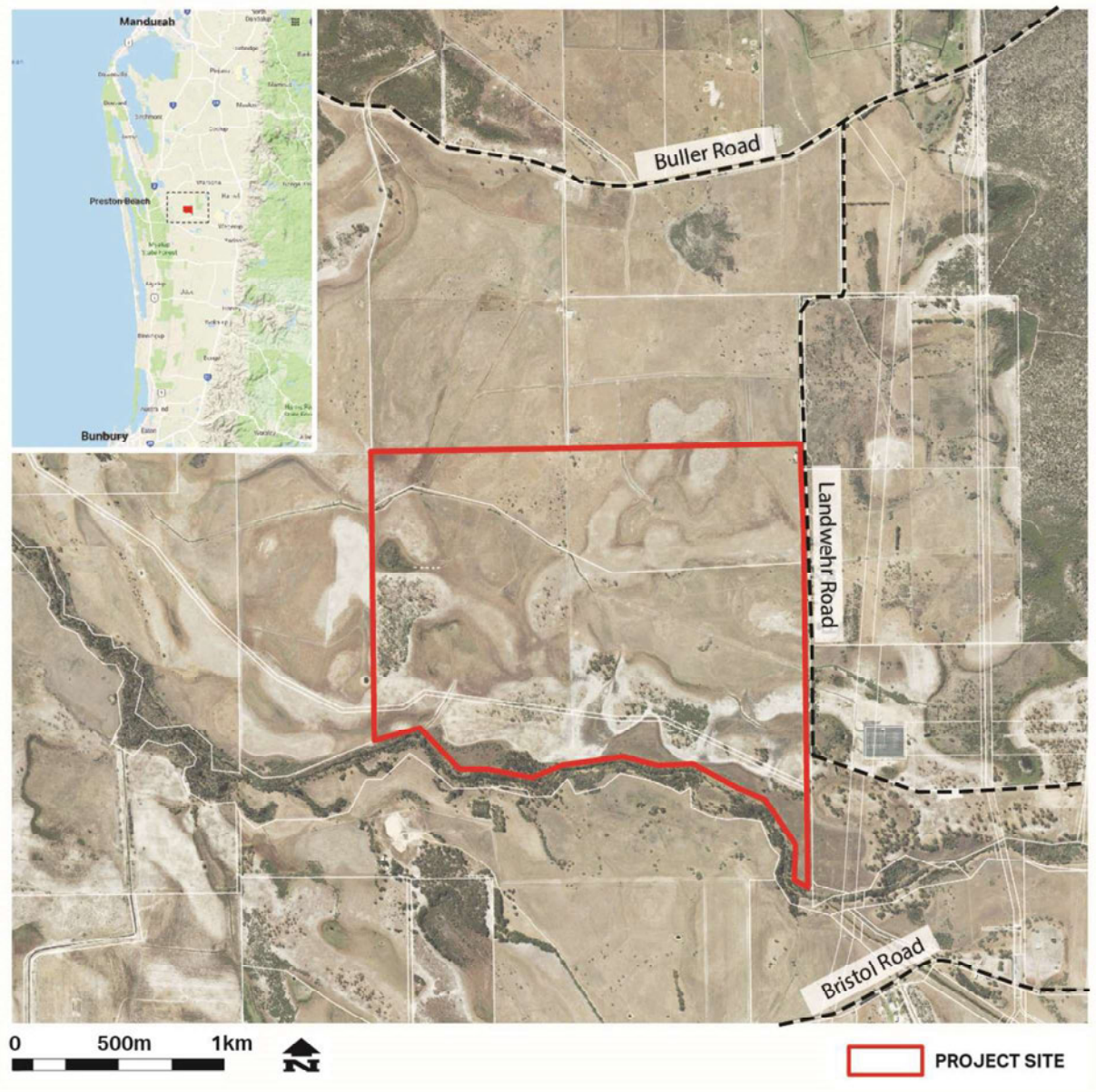

Figure 1 Project Location.

(Source: Nearmap © 2019)

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1.2 Purpose

The purpose of this LVIA is to identify sensitive visual receptors and illustrate through visualisations the visual impacts from the construction and operation of the proposed solar farm. A secondary purpose is to identify mitigation required to minimise landscape and visual impact.

1.3 Report structure

The LVIA includes the following sections:

Table 1 Report structure

Report Section	Description
1.0 Introduction	This section provides an introductory overview that describes the purpose and structure of the LVIA.
2.0 Methodology	This section describes the method employed to assess the potential impacts of the Project.
3.0 Legislation, Policy and Guidelines	This section outlines the legislation, policies and planning guidelines relevant to the Project.
4.0 Project Location and Description	This section describes the site locality and key components of the Waroona Solar Farm.
5.0 Landscape Character Impact Assessment	This section identifies the variations in the character of the landscape within and surrounding the Project and determines the sensitivity and magnitude of the landscape to the proposed change.
6.0 Visual Impact Assessment	This section describes and determines the potential visual impact of the Project from key visual receptor locations.
7.0 Mitigation Measures	This section considers the application of mitigation measures to minimise potential visual impact.
8.0 Conclusion	Conclusions are made on the overall impact of the Project.

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2.0 Methodology

2.1 Overview

The following method to assess landscape character and visual amenity impacts arising from the Project has been derived from an analysis of a preliminary concept design plan. The method:

- analyses the existing landscape character and visual environment
- determines the extent and nature of potential landscape and visual impacts of the Project on surrounding areas
- identifies measures to mitigate and minimise potential landscape and visual impacts.

2.2 Objectives

The Department of Planning, Lands and Heritage (DPLH) "*Visual Landscape Planning in Western Australia: A manual for evaluation, assessment, siting and design"* and Landscape Institute and the Institute for Environmental Management (United Kingdom) (2013) "*Guidelines for Landscape and Visual Impact Assessment*" (GLVIA3), have been used to develop the landscape and visual impact assessment methodology. The principal objectives to conduct the evaluation and assessment include:

1. Describe the existing visual landscape character.
2. Describe the proposed development.
3. Describe and evaluate the potential visual impacts.
4. Develop visual management measures.
5. Provide recommendations.

These objectives are considered to be in line with the approach outlined in (DPLH) '*Visual Landscape Planning in Western Australia: A manual for evaluation, assessment, siting and design'* and (GLVIA3).

2.3 Desktop assessment and fieldwork

Key information was reviewed during the desktop assessment. This included review of topographic maps and aerial photography of the Project site and surrounding landscape. The topographic maps and aerial photography were used to identify the locations of potential receptor locations.

The desktop assessment also outlined the visual character of the surrounding landscape including features such as landform, elevation, water courses, vegetation cover, residential properties and the location of public roads. A one day site visit was undertaken on the 5th June 2019, and attended by two landscape architects. Fieldwork was conducted to determine and confirm the potential extent and visibility of the Project.

2.4 Assessment of landscape character impacts

Assessment of landscape character deals with the impact of a visible change on the landscape and development on: the elements that make up the landscape; the aesthetic and perceptual aspects of the landscape; and, its distinctive character. The assessment comprises the combination of the following assessments:

2.4.1 Sensitivity of landscape to visual change

The identification of the sensitivity of the landscape to a specific change encompasses the following components:

Susceptibility to change

The existing landscape receptor is assessed to understand the capacity to accommodate the Project; without adverse impact on existing landscape character, e.g. based on landform, land use, pattern or scale; and the capacity to achieve landscape planning policy and strategy objectives.

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Value of the landscape

This assesses whether the value of the landscape would be affected based on existing landscape character designations (e.g. state, regionally or locally recognised landscapes), and the value of particular landscape elements or notable aesthetic, perceptual or experiential qualities.

These individual criteria are combined to achieve a landscape sensitivity rating that is defined in Table 2.

Table 2 Landscape sensitivity rating

High	Landscapes of international designation and/or landscapes that have high sensitivity to the type of development proposed which could have a detrimental impact on the landscape character or value. Mitigation measures will be unlikely to reduce all of the impacts of the change.
Moderate	Landscapes of regional designation or valued more locally and tolerant of moderate levels of change. Any change would be unlikely to have a significant adverse impact on the landscape character or value and mitigation would neutralise some of the impacts.
Low	Landscapes of local designation that are more commonplace and potentially tolerant of noticeable change or are undergoing substantial development themselves, with mitigation measures likely to neutralise or improve the landscape character.
Negligible	Landscapes of local designation and/or with low sensitivity to the type of change proposed with mitigation likely to completely neutralise any impacts or not required at all.

2.4.2 Magnitude of landscape impact

The magnitude of landscape impacts comprises the following components:

Size or scale of change

An assessment of size or scale of change in the landscape likely to be experienced as a result of the Project which may include the extent of loss of existing landscape elements, the degree of alteration to aesthetic or perceptual aspects of the landscape or change to key characteristics of the landscape.

Geographical extent of impacts

This considers the geographical extent over which the landscape impacts will be felt and is distinct from the size or scale of the change. This is influenced by site levels, the immediate setting of the site, and landscape character types in the vicinity.

Duration and reversibility of the impacts

Duration is judged on a scale of short term (zero to five years), medium term (five to ten years) and long term (ten to thirty years).

Reversibility is a judgement about the prospects of the impact being reversed, for example, a project such as a mine might have a limited life and then be rehabilitated for a new or pre-existing purpose.

These individual criteria are combined to achieve a magnitude of landscape impact that is defined in Table 3.

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Table 3 Magnitude of landscape impact

High	A substantial/obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Change would cause a landscape to be permanently changed and its quality diminished.
Moderate	Discernible changes in the landscape due to partial loss of, or change to key elements, features or characteristics of the landscape which may be partly mitigated. The change would be out of scale with the landscape, at odds with the local character, and would leave an adverse impact on the landscape. The change would partially obstruct or change a view.
Low	Minor loss or alteration to one or more key landscape features or characteristics, or the introduction of elements that may be visible but may not be uncharacteristic within the existing landscape.
Negligible	Almost imperceptible or no change in the landscape or views as there is little or no loss of, or change to the elements, features or characteristics of the landscape.

2.4.3 Overall significance of landscape character impacts

Once the sensitivity of the landscape to visual change and the magnitude of the landscape impact is determined, a rating matrix is used to determine an overall rating of landscape impacts, and rated on the level of significance of the impact, described as being Negligible, Low, Moderate - Low, Moderate, High - Moderate or High, as set out in in Table 4. Ratings of High and High - Moderate are considered to be significant.

Table 4 Overall significance of landscape character impacts

		Magnitude of impact			
		High*	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	High - Moderate	Moderate	Negligible
	Moderate	High - Moderate	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

2.5 Assessment of visual impacts

Assessment of visual impacts deals with the impact of changes to the landscapes perceived by individuals or groups of people. This identifies the change or loss of existing elements of the visual landscape and/or introduction of new elements to relevant users.

Receptor Types

The viewpoints have been organised into key receptor types, each of which are considered typically to share defined levels of sensitivity to changes in the context and character of views. The receptor types that form this assessment comprise nearby residential properties, public space and road users.

Visual Envelope Mapping

The likely visibility of the proposed elements of the Project at operation from surrounding areas is broadly mapped to define a visual envelope. This map indicates 'worst case' and is indicative only as it does not consider the impacts of existing vegetation cover.

Photomontages

Photography

Photographs of the Project site from nominated receptor locations were used to assist in the analysis process. The photographs were taken during a site visit on 5 June 2019.

Camera

A series of photographs were captured on site using a Nikon D5600 digital camera with a Nikon 18- 55 F3.5-5.6 G Lens. The camera has an APS-C sensor which produces a crop factor of 1.5x relative to 35mm film. Photos were taken with the lens set at 24mm, providing a horizontal Field of View (FoV) of 51.4° and a vertical FoV of 35.6°. Photos were taken using an aperture of F8 to provide a deep depth of field, an ISO of 100 to keep noise to a minimum and shutter speed of 1/125 to 1/500 seconds to create a suitable exposure. The camera was mounted on a tripod to eliminate camera shake or motion blur. Camera positions were recorded using Survey123, an ESRI ARC GIS application providing an accuracy of +/- 3m. Coordinates were recorded using the Universal Transverse Mercator co-ordinate system.

Photomontage model

The photomontages were created using Adobe Photoshop software. A three dimensional (3D) indicative model of the Project was made using Trimble SketchUp Pro software to represent an indicative arrangement of solar arrays, based on the georeferenced Autodesk Autocad layout. Both the existing terrain (using Landgate topographic data) and the solar farm array model were built as a 3D model. The intent of the model was focussed on viewing the Project in its wider setting, at the view level of a pedestrian at a nominal eye height of 1.85 metres. The materials and finishes used in the photomontages are indicative only and would be further investigated during detailed design.

Virtual camera matching

Photographs were corrected for distortion using specific camera and lens profiles, and camera coordinates were then merged with the 3D model to allow a 'virtual camera' to be set up using these coordinates. Camera matching was undertaken using reference points common to the 3D model and physical features in the photographs. Photos and 3D model were combined using the 'Match Photo' tool within Trimble SketchUp Pro software and then transferred to Adobe Photoshop for rendering.

Rendering

The model was rendered with the photographs and edits to the foreground and background elements made as necessary. AECOM carefully compares site photography, plans, aerial photography and other sources of information such as Google Street View when editing photographic data to ensure that represented views are realistic.

2.5.1 Sensitivity of visual receptors

The sensitivity of visual receptors encompasses the components outlined below.

Susceptibility of visual receptors to change

The susceptibility of different visual receptors to changes in views and visual amenity is mainly a function of the activity of people experiencing the view and the extent to which their attention or interest may therefore be focused on the view.

Visual receptors most susceptible to change are generally residents who are likely to occupy these locations for long periods of time, people engaged in outdoor recreational activity, visitors to attractions where the surroundings are part of the experience, and communities where the landscape setting is an important contributor to the amenity of their environment.

Visual receptors with a moderate susceptibility to change are generally travellers on road and rail transport. Where travel involves recognised scenic routes, the awareness of views may be particularly high.

Visual receptors with less sensitivity to change include people engaged in outdoor sport and people at their place of work where attention is focussed on their activity and the setting is less important to their experience.

Value attached to views

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This assessment considers:

- the recognition of the value attached to particular views, either in relation to heritage assets or through planning designations, planning policy or other existing planning or urban design studies.
- indications of the value attached to views, either through inclusion in guidebooks or on tourist maps, or provision of facilities for their enjoyment such as sign boards and interpretive material.

These components are combined to produce a sensitivity assessment that ranges from High to Negligible.

2.5.2 Magnitude of the visual impacts

The magnitude of visual impacts comprises the components outlined below.

Size or scale of the change
This assessment takes account of the scale of change in the view with respect to: the loss or addition of features in the view; the degree of contrast or integration of any new features or changes and characteristics in terms of form, scale and mass, line, height, colour and texture; the nature of the view of the proposal; and, whether views will be full, partial or glimpses.

Geographical extent of impacts
The geographical extent of a visual impact will vary with different viewpoints and is likely to reflect the horizontal angle of the view, the distance of the viewpoint, and the extent of the area over which changes would be visible.

Duration and reversibility of the impacts
Duration is judged on a scale of short term (zero to five years), medium term (five to ten years) and long term (more than ten years). Reversibility is a professional judgement about the prospects of the impact being reversed, with a solar farm having a good potential to revert to farmland.

These components are combined to produce a magnitude of visual impact assessment that ranges from High to Negligible.

2.5.3 Overall significance of visual impacts

Once the sensitivity of the landscape to visual change and the magnitude of the landscape impact is determined, a rating matrix is used to determine an overall rating of visual impacts, and made on the level of significance of the impact, described as being Negligible, Low, Moderate - Low, Moderate, High - Moderate or High, as set out in Table 5.

Table 5 Overall significance of visual impacts

		Magnitude of impact			
		High*	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	High - Moderate	Moderate	Negligible
	Moderate	High - Moderate	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

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2.6 Mitigation measures

Following from the assessment of impacts, a set of mitigation measures have been developed to reduce adverse impacts by the Project on sensitive receptors. Mitigation measures typically include appropriate design considerations, materials selection, colour selection and landscape planting.

2.7 Assumptions and limitations

This methodology includes the following assumptions and limitations:

- For assessment purposes, it is assumed that no landscape mitigation is in place.

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3.0 Legislation Policy and Guidelines

3.1 Legislative Framework

There is currently no national level guideline document for Landscape and Visual Assessment (LVA) in Australia. Landscape Architects in Australia have instead relied on a number of guidance documents offered by other Landscape Architecture Institutes and Government bodies.

The Landscape Institute and the Institute for Environmental Management (United Kingdom) (2013) "*Guidelines for Landscape and Visual Impact Assessment*" (GLVIA3), provides the basis for 'best practice' in this field.

The Western Australian Planning Commission's (WAPC) '*State Planning Policy No. 2 Environment and Natural Resource Policy'* For Western Australia states that the objective for planning is to:

- 'Identify and safeguard landscapes with high geological, geomorphological or ecological values, as well as those of aesthetic, cultural or historic value to the community, and encourage the restoration of those that are degraded.'
- 'Consider the level or capacity of the landscape to absorb new activities and incorporate appropriate planning and building design and siting criteria to ensure that new development is consistent and sensitive to the character and quality of the landscape.'
- 'Consider the need for a landscape, cultural or visual impact assessment for land use or development proposals that may have a significant impact on sensitive landscapes.'

The Department of Planning, Lands and Heritage (DPLH) '*Visual Landscape Planning in Western Australia: A manual for evaluation, assessment, siting and design'* has been used to develop the landscape and visual impact assessment methodology. The principal objectives to conduct the evaluation and assessment include:

1. Describe the existing visual landscape character.
2. Describe the proposed development.
3. Describe and evaluate the potential visual impacts.
4. Develop visual management measures.
5. Provide recommendations.

Therefore, this assessment is made with reference to an understanding of planning policy, methodology and techniques set out in the documents above.

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4.0 Project location and description

4.1 Regional setting

4.1.1 Swan Coastal Plain

The Project is located within the Swan Coastal Plain, near Waroona in Western Australia. The Swan Coastal Plain is a strip of land approximately 10 kilometres wide that is aligned north-south between the Indian Ocean to the west and the Darling Scarp to the east. Within the district of the Swan Coastal Plain in which the Project Area is located, there is a broad land type identified as Palusplain. The Palusplain is a seasonally waterlogged, flat wetland typical of the duplex and sandy soils found on the Pinjarra Plain to the east of the Swan Coastal Plain (Semeniuk, cited in Hill et al. 1996).

The Palusplain is characterised by a very gently undulating landscape, high winter water tables, sandy and duplex soils, and variable quality groundwater resources. Prior to European settlement, the Palusplain was a slowly moving, interconnected, seasonal wetland system with areas of higher ground, and a rich food source for the local Noongar peoples. Extensive clearing and drainage occurred in the late 1800s through to the mid-1900s to facilitate agriculture (Safstrom and Short, 2012).

4.1.2 Recent Landscape History

Bradby (cited in Environmental Protection Authority, 2008) describes the Swan Coastal Plain in 1829 as being a wetland. Each winter, it and the upstream jarrah forest would be hit by heavy and concentrated rains. Streams and brooks would flow onto the plain, dissipating their energy into a broad, interconnected chain of swamps many kilometres wide. Only the rivers of the largest system, the Murray and the Dandalup, stayed in clear stream beds for all their length, except in larger floods.

The other main rivers, the Serpentine and the Harvey, were well-defined in their upper and lower sections, but their middle reaches were a maze of swamps. Here, the rivers would spread out in winter and join forces with the flow from all the smaller brooks and streams. Some of this water would eventually seep through to the rivers' lower reaches, and flow through the estuary to the sea. The plain would be flooded from the scarp through to the long ridge of tuart-covered Spearwood dunes towards the coast, with only occasional sand hills remaining exposed (Safstrom and Short, 2012).

4.1.3 Vegetation Clearing and Drainage for Agriculture

Prior to European settlement, the land in the district was heavily vegetated with paperbark woodland and jarrah–marri forests to the east. With increased colonisation in the late 1800s came increased clearing for agriculture resulting in groundwater rise which exacerbated the extent of seasonal inundation. Eventually, after landholders lodged numerous complaints relating to lost crops and property damage, the government addressed the problem of inundation by implementing a network of drains. In 1900, the first Drainage Bill was passed by state parliament. Over the next 70 years, trees on the banks of the waterways were removed, lower river reaches were de-snagged, the rivers were straightened and deepened, and systems of interconnecting drains were dug across pastoral lands, resulting in the current landscape setting (Safstrom and Short, 2012).

4.2 Local setting

4.2.1 Soils and Landscape

The Project is located within the Swan Soil-Landscape province and is recognised as described by Purdie *et al.* (2004) as being part of the following mapped land systems in the area:

- Bassendean System (212Bs) – sand dunes and sandplains with pale deep sand, semi-wet and wet soil. This system covers most of the Project Area.
- Pinjarra System (213Pj) – Poorly drained coastal plain with variable alluvial and aeolian soils. This system presents as the alluvial plain of the Harvey River located along the southern margin of the Project Area, as well as a small depression in the north eastern corner of the Project Area.

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Land systems in the Project Area can be further defined into nine sub-systems that form a mosaic of sandplains, low dunes and depressions with varying drainage – in some parts, depressions may form poorly-defined creeks. Where the Pinjarra System is present, clays and duplex soils are more prevalent. These duplex soils support the defined, incised channel and banks of the Harvey River.

More broadly, this area of the Swan Coastal Plain at the interface of the Bassendean and Pinjarra Systems is defined by its gently undulating land surface, extensive areas of poor drainage and palusplain, formed on alluvium originating from the Darling Range. Soils are generally sandy at the surface, tending to loamy duplex soils and clays at depth (Tille et al, 1994). Soil-Landscape mapping within the Project site is shown in Figure 2.

4.2.2 Wetlands

Mapping within the Geomorphic Wetlands, Swan Coastal Plain (DBCA-019) database identifies Multiple Use category wetlands occurring over a substantial portion of the site. The Harvey River is identified as a Conservation Category wetland. A small area of Resource Enhancement wetland is also identified by the DBCA-019 database (Figure 2).

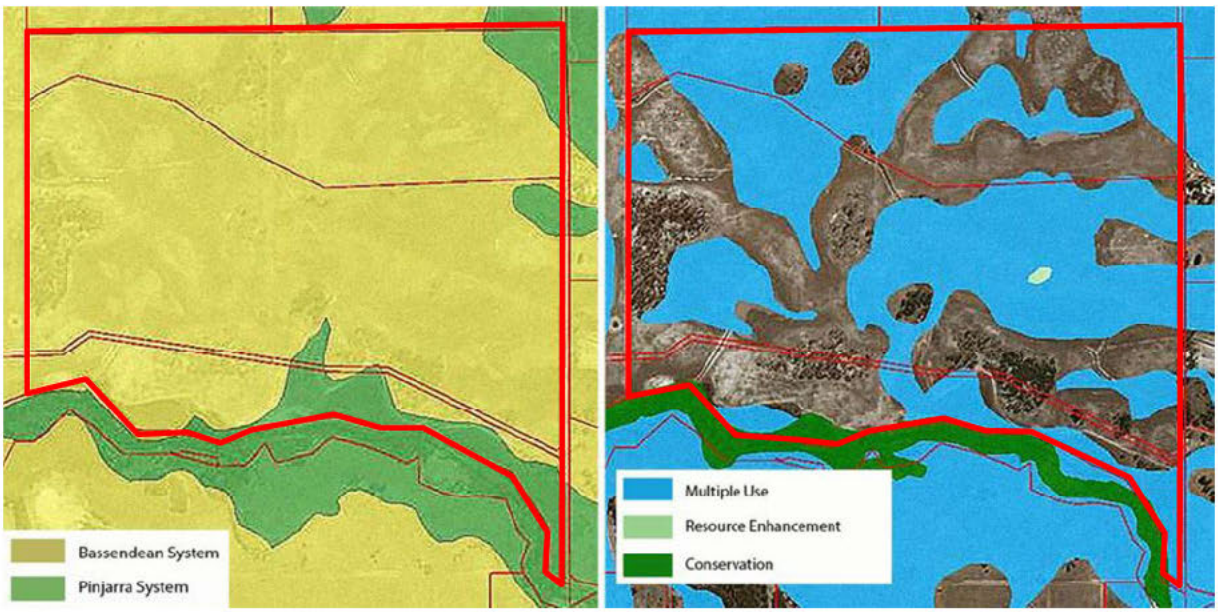

Figure 2 Soil Landscape Systems (Left) & Wetland categories (Right)

4.2.3 Vegetation

Pre-European vegetation mapping has been undertaken by Beard (1974). This mapping shows one vegetation association within the Project Area, described as:

> Association 1000 Low forest or woodland. Mosaic: medium forest; Jarrah-Marri / low woodland; *Banksia* / Low forest; Teatree (*Melaleuca* spp.).

Heddle *et al.* (1980) conducted vegetation complex mapping for the Swan Coastal Plain at a scale of 1:250,000. The mapping shows three vegetation types including Serpentine River, Cannington and Southern River Complex (Figure 3 and Table 6).

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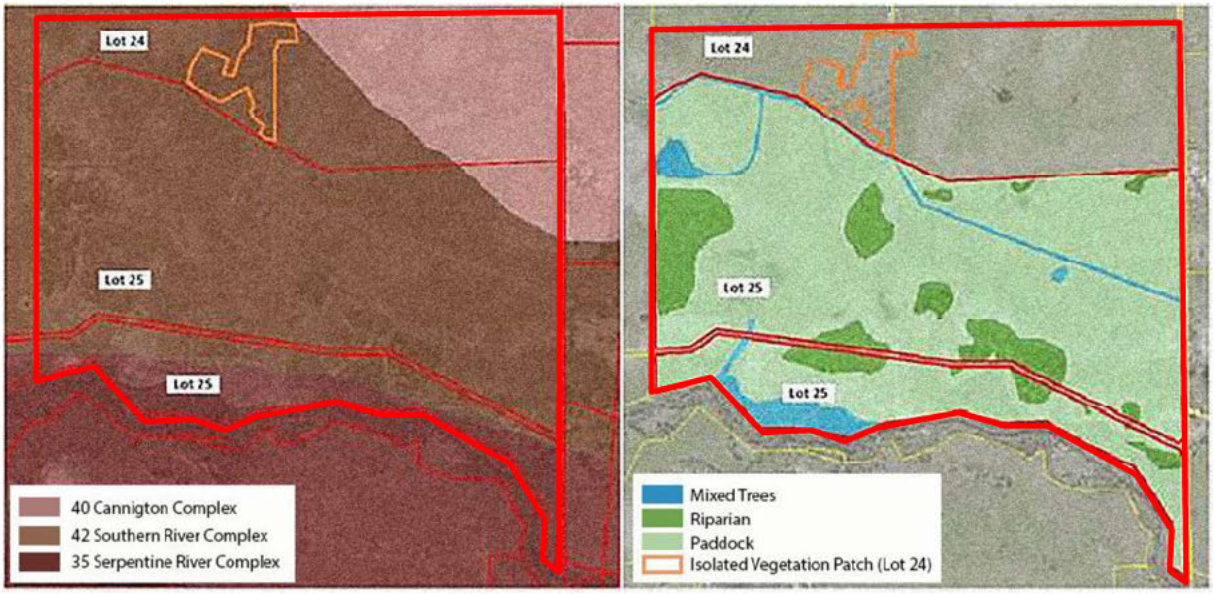

Figure 3 Pre-European vegetation (Left) and AECOM 2019 survey (Right)

Table 6 Vegetation complex mapping in the Project Area by Heddle *et al.* (1980)

Landform Unit	Complex	Description
Pinjarra Plain	35 Serpentine River Complex	Closed scrub of *Melaleuca* species and fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along streams.
Combination Bassendean Dunes and Pinjarra Plain	40 Cannington Complex	Mosaic of vegetation from adjacent vegetation complexes of Bassendean, Karrakatta, Southern River and Vasse.
	42 Southern River Complex	Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.

4.2.4 Site Vegetation

AECOM mapped the vegetation within the Project site and reported stands of mixed trees, riparian vegetation and paddock (grasses cultivated for stock feed). Tree death was prominent throughout all areas of native vegetation. Understorey vegetation was generally absent with some evidence of regrowth of herbs following the drying-out of inundated areas.

Degrading factors such as erosion, grazing, potential dieback or alterations in groundwater levels, and weeds are causing considerable decline in the condition of native vegetation within the Project site.

Vegetation descriptions for the main vegetation associations observed in the Project site and typical photographs are provided in Table 7.

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Table 7 Vegetation associations including extent and condition

Description	Photograph
Mixed trees Stands of mixed trees including *Eucalyptus marginata* and *Corymbia calophylla* with occasional *Melaleuca* and *Banksia* spp. Condition: Degraded	
Riparian *Eucalyptus rudis* subsp. *rudis* tall overstorey over *Melaleuca preissiana* low trees over weeds. Density of vegetation varied with degradation. Condition: Degraded to Completely Degraded (man-made drains)	
Paddock Predominantly cleared paddock comprising common pasture weeds. Low-lying areas winter-wet. Scattered *Eucalyptus* trees. Condition: Completely Degraded	

4.3 Project site

The site is located within the rural area on a 303.52 ha parcel of pastoral land near Waroona, located approximately 40 km south of Mandurah and approximately 100 km south of Perth, in the Shire of Waroona in Western Australia (Figure 4). Project site is identified as Lot 24 on Plan 59266 (Land ID 3800596) and Lot 25 on Plan 59266 (Land ID 3800597), located on flat to gently undulating plains.

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Figure 4 Project site
(Source: Nearmap © 2019)

4.4 Site surrounds

Land surrounding the subject site is mostly pastoral land that is currently zoned as Rural 1 - General Farming.

Built environment features include farm houses and residential dwellings, farm-related infrastructure such as out-buildings, sheds, trees, vegetation and waterways.

The immediate surrounds can be described as follows:

- **North:** Northern boundary of Lot 24 on Plan 59266 (Land ID 3800596) and Farmland
- **South:** Harvey River, riparian forest and wetlands
- **East:** Landwehr Road, Landwehr Terminal and Buller Nature Reserve
- **West:** Western boundary of Lot 24 on Plan 59266 (Land ID 3800596) and Lot 25 on Plan 59266 (Land ID 3800597) and Farmland.

4.5 Site characteristics

4.5.1 Land Use

The project is wholly within general Farming Zone of the Local Town Planning Scheme and is on agricultural land that has been heavily cleared for broad acre farming. It is envisaged that throughout the operation of the Project, the site area will continue to be used for the purposes of grazing livestock when not waterlogged.

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4.5.2 Landscape

Vegetation present includes native riparian vegetation in the southwest corner and scattered trees throughout the farming paddocks. There are wetland areas throughout the site, which are prone to seasonal waterlogging and inundation. Numerous man-made drains are also present. Buller Nature Reserve is located at approximately 1,000 m east of the site.

4.5.3 Access

The site's main vehicle access point is via Landwehr Road at the south-eastern corner of the site. The site has a frontage to Landwehr Rd along its eastern boundary. The site is surrounded by two main roads – Buller Road approximately 1,250m north of the site and Bristol Road, approximately 1,000m south of the site. The site is bound by the Harvey River to the south and is surrounded by farmland on all the other sides. The main transport corridors in the region include the South Western Highway (east) and Forrest Highway (west), both connecting Perth to Bunbury and all other townships in between (Figure 5).

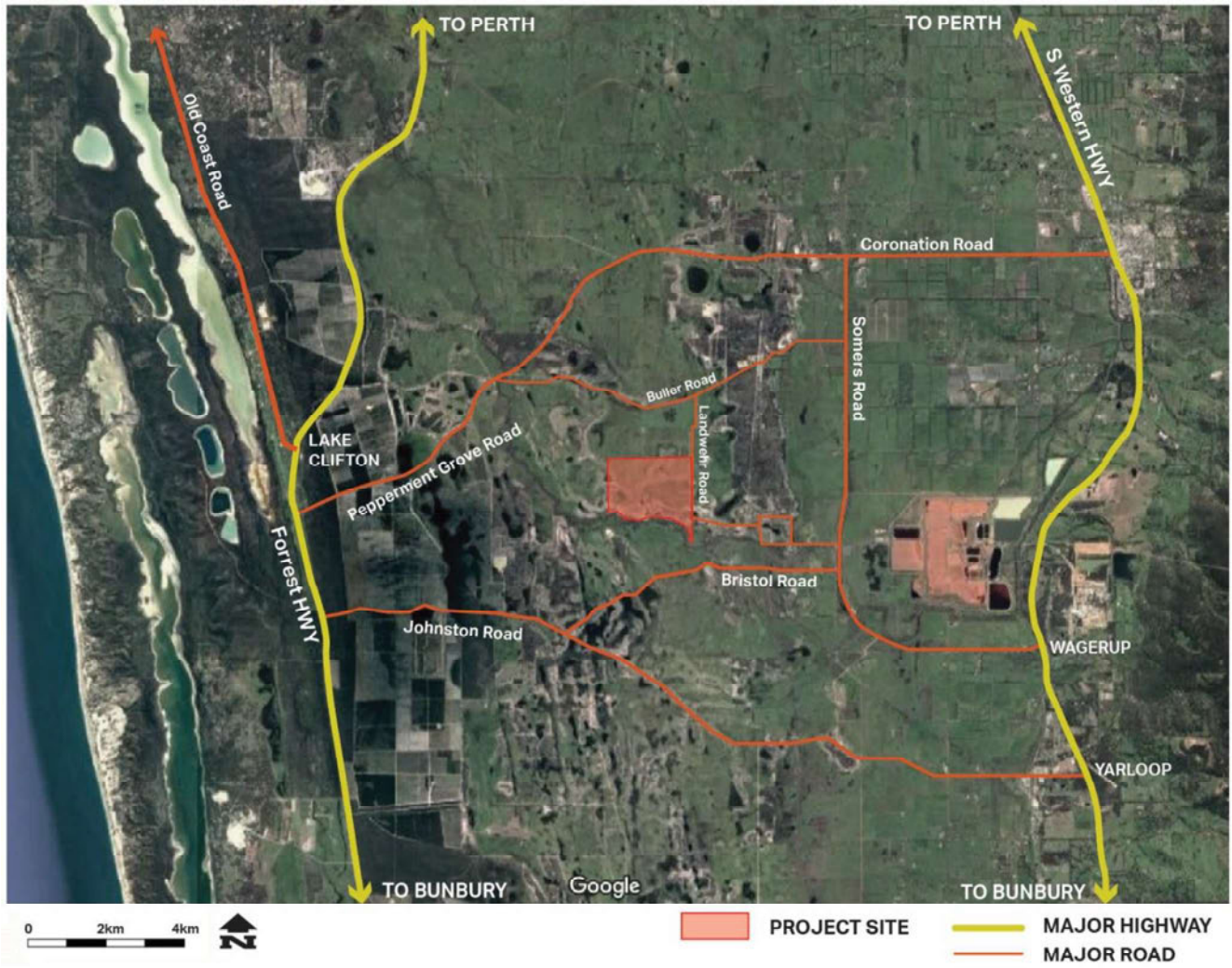

Figure 5 Site Access

(Source: Nearmap © 2019)

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4.6 Topography

Based on inferred contours derived from Western Australian Land Information Authority - Landgate, the site elevation ranges between approximately 9 metres Australian Height Datum (mAHD) to 16 mAHD, with several undulating mounds within the site interspersed with low points associated with areas of poor drainage within the site. The majority of the site is at an elevation of 11 mAHD. From the highest area of the landscape located in the southwestern portion of the site, the land generally slopes downwards towards the east and north. The lowest elevations are along the Harvey River (southern boundary). Refer to Figure 6.

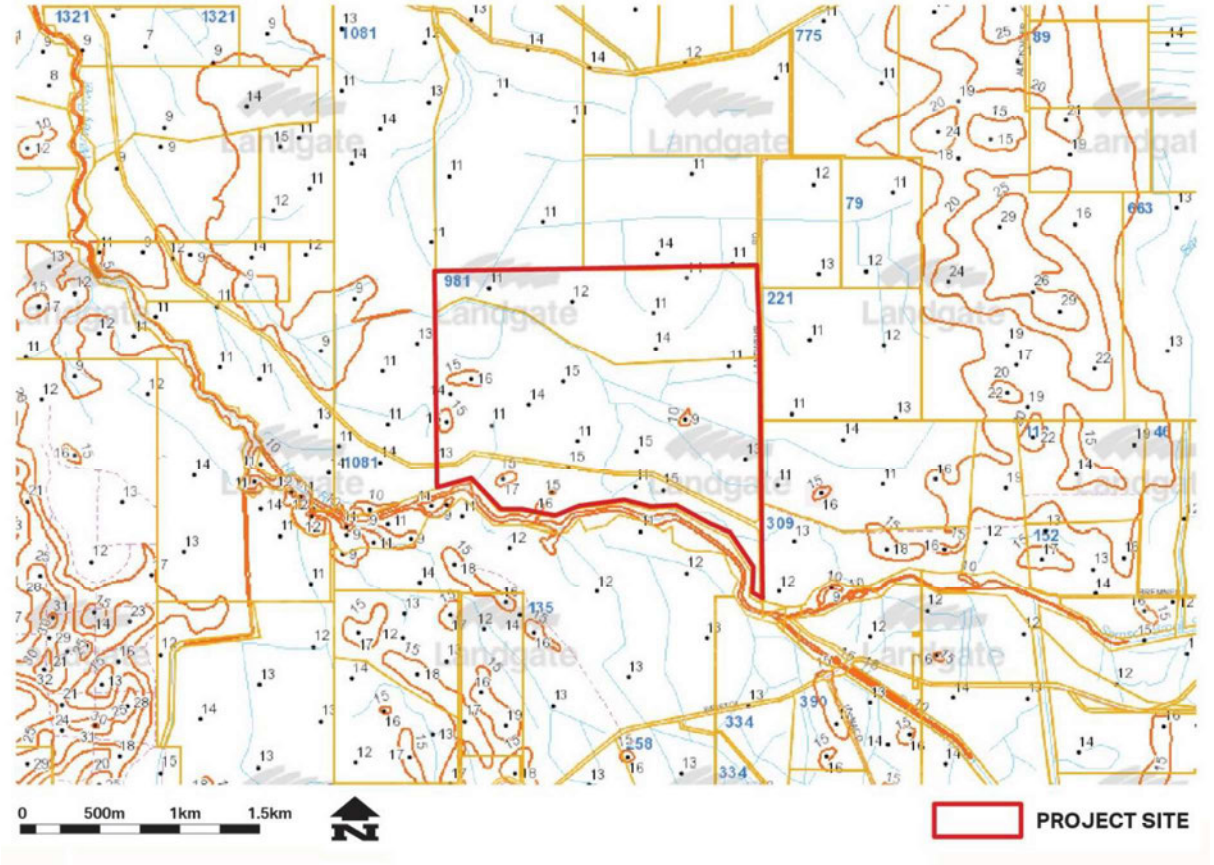

Figure 6 Site Topography and Elevation Points

(Source: Nearmap © 2019)

4.7 Proposed Development

The proposed development is at concept stage and a finalised schematic was not available at the time of preparing this report. Based on previous experience with similar projects, it is assumed the development will comprise:

- Photovoltaic (PV) solar modules mounted on a single-axis tracking system mounted on steel piles
- Solar Farm Substation (including O&M Facility, Control Room, BESS and Western Power Terminal Station equipment)
- Electrical transmission structures
- Power Conversion Unit (PCU)
- Fencing
- Internal all-weather access tracks and associated drainage
- Landscaping.

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An indicative site layout is shown below in Figure 7.

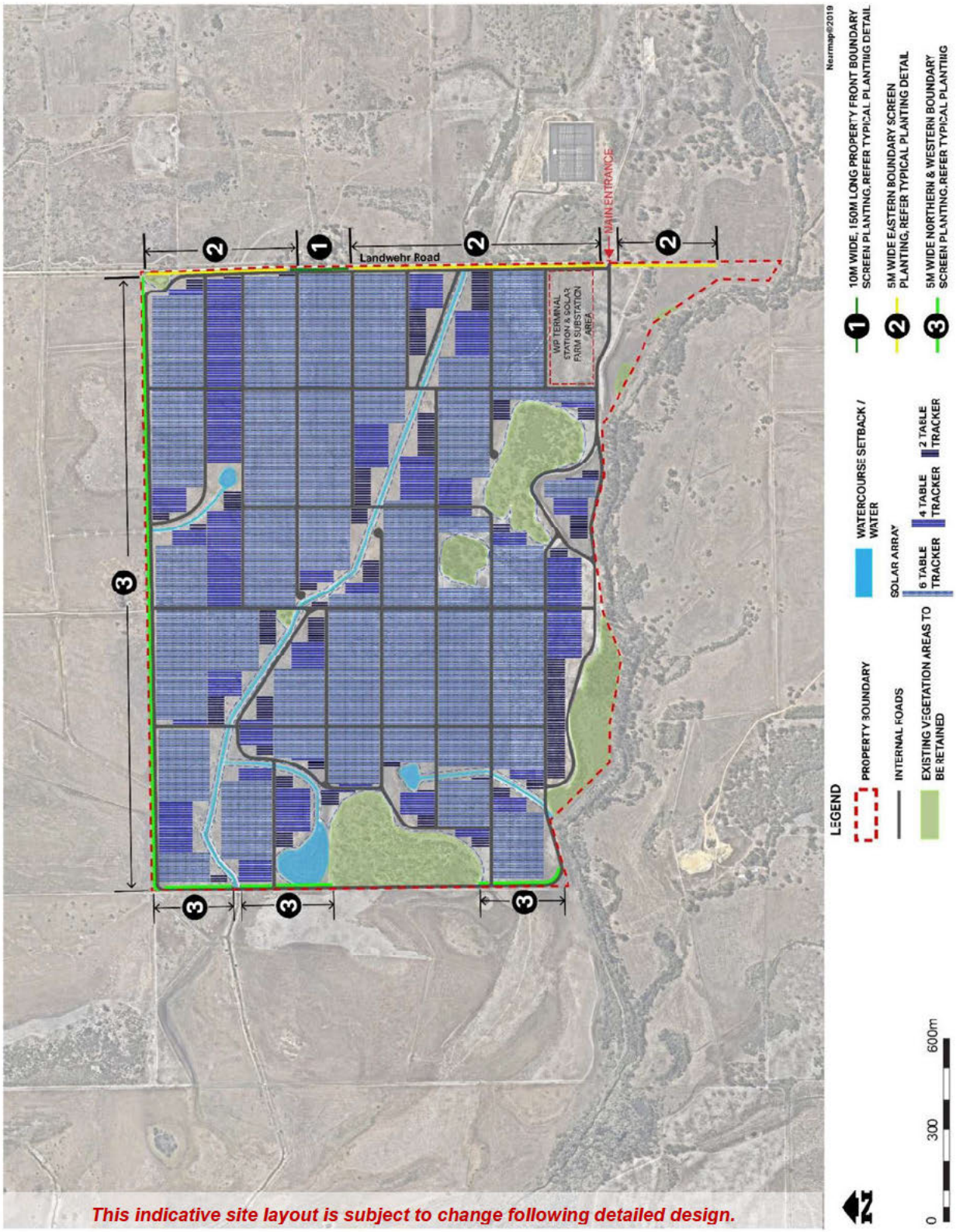

Figure 7 Indicative site layout

(Source: Nearmap © 2019)

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The proposed mounting configuration of the individual PV modules will be a series of modules on tracking structures. PV modules will be mounted on tracker arms in landscape arrangement, with the tracking angle ranging from +55 to -55 degrees to the horizontal each day. The modules will be oriented to face east for first light in the morning and will track to follow the position of the sun throughout the course of the day. At solar noon, the position of the modules will be zero degrees (parallel to the ground) and they will finish facing west in the late afternoon.

In order to maximise electricity production, it is assumed that the PV modules will be arranged on a single tracking system that rotates about a north-south aligned axis to follow the sun +/- 55° from the horizontal, with the panels being oriented as close as perpendicular to the incoming sun as possible.

The tracking structures will be arranged in rows, mounted on piles, which will be screwed, or pile driven depending on final geotechnical analysis. This eliminates the need for concrete and foundations which significantly reduces the impact of construction. In turn, this enables the retention of native grasslands and habitats under the array.

This construction methodology keeps ground disturbance to a minimum and allows the final site design to follow the existing lie of the land. It is expected that the site will be maintained by livestock grazing as much as possible.

The PV module and tracking structures used for this analysis are shown in Figure 8. The actual module and tracking structures may differ once a construction partner has been appointed and detailed design progresses.

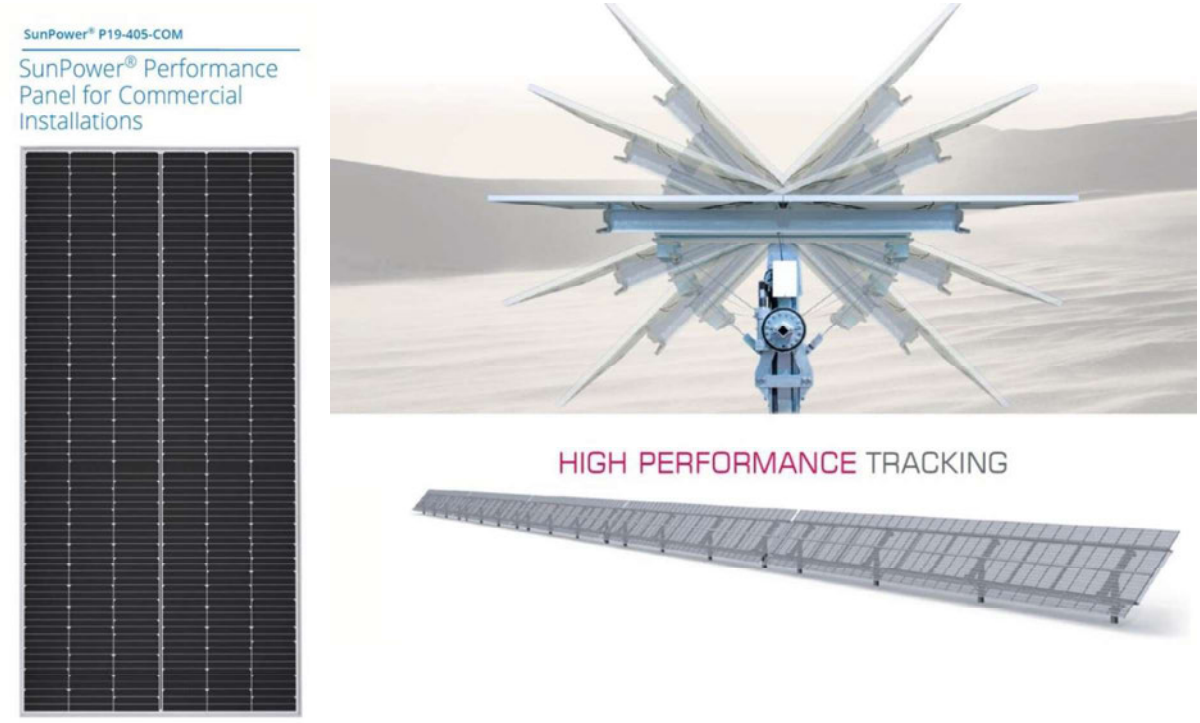

Figure 8 Typical example of a PV module and axis tracker system

A number of Power Conversion Units (PCU) will be located on site as well as a terminal station. A typical example of a PCU is shown in Figure 9. A typical example of a Solar Farm Substation is shown in Figure 10.

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Figure 9 Typical example of power conversion unit (PCU) for solar farm

Figure 10 Typical example of a Solar Farm Substation.

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5.0 Landscape Character Assessment

5.1 Landscape character zones

Three landscape character zones (LCZ) have been identified within the study area, comprising:

- LCZ 1: Open rural landscape
- LCZ 2: Bushland rural landscape
- LCZ 3: Farmhouse landscape.

Figure 11 presents the extent of the landscape character zones. For the purpose of this assessment, the key area of focus is considered to be those with a one kilometre offset from the Project. Beyond this area, it anticipated that the combined impacts of intervening landform and vegetation will combine to limit landscape and visual impacts of the Project.

5.1.1 Landscape Character Zone 1 - Open rural landscape

This LCZ is characterised by a predominantly open rural landscape with large rural lot holdings (refer to Figure 12), laid out in a mosaic of grid forms comprising agricultural fields. The orientation of many of the field boundaries is influenced by the flat to gently undulating topography. This 'mosaic grid' is emphasised with a combination of lot boundary planting, road layout with roadside planting and different crops and pasture management practices.

As mentioned above, the topography is generally flat to gently undulating. The overall landscape comprises a scattering of remnant trees spread across the open pasture landscape. Most of lower parts of the landscape have some remnant pockets of riparian and riparian native vegetation. Remnant thickets of dark green bushland occupy some of the drains and watercourses running through the landscape.

5.1.2 Landscape Character Zone 2 - Bushland rural landscape

This LCZ comprises a generally fragmented, group of landscape units, underlain by either harder rock that was likely not capable of supporting agriculture, drainage areas (Harvey River and drains) and clusters of wetland that floods during the wet season. The LCZ is often subject to dense bushland cover. The vegetation type supported by this LCZ creates partial to full enclosure of the Project landscape setting (Figure 13).

5.1.3 Landscape Character Zone 3 - Farmhouse Landscape

This LCZ is generally characterised by domestic landscapes including gardens, farmhouses and other low density residential and ancillary dwellings of varying architectural styles. The built forms are all setback from the road edge. Front yards are generally open, with lawns and simple garden beds framed by groupings of mature trees creating semi-enclosed domestic external environments. Solid boundary fencing is absent (Figure 14).

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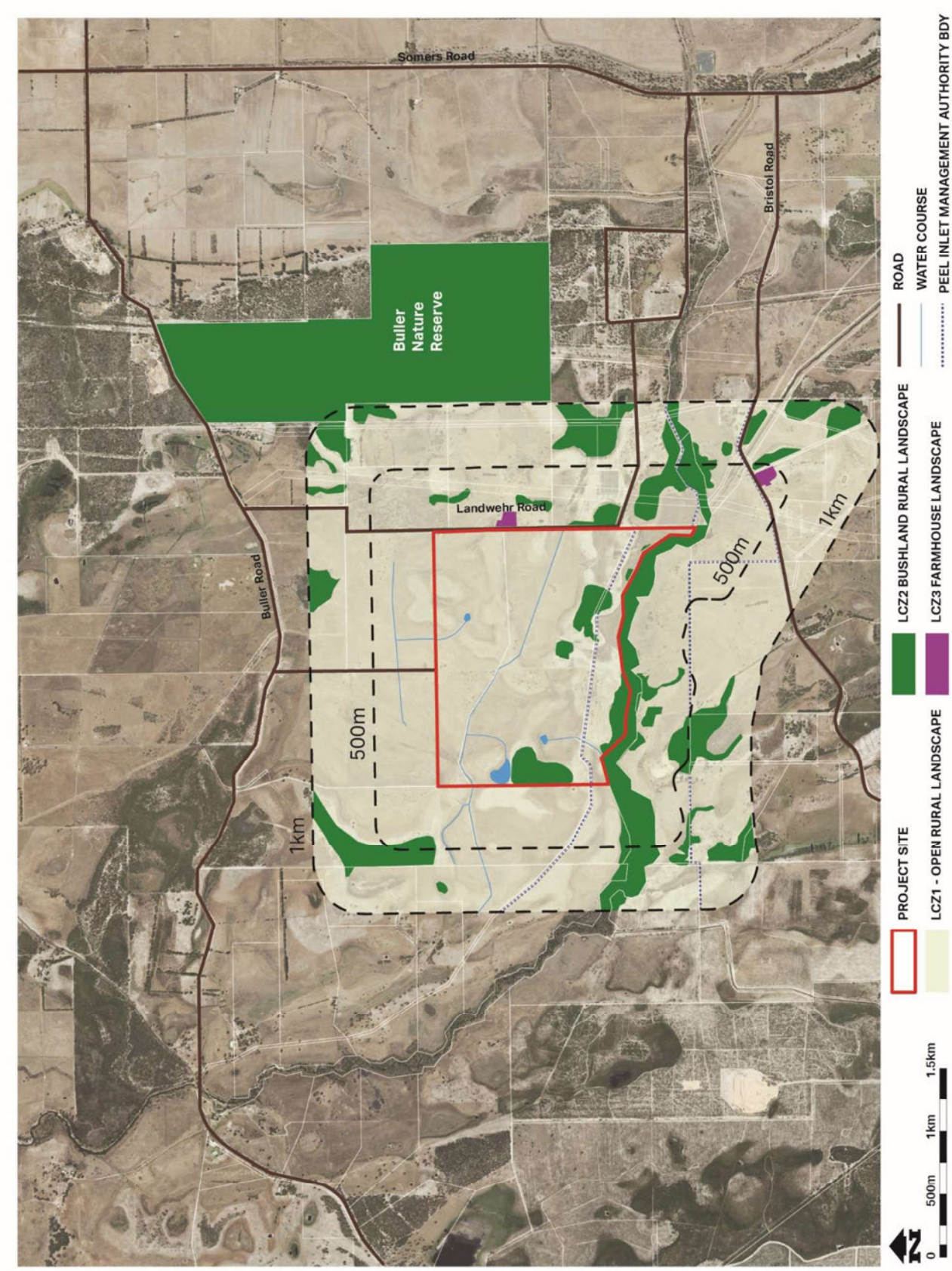

Figure 11 Landscape character zones and study area
(Source: Nearmap © 2019)

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Figure 12 Examples of the open rural landscape of LCZ 1 – typical images

Figure 13 Examples of the bushland rural landscape of LCZ 2 – typical images

Figure 14 Examples of the farmhouse landscape of LCZ 3 – typical images

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5.2 Existing visual buffers (vegetation analysis)

Broadening the existing vegetation analysis surrounding the Project site, it is possible to infer possible visual buffers that will contribute to the enclosure on the Project site from the main public access roads surrounding the site. These areas or buffers are composed of partial to dense clusters of remnant bushland, nature reserves, clusters of paperbark woodland scattered through the lower wetlands, Riparian forest along the Harvey River and farmland hedges. Due to its dense nature, these existing visual buffers enhance the capacity of the surrounding landscape to mitigate some of the visual effects of the Project (Figure 15).

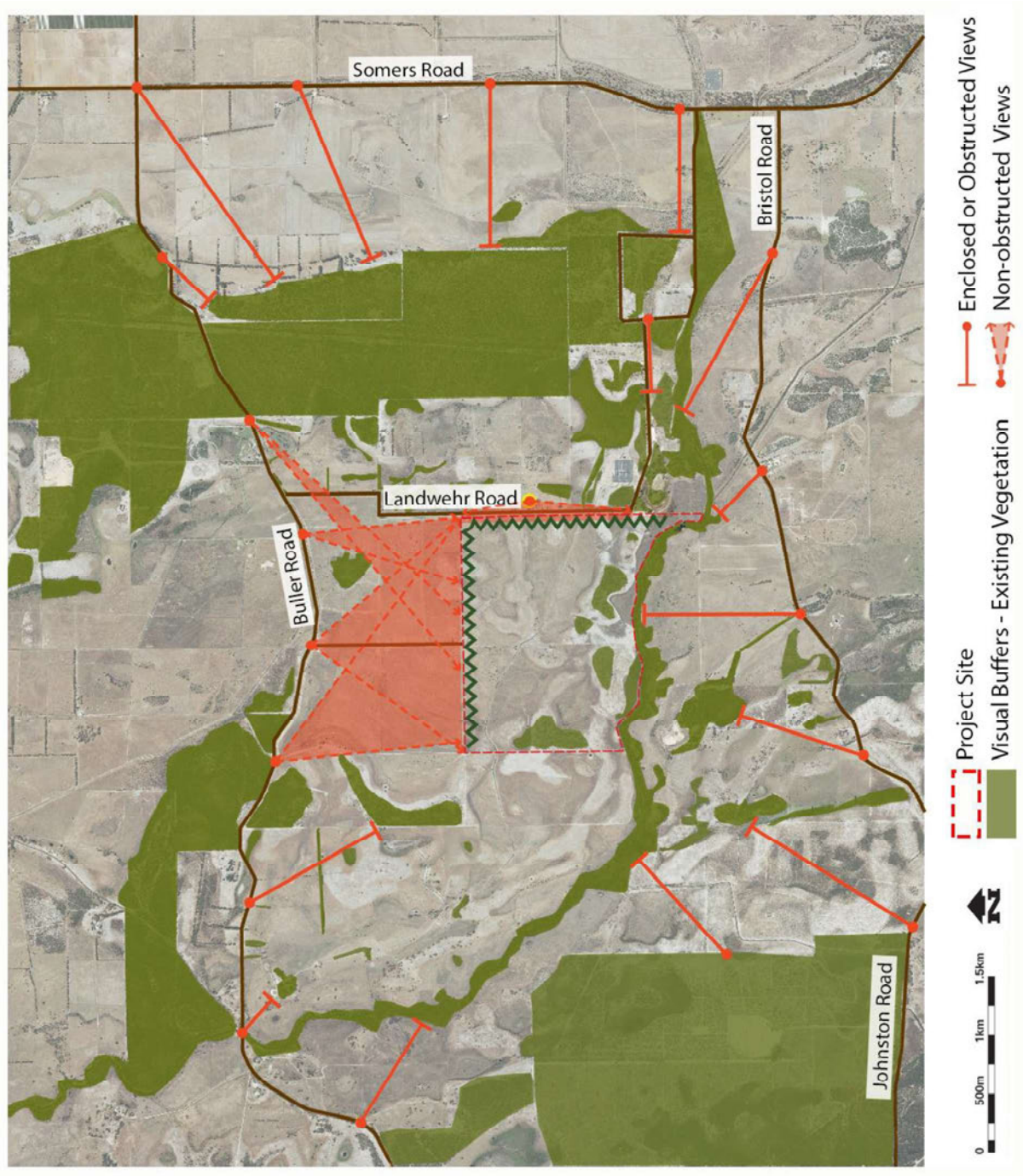

Figure 15 Existing Visual Buffers – Existing Vegetation surrounding Project site
(Source: Nearmap © 2019)

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5.3 Landscape character impacts

Landscape character impacts upon the identified landscape character zones (arising from the Project) have been assessed in Tables 8, 9 and 10). The assessment has determined the likely significance of potential changes to the character of the landscape within each of the identified landscape character zones.

Table 8 Landscape character impacts assessment - LCZ 1

Landscape Character Zone 1 - Open rural landscape
Anticipated change to LCZ The Project would comprise a contrasting element across the open, gently undulating, rural landscape.
Sensitivity to change: Moderate **Susceptibility to change** The LCZ is considered to have a moderate potential to accommodate the proposed change within the context of the existing landscape but mitigated by the potential to retain vegetation and supplement roadside planting along the boundaries of the Project as reflected in the broader landscape patterns of linear windrows and roadside vegetation. **Value of LCZ** LCZ 1 is considered to be of regional value, given the regionally-consistent, intensive agriculture character and grid mosaic pattern landscape formed by fenced pastures. This character, in conjunction with the gently undulating topography, is characteristic of the landscape character and visual amenity across large areas of the surrounding region. This LCZ provides a *foreground* or *middle ground* to the way the overall landscape is viewed and valued.
Magnitude of change: Moderate **Size/scale** The scale of change in the landscape would be moderate, given the size and uncharacteristic form of the solar array within the open rural landscape setting, and other key structures including electrical terminal station and substation. However, the north and eastern boundaries of the Project would be reinstated with planting characteristic of roadside and natural bushland planting that is typically found within this LCZ, reinforcing this element of the landscape. **Geographical extent** The Project comprises the addition of a low (4m high) but contrasting feature, which will closely follow the topography of what is however part of an extensive regional setting. **Duration/reversibility** The Project would comprise a long-term but potentially temporary (30 years) change to the character of the landscape, with the potential for the site to revert back to agriculture only at the completion of this period.
Significance of landscape character impact: Moderate

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Table 9 Landscape character impacts assessment - LCZ 2

Landscape Character Zone 2 - Bushland rural landscape
Anticipated change to LCZ The Project would have no direct effects on the character of this LCZ. It would have an indirect effect on the landscape setting of this LCZ through the proximate introduction of an infrastructure footprint occupied by approximately 227 ha of solar farm infrastructure (approximately 75% of the Site area).
Sensitivity to change: Low **Susceptibility to change** The ability of this LCZ to accommodate the proposed change without impacts on its landscape character is considered to be high (low sensitivity to change) given its separation from the Project area and the distinction between the contrasting characters of LCZ 1 and LCZ 2. **Value of LCZ** LCZ 2 is considered to be of regional value given that the remnant bushland is characteristic of the pre-settlement landscape condition. Parts of the LCZ are preserved as Regional Open Space including the waterway of the Harvey River on the southern boundary of the Project site. This LCZ provides a 'backdrop' or *background* to the way the overall landscape is viewed and valued. Also, clusters of paperbark woodland within site will provide enclosure to the overall landscape from certain points of view.
Magnitude of change: Low **Size/scale** The size of change for this LCZ is considered to be low within the context of the form and scale of the Project. In most parts of the LCZ, the height of the remnant tree canopy within this LCZ exceeds the height of the proposed Project infrastructure across the adjoining extensive, open rural landscape of LCZ 1. Change to scale of the perception of the *background* provided by LCZ 2 is considered to be low to negligible. **Geographical extent** The Project comprises the addition of a low (4m high) but contrasting feature, which will be perceived in the *middle ground* and encompassed by the *background* of LCZ 2 as part of the extensive regional setting. **Duration/reversibility** The Project would comprise a long-term but potentially temporary (30 years) change to the character of the landscape, with the potential for the site to revert back to agriculture at the completion of this period.
Significance of landscape character impact: Low

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Table 10 Landscape character impacts assessment - LCZ 3

Landscape Character Zone 3 – Farmhouse rural landscape
Anticipated change to LCZ The Project would have no direct effects on the character of LCZ 3. It would have an indirect effect on the landscape setting of this LCZ through the proximate introduction of an infrastructure footprint occupied by approximately 227 ha of solar farm infrastructure (approximately 75% of the total area).
Sensitivity to change: Moderate **Susceptibility to change** The susceptivity of LCZ 3 to accommodate the proposed change without impacts on its landscape character is considered to be moderate given the closeness to the Project area and the distinction between the contrasting characters of LCZ 1 and LCZ 3, mainly for the Farmhouse near the Project site. The neighbouring Farmhouses will have low sensitivity due to its distance. The slightly undulating topography and stands of vegetation between LCZ 3 and the Project area will contribute to the capacity of this LCZ to accommodate the proposed change. **Value of LCZ** LCZ 3 is considered to be of local value, given most of built form is characteristic of the local vernacular of building and garden styles. Consistent dwelling setbacks from road corridors combined with a generally consistent style of open front gardens (with no solid fencing) lend an aesthetically appealing character to this LCZ. This LCZ provides a *foreground* to the way the overall landscape is viewed and valued.
Magnitude of change: Moderate **Size/scale** The size of change for this LCZ is considered to be moderate within the context of the form and scale of the Project. For the majority of the LCZ 3, the height of the adjacent domestic and roadside vegetation (including mature trees) within this LCZ exceed the predicted perceived height of the proposed Project infrastructure across the adjoining extensive, open rural landscape of LCZ 1. Change to scale of the perception of the background provided by LCZ 2 is considered to range from low to moderate, pending on the location of the LCZ unit when compared to the Project site topography and existing vegetation. The magnitude of change will decrease with distance to the site. **Geographical extent** The Project comprises the addition of a low (4m high) but contrasting feature, which will be perceived in the background from LCZ 3 within and as part of the extensive regional setting. **Duration/reversibility** The Project would comprise a long-term but potentially temporary (30 years) change to the character of the landscape, with the potential for the site to revert back to agriculture at the completion of this period.
Significance of landscape character impact: Moderate

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6.0 Visual Impact Assessment

6.1 Desktop study

A desktop study was undertaken of the study area in order to identify potential visual receptors likely to be impacted by the Waroona Solar Farm. This included an assessment of existing planning designations, public open spaces, public roads and clusters of residential properties.

6.2 Site visit

During the site visit the representative viewpoints were confirmed and an assessment was made of each potential representative public viewpoint against the known extent of the Waroona Solar Farm project. The viewpoints are considered to be representative of:

- The variety of landscape types within the study area
- The range of public views and the types of viewers likely to be affected by the project.

6.3 Viewpoint Selection

A total of 14 representative public visual receptor locations have been identified within the study area to represent viewpoints for the assessment of potential impacts on views as a result of the Project during construction and operations, as shown in Figure 16. Photographs, descriptions and impact assessment for each follow. Photo montages of the proposed Waroona Solar Farm from selected viewpoints are included as Appendix A.

6.4 Visual receptor types

The viewpoints have been organised into three key receptor types, each of which are considered to typically share defined sensitivity to changes in the context and character of views.

6.4.1 Residents

Residents are interested in the outlook from their properties and have a sense of proprietary interest in their local environment. Residents typically have regular and prolonged viewing opportunities, so are considered likely to have a high level of sensitivity to the proposed change. All of the viewpoints assessed take into account any curtilage surrounding each residence which may be considered an extension to the dwelling for domestic or social activities.

6.4.2 Road users

Road users may generally have only a passing interest in the quality of their surroundings as they are travelling through the landscape and the Project comprises only a small component of the landscape through which they are travelling. Additionally, drivers would be expected to have much of their attention focussed on road conditions and so are considered to have moderate to low sensitivity to change. Local road users may have a moderate level of sensitivity to change, given the potential for a sense of proprietary interest in their local environment.

6.4.3 Farm Land (Private property Entrance)

Farm land users are interested in the outlook from their properties and have a sense of proprietary interest in their local environment. Farm land users will typically have regular and prolonged viewing opportunities; as the same time those opportunities will only occur when working on site, as these areas don't include residences, only sheds and other farming related facilities. In sum, these can be considered likely to have a moderate level of sensitivity to the proposed change. All of the viewpoints assessed were taken from the private properties main entrance.

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6.5 Visual receptor locations

Visual receptor locations are shown in Figure 16.

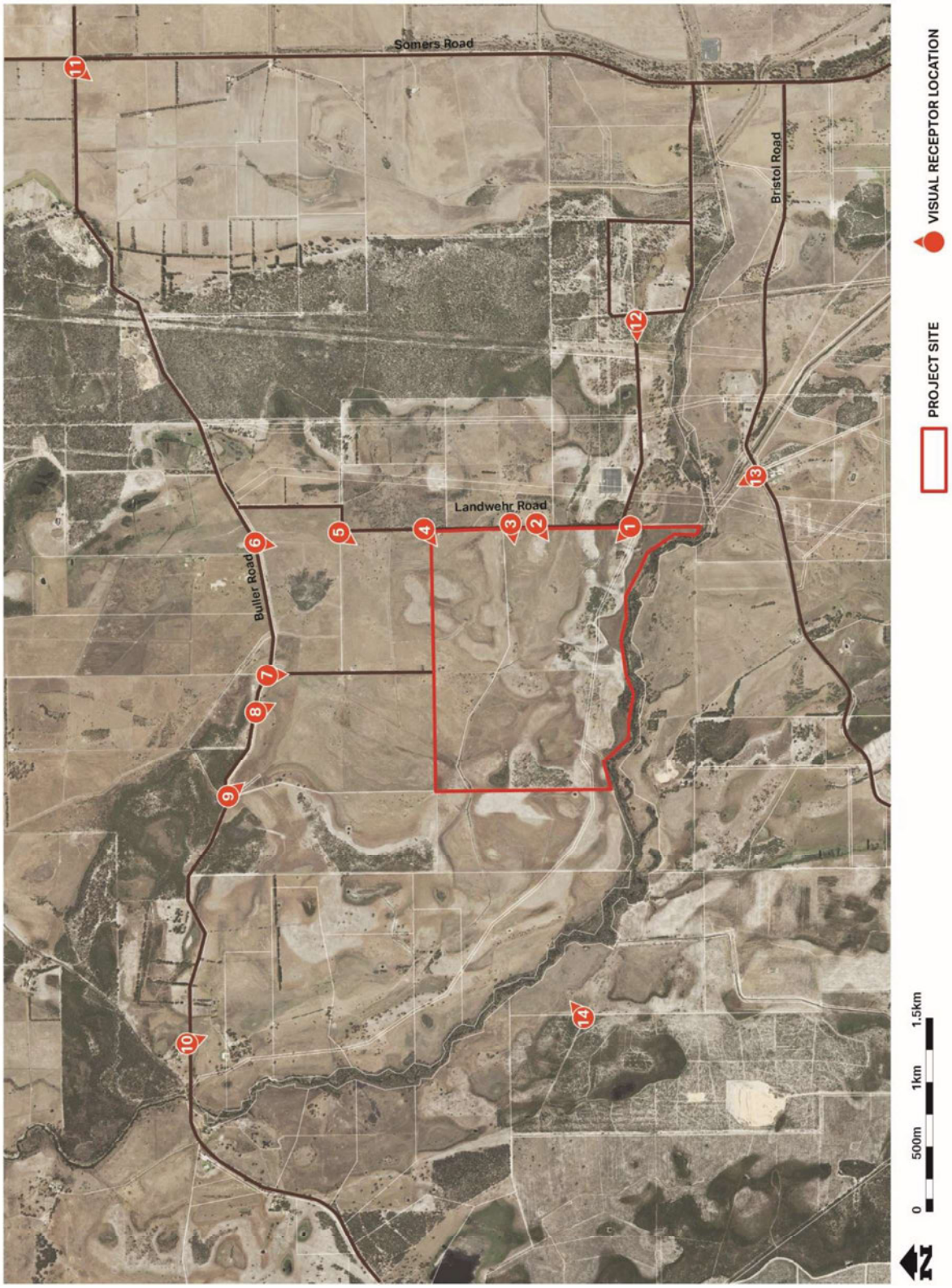

Figure 16 Visual Receptor / Viewpoint Locations

(Source: Nearmap © 2019)

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6.6 Visual impact assessment

There are potential visual impacts that may occur during the construction phase of the Project. The key construction activities that may be visible from areas surrounding the Project include:

- minor civil/earthworks involved in the preparation of the site
- hardstand areas required for laydown and storage of construction materials
- temporary site facilities such as parking, toilets and amenities
- temporary site access tracks instated for construction vehicles
- plant and equipment required for the construction of the Project including:
  - medium rigid trucks, utes and light vehicles
  - piling machines
  - forklifts and assisted material handling equipment
  - water trucks for dust suppression.

The majority of construction activities which would result in physical changes to the landscape are generally temporary in nature and for the most part are restricted to specific areas within the Project site.

While extensive earthworks are not considered necessary, minor land disturbance may be required. However, the areas of disturbance would be rehabilitated, and the surrounding groundcover would be retained. Areas of earthworks would be subject to dust control measures that would aim to minimise any airborne dust that could affect local visibility.

The majority of construction activities would be unlikely to result in an unacceptable level of visual impact due to the relatively short duration (approximately 12 months) and temporary nature of the works.

There are potential visual impacts that will occur during the operational phase of the Project. The main infrastructure that may be visible from areas surrounding the Project includes:

- solar array
- electrical infrastructure
- access tracks
- fencing.

The majority of operational infrastructure which would result in physical changes to the landscape is restricted to specific areas within the Project site.

The potential visual impacts from visual receptors and viewpoints are described in Tables 11 through 24. Photomontages of three (3) key viewpoints including existing view, un-mitigated view and mitigated view are included as Appendix A. A plan showing proposed mitigation with landscaping is included as Appendix B.

6.6.1 Theoretical visibility map

The theoretical visibility of the proposed elements of the Project from surrounding areas has been broadly mapped to define a theoretical visibility map (refer to Figure 17). This provides an indication of where the Project is potentially visible from (assuming no vegetation or other structures present). This map indicates ‘worst case’ and is indicative only, and it does not consider the impacts of existing vegetation cover, structures or views obstructed by local topographic changes e.g. road cuttings etc.

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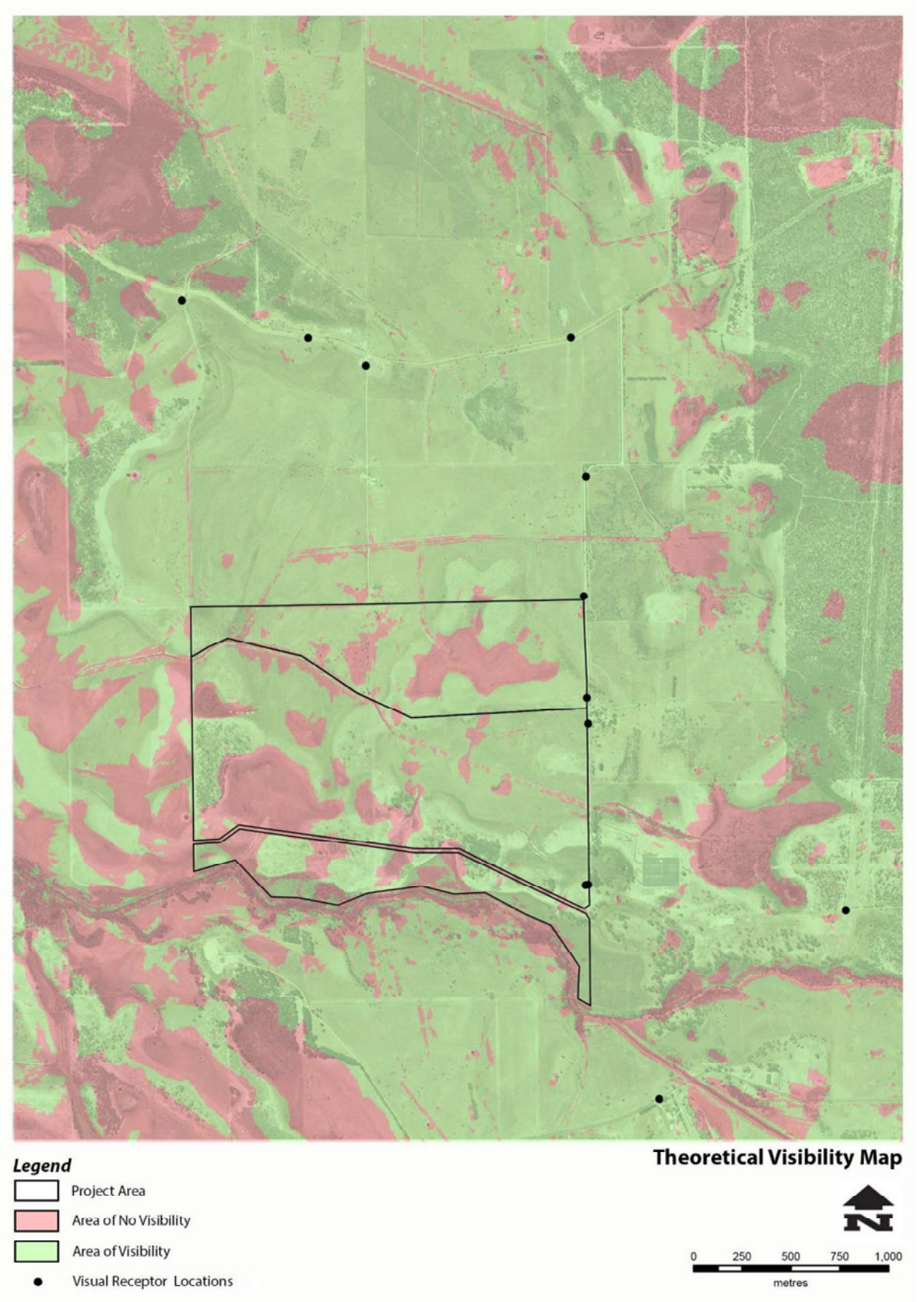

Figure 17 Theoretical visibility map

(Source: Nearmap © 2019)

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Table 11 Visual impact assessment – V1 (Survey Photo 1)

V1: Road User / Proposed Main Entrance

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will be visible throughout the entire eastern side from this viewpoint. This viewpoint is the entry location to the Project. There is little existing vegetation to screen the viewpoint, making changes to the foreground particularly visible. Nevertheless, from the roadside behind this viewpoint there are some remnants of vegetation (Jarrah trees) that will provide screening to the roadside. In this location, visual change will partly be absorbed by the clumps of vegetation to be maintained in the middle distance. Additional vegetation should be established in the foreground to assist visual mitigation (Refer to Appendix B).

Sensitivity to change: Low

Susceptibility of road user to proposed change
The nature of the access track that provides entree to this viewpoint, means that only people using the Landwehr terminal and the solar farm will be impacted by views of the project. The susceptibility of motorists travelling along this portion of road is low due to the infrequent number of road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered low, given the nature of the access track (no through road), remoteness of its location and infrequent number of possible users to the site (mainly terminal and solar farm workers). The viewpoint is relativity far from any surrounding rural roads.

Magnitude of change: Moderate

Size/scale
The scale of change is considered to be moderate, given the anticipated visibility of the new elements, for localised areas along the access track to this viewpoint. A substantial proportion of the view will be occupied by the Project with a noticeable change in contrast in the landscape setting.

Geographical extent
The viewpoint is located within the project site, at the boundary line, resulting in high visual detail due to the low amount of existing vegetation and flat topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Moderate - Low

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Table 12 Visual impact assessment – V2 (Survey Photo 2)

V2: Road User / Resident
 **Existing view** *Area of visual change highlighted red* **Anticipated change to view** The Project will be highly visible when viewed towards the northwest and southwest from this viewpoint, however, the view of the Project will be partially screened by roadside vegetation and garden vegetation when viewed from the adjacent residential lot. A denser vegetation buffer should be established in the foreground to assist visual mitigation along the extent of the resident's line of sight. (Refer to Appendix B).
Sensitivity to change: Moderate **Susceptibility of road users and residents to proposed change** The susceptibility of motorists travelling along this portion of road is low due to the infrequent number of road users that would be possibly impacted by views of the Project. The susceptibility of residents at this location of road is moderate due to the proprietary interest residents can be expected to take in changes to the view from their home and permanent nature of the view and the moderate extent of the Project visible. **Value attached to view** The value attached to the view for motorists along this section of road is considered low due to low to infrequent number of users. On the other hand, the value attached to the view for residents at this location is considered moderate, given the interest they are likely to have with regard to changes in their landscape views.
Magnitude of change: High **Size/scale** The scale of change is considered to be high, given the anticipated visibility of the new elements in the view will be high along the eastern boundary due to the low amount of screening vegetation in the foreground and planeness of the site. A high proportion of the view will be occupied by the Project with a noticeable change in contrast in the landscape setting. The view will always be seen as cars travel along the road. **Geographical extent** The viewpoint is located approximately two (2) metres from the Project boundary, resulting in high visual detail due to the existing vegetation and topography **Duration/reversibility** The duration of impacts would be expected to be long term, but potentially reversible after 30 years.
Significance of visual impact: High - Moderate (Refer to Appendix A Sheet 1)

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Table 13 Visual impact assessment – V3 (Survey Photo 3)

V3: Road User / Resident

Existing view *Area of visual change highlighted red*
Anticipated change to view The Project will be highly visible when viewed towards the northwest and southwest from this viewpoint, however, the view of the Project will be partially screened by roadside vegetation and garden vegetation when viewed from adjacent residential lot. A denser vegetation buffer should be established in the foreground to assist visual mitigation along the extent of the resident's line of sight. (Refer to Appendix B).
Sensitivity to change: Moderate **Susceptibility of road users and residents to proposed change** The susceptibility of motorists travelling along this portion of road is low due to the infrequent number of road users that would be possibly impacted by views of the Project. The susceptibility of residents at this location of road is moderate due to the proprietary interest residents can be expected to take in changes to the view from their home and permanent nature of the view and the moderate extent of the Project visible. **Value attached to view** The value attached to the view for motorists along this section of road is considered low due to low to infrequent number of users. On the other hand, the value attached to the view for residents at this location is considered moderate, given the interest they are likely to have with regard to changes in their landscape views.
Magnitude of change: High **Size/scale** The scale of change is considered to be high, given the anticipated visibility of the new elements in the view will be high along the eastern boundary due to the low amount of screening vegetation in the foreground and planeness of the site. A high proportion of the view will be occupied by the Project with a noticeable change in contrast in the landscape setting. The view will always be seen as cars travel along the road. **Geographical extent** The viewpoint is located approximately two (2) metres from the Project boundary, resulting in high visual detail due to the existing vegetation and topography **Duration/reversibility** The duration of impacts would be expected to be long term, but potentially reversible after 30 years.
Significance of visual impact: High - Moderate

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Table 14 Visual impact assessment – V4 (Survey Photo 4)

V4: Road User
 **Existing view** *Area of visual change highlighted red* **Anticipated change to view** The Project will be visible when viewed towards the southwest from this viewpoint. This viewpoint is from the roadside verge opposite to the corner of the Project site, overlooking the eastern and northern boundaries of the site. The view is partly screened due to existence of roadside vegetation on the verge of the Project site in this location on the eastern side but fully opened along its northern boundary. Additional vegetation should be established in the foreground to assist visual mitigation (Refer to Appendix B).
Sensitivity to change: Moderate **Susceptibility of road users to proposed change** The susceptibility of motorists travelling along this portion of road is moderate due to the infrequent number of road users that would be possibly impacted by close-up views of the Project. **Value attached to view** The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.
Magnitude of change: Moderate **Size/scale** The scale of change is considered to be moderate, given the anticipated visibility of the new elements in the view will be high for localised areas. A moderate proportion of the view will be occupied by the Project with a noticeable change in contrast in the landscape setting. The view will be obstructed for short intervals as cars travel along the road due to the existence of clusters of vegetation. **Geographical extent** The viewpoint is located approximately 30 metres from the Project boundary, resulting in moderate visual detail due to the low amount of existing screening vegetation and flat topography, especially along the northern boundary. **Duration/reversibility** The duration of impacts would be expected to be long term, but potentially reversible after 30 years.
Significance of visual impact: Moderate (Refer to Appendix A Sheet 2)

Table 15 Visual impact assessment – V5 (Survey Photo 5)

DRAFT

V5: Road User / Resident

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will be visible when viewed towards the southwest from this viewpoint. This viewpoint is from the roadside that gives access to the residential lot located near the Project site and the Landwehr Terminal. One more residential lot is located in the opposite direction of the viewpoint, further east. The view will be partially screened by roadside vegetation and partly screened by remnant vegetation in the neighbouring land. Additional vegetation should be established along the northern boundary to assist visual mitigation (Refer to Appendix B).

Sensitivity to change: Low

Susceptibility of road users and residents to proposed change
The susceptibility of motorists travelling along this portion of road is low due to the small extent of the Project visible and the infrequent number of road users that would be possibly impacted by views of the Project. The susceptibility of residents at this location of road is low due to the distance of perceived change to the view from the viewer and the small extent of the Project visible.

Value attached to view
The value attached to the view for motorists along this section of road is considered low, given the infrequent number of possible users travelling to the Site and the variable nature of existing vegetation. The value attached to the view for residents at this location is considered low, given the relatively common nature of the view.

Magnitude of change: Low

Size/scale
The scale of change is considered to be moderate, given the anticipated visibility of the new elements in the view will be noticeable only for localised areas in the view. A medium size proportion of the view will be occupied by the Project with a medium to low amount of change in contrast in the landscape setting, due to distance and the existing vegetation screening in the background.

Geographical extent
The viewpoint is located approximately 650 metres from the Project boundary, resulting in low visual detail due to the existing vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Low

DRAFT

Table 16 Visual impact assessment – V6 (Survey Photo 6)

V6: Road User

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will be visible when viewed towards the south / southwest from this viewpoint. This viewpoint is from the main roadside located north of the Project site. The foreground is occupied mainly by flat farm land, with clusters of existing vegetation in the background. The Project will be partly screened by this remnant vegetation. The main road is located more than one kilometre away. The viewing distance and existing vegetation make it hard to visualise the Project site from this viewpoint. Additional vegetation should be established along the northern boundary to assist visual mitigation (Refer to Appendix B).

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is low due to the transient nature of the view, the small extent of the Project visible and the infrequent number of road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Low

Size/scale
The scale of change is considered to be low or negligible, given the anticipated visibility of the new elements in the view will be low. A small proportion of the view will be occupied by the Project with a minimum change in contrast in the landscape setting. Existing pockets of vegetated wetland contribute to screen larger portions of the Project site from this viewpoint. Additional vegetation planted along the northern boundary will help mitigate views observed by motorists along the road.

Geographical extent
The viewpoint is located approximately 1,350 metres from the Project boundary, resulting in low to negligible visual detail due to the existing vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Low

DRAFT

Table 17 Visual impact assessment – V7 (Survey Photo 7)

V7: Road User / Private Property Entrance (Farm Land)

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will be visible when viewed towards the south from this viewpoint. This viewpoint is from the entrance of a farm (private property) and adjacent road. The Project will be partly screened by remnant vegetation between the viewpoint and the northern boundary of the Project. Due to the flat, expansive scene combined with low amounts of existing vegetation, some additional visual mitigation is recommended in the background from this viewpoint. Additional vegetation should be established along the northern boundary to assist visual mitigation (Refer to Appendix B).

Sensitivity to change: Moderate

Susceptibility of road users and farm land users to proposed change
The susceptibility of motorists travelling along this portion of road is low due to the transient nature of the view and the infrequent number of road users that would be possibly impacted by views of the Project. The susceptibility of farmworkers at this location is moderate, due to the distance of the perceived change to the view and the regularity of time spent on site.

Value attached to view
The value attached to the view for both motorists and farm workers along this section of land is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across the quiet rural roads, with variable levels of screening.

Magnitude of change: Low

Size/scale
The scale of change is considered to be low, given the anticipated low visibility of the new elements in the background of the view. The open field, small amount of screening vegetation, slightly higher topography and regularity of usage by the farm workers, allows a portion of the Project to be discerned within the background of the view, however the proportion of change is considered to be low due to the distance of this viewpoint from the Project.

Geographical extent
The viewpoint is located approximately 1,250 metres from the Project boundary, but its elevated topography and lack of screening vegetation allows for some visual detail to be discerned in the background. Additional screening along the northern boundary of the site can mitigate this effect.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Moderate - Low

DRAFT

Table 18 Visual impact assessment – V8 (Survey Photo 8)

V8: Road User

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will be visible when viewed towards the south / southeast from this viewpoint. This viewpoint is from the roadside at the top of a small hill within the flat topography of the area. Due to the topography it is possible to view a portion of the Project area in the background. Additional visual screening along the northern boundary of the site can mitigate any adverse effect on views from this viewpoint. Additional vegetation should be established along the northern boundary to assist visual mitigation (Refer to Appendix B).

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is low due to the transient nature of the view, the small amount of Project visibility and the infrequent number of road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Low

Size/scale
The scale of change is considered to be moderate, given the anticipated visibility of the new elements in the view will noticeable only for localised areas in the view. A small proportion of the background of the view will be occupied by the Project with a low amount of change in contrast in the landscape setting. The view will be seen for short intervals as cars travel along the road.

Geographical extent
The viewpoint is located approximately 1,380 metres from the Project boundary, but its higher topography and low amount of screening vegetation allows for a moderate visual detail in the background. This can be mitigated easily with additional screening along the northern boundary of the site.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Low (Refer to Appendix A Sheet 3)

DRAFT

Table 19 Visual impact assessment – V9 (Survey Photo 9)

V9: Road User / Private Property entrance (Farm Land)

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will only slightly be visible when viewed towards the east / southeast from this viewpoint. This viewpoint is from the entrance of a farm land (private property) and adjacent road. The view is not anticipated to change due to the distance of the viewpoint from the Project and the presence of remnant vegetation. Additional visual mitigation is not considered necessary from this viewpoint.

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is low due to the closed view and the infrequent number of road users. The susceptibility of farm workers at this location is low, due to the distance of the perceived change to the view, the existing vegetation and other elements that screen the majority of the Project and the regularity of time spent on site.

Value attached to view
The value attached to the view for both motorists and farm workers along this section of land is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Low - Negligible

Size/scale
The scale of change is considered to be negligible, given the anticipated visibility of the new elements in the view will be very low. No noticeable change in contrast in the landscape setting is anticipated. The view is mostly obstructed to cars travelling along main road and users travelling the private access track due to the flatter topography and large amount of screening vegetation between the project site and the viewpoint.

Geographical extent
The viewpoint is located approximately 1,586 metres from the Project boundary, resulting in negligible visual detail due to the existing vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible

DRAFT

Table 20 Visual impact assessment – V10 (Survey Photo 10)

V10: Road User / Resident

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will not be visible when viewed towards the east / southeast from this viewpoint. This viewpoint is from the roadside, adjacent to a residential lot. It will be screened by remnant vegetation and farm land hedging. Additional visual mitigation is not considered necessary from this viewpoint.

Sensitivity to change: Low

Susceptibility of road users and residents to proposed change
The susceptibility of motorists travelling along this portion of road is negligible due to the transient nature of the view, lack of Project visibility and the infrequent number of road users that would be possibly impacted by views of the Project. The susceptibility of residents at this location is also negligible due to the distance of perceived change to the view from the viewer and the lack of the Project visibility.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening. The value attached to the view for residents at this location is considered moderate, given the interest they are likely to have with regard to changes in their landscape views.

Magnitude of change: Negligible

Size/scale
The scale of change is considered to be zero, given that the anticipated visibility of the new elements in the view will remain unchanged. No change in contrast in the landscape setting. The view to the Project site is obstructed by existing vegetation all along the road and within the residential lot, between Harvey river and Viewpoint V9.

Geographical extent
The viewpoint is located approximately 2,670 metres from the Project boundary, resulting in zero visual detail due to the existing vegetation and topography.

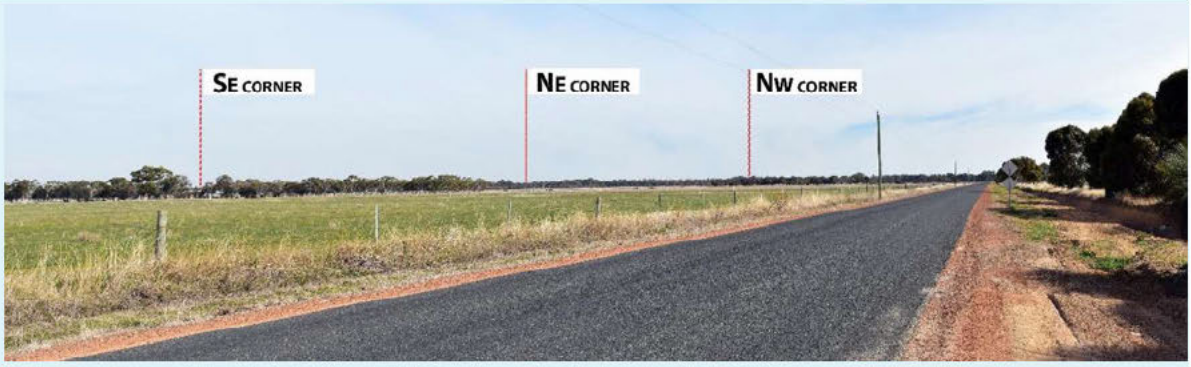
Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible / No change

DRAFT

Table 21 Visual impact assessment – V11 (Survey Photo 11)

V11: Road User



Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will not be visible when viewed towards the southwest from this viewpoint. This viewpoint is from the roadside of the main road that comes near the project site. The viewpoint is as seen from behind the Buller Nature Reserve. The view to the Project site is completely closed due to the distance to site and the existing dense vegetation in the background (Buller Nature Reserve).

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is negligible due to the closed view, distance to site and infrequent number of road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Negligible

Size/scale
The scale of change is considered to be zero, given that the anticipated visibility of the new elements in the view will remain unchanged. No change in contrast in the landscape setting. The view to the Project site is obstructed by existing vegetation all the way along the road, between the current viewpoint and Viewpoint V6.

Geographical extent
The viewpoint is located approximately 4,600 metres from the Project boundary, resulting in zero visual detail due to the existing vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible / No change

DRAFT

Table 22 Visual impact assessment – V12 (Survey Photo 12)

V12: Road User

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will not be visible when viewed towards the west from this viewpoint. This viewpoint is from a public access track located east of the Project site that links Landwehr Road to Somers Road. The view is closed to the site, due to the existing roadside vegetation and overall remnant vegetation.

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is negligible due to the closed view and infrequent number of road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Negligible

Size/scale
The scale of change is considered to be zero, given that the anticipated visibility of the new elements in the view will remain unchanged. No change in contrast in the landscape setting is anticipated. The view to the Project site is obstructed by existing vegetation.

Geographical extent
The viewpoint is located approximately 1,300 metres from the Project boundary, resulting in zero visual detail due to the existing vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible / No change

DRAFT

Table 23 Visual impact assessment – V13 (Survey Photo 13)

V13: Road User / Resident

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will not be visible when viewed towards the north from this viewpoint. This viewpoint is from the roadside, opposite a residential lot overlooking the riparian vegetation along the Harvey River. Views to the Project site will be closed by topography and vegetation.

Sensitivity to change: Low

Susceptibility of road users and residents to proposed change
The susceptibility of motorists travelling along this portion of road is negligible due to the transient nature of the view, lack of Project visibility and existence of the riparian vegetation along the river. The susceptibility of residents at this location is also negligible due to the distance of perceived change to the view from the viewer, the lack of Project visibility and the presence of a natural vegetated screen along the river, enclosing any views towards the north from this viewpoint.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening. The value attached to the view for residents at this location is also considered moderate, given the interest they are likely to have with regard to changes in their landscape views.

Magnitude of change: Negligible

Size/scale
The scale of change is considered to be zero, given that the anticipated visibility of the new elements in the view will remain unchanged. No change in contrast in the landscape setting is anticipated. The view to the project site is obstructed by the existing riparian and remnant vegetation.

Geographical extent
The viewpoint is located approximately 580 metres from the Project boundary, resulting in zero visual detail due to the riparian vegetation, remnant vegetation and topography.

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible / No change

DRAFT

Table 24 Visual impact assessment – V14 (Survey Photo 14)

V14: Road User

Existing view *Area of visual change highlighted red*

Anticipated change to view
The Project will not be visible when viewed towards the east / northeast from this viewpoint. This viewpoint is from an access track that meanders through area of newly planted forest, located southwest of the Project site. Views to the Project will be closed by topography and vegetation.

Sensitivity to change: Low

Susceptibility of road users to proposed change
The susceptibility of motorists travelling along this portion of road is negligible due to the lack of Project visibility, existence of the riparian vegetation along the Harvey river and the rare number of access road users that would be possibly impacted by views of the Project.

Value attached to view
The value attached to the view for motorists along this section of road is considered moderate, given the proprietary interest they are likely to have with regard to changes in their rural landscape views across a network of quiet rural roads, with variable levels of screening.

Magnitude of change: Negligible

Size/scale
The scale of change is considered to be zero, given that the anticipated visibility of the new elements in the view will remain unchanged. No change in contrast in the landscape setting is anticipated. The view to the project site is obstructed by the existing riparian and remnant vegetation.

Geographical extent
The viewpoint is located approximately 1,750 metres from the Project boundary, resulting in zero visual detail due to the riparian vegetation, remnant vegetation and topography

Duration/reversibility
The duration of impacts would be expected to be long term, but potentially reversible after 30 years.

Significance of visual impact: Negligible / No change

DRAFT

7.0 Mitigation Measures

7.1 Detailed Design

Mitigation measures during the detailed design process should consider:

- further refinement in the design and layout which may assist in the mitigation of bulk and height of proposed structures
- a review of materials and colour finishes for selected components including the use of non-reflective finishes to structures where possible.

7.1.1 Draft Landscape Plan

This LVIA has determined that a planted buffer area is prescribed to the boundary of sensitive visual receptors for the purpose of mitigating visual impacts to the residents and road users. The Landscape Plan (Appendix B) provides planted buffer areas of a minimum width of:

- Ten metres buffer for approximately 150m along the boundary adjacent to the residential property located in the Landwehr Rd to minimise the extent of visible solar farm when seen from residential lot.
- Five metres buffer along all other eastern property boundaries along Landwehr Rd.
- Five metres softer buffer along Northern property boundaries, facing neighbouring farm land.

The buffer areas will contain random plantings of a variety of native / endemic trees and shrub species of differing growth habits, and a ground layer of grasses and low growing species. The intention is to reinstate screening vegetation with characteristics of local plant communities, and to reflect a consistent landscape character. The linear nature of the screen planting will be in keeping with the windrows and roadside vegetation that is regularly present in the surrounding landscape.

7.2 Construction

Mitigation measures during the construction period should consider:

- minimise tree removal where possible
- rehabilitation of disturbed areas
- protection of vegetation within the Project where retained.

7.3 Operation

Mitigation measures during the operational period should consider:

- ongoing maintenance and repair of constructed elements to maintain the visual appearance of the Project
- long term maintenance (and replacement as necessary) of screen planting within the Project to maintain visual filtering and screening of external views where appropriate.

D R A F T

8.0 Conclusion

This report provides an overview of the potential Landscape and Visual Impacts and required mitigation associated with the development of Waroona Solar Farm.

8.1 Potential landscape impacts

The report findings generally show that the proposed Waroona Solar Farm has the potential to result in:

- **Moderate** direct impacts to the open rural landscape character of the Pinjarra System of the Swan Coastal Plain character type within which the Project is located
- **Low** to negligible direct impacts to the bushland rural character type to which the Project is adjacent
- **Moderate** direct impacts to the farmhouse rural character type to which the Project is adjacent.

8.2 Potential visual impacts

Potential visual impacts of the proposed Waroona Solar Farm have been assessed from 14 representative public viewpoint locations ranging from **Negligible** impact through to **High - Moderate** impact. The visual impact ratings for each viewpoint are based on a consideration of the sensitivity of the visual receptors and the magnitude of expected visual change.

The greatest levels of impact are from the viewpoints in close proximity to the Project site, where the solar panels themselves will form discernible elements within a given view.

8.3 Mitigation

In order to minimise impacts on the landscape and visual character and values around the Project site, and to ensure the timely progression of approvals for the proposed solar farm, AECOM provide the following recommendations:

- Further refine the design and layout during detailed design to reduce bulk and height of proposed structures.
- Review materials and colour finishes for selected components including the use of non-reflective finishes to structures where possible.
- Avoid or minimise impacts to the native vegetation including the isolated trees in paddock and riparian vegetation; minimise tree removal and rehabilitate disturbed areas.
- Carry out the proposed mitigations as described the in the Landscape Concept Plan.
- Continuously maintain and repair the constructed elements to maintain the visual appearance of the Project.
- Provide long term maintenance (and replacement as necessary) of screen planting within the Project to maintain visual filtering and screening of external views where appropriate.

D R A F T

9.0 References

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Appendix A

Photomontages

Appendix A Photomontages

ISO A1 594mm x 841mm

Figure 1: Survey Photo 2. Existing view along the Eastern boundary, looking towards the site (Southwestern perspective), from Landwehr Road, adjacent to a farm housing. Distance approximately 2m from the site boundary.

Figure 2: Survey Photo 2. Proposed solar farm view from the same location without screen planting.

Figure 3: Survey Photo 2. Proposed view from the same location with screen planting along the Eastern boundary of the site.

SURVEY PHOTO 2

Photo Taken:
Latitude: -32.891771
Longitude: 115.813037
Height of Camera = approx.1.85m
Direction of camera: approx. 230 degrees Southwest (SW)
Focal length: 24mm
Max aperture: 4

AECOM

PROJECT

WAROONA
SOLAR FARM
CONCEPT DESIGN

WAROONA
Western Australia

CLIENT

SE Waroona
Development Pty Ltd
Level 27, 150 Lonsdale Street
Melbourne, VIC 3000

South Energy

CONSULTANT

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PROJECT NUMBER

60605068

SHEET TITLE

WAROONA SOLAR FARM
PHOTOMONTAGES SHEET 1

PROJECT NUMBER

60605068-SHT-LD-003

ISO A1 594mm x 841mm

Figure 4: Survey Photo 4. Existing view of site boundary at the Northeastern corner. View looking towards the site (Southwestern perspective), from Landwehr Road. Distance approximately 30m from the site boundary.

Figure 5: Survey Photo 4. Proposed solar farm view from the same location without screen planting.

Figure 6: Survey Photo 4. Proposed view from the same location with screen planting along the Eastern and Northern boundaries.

SURVEY PHOTO 4

Photo Taken:
Latitude: -32.885859
Longitude: 115.812871
Height of Camera = approx.1.85m
Direction of camera: approx. 230 degrees Southwest (SW)
Focal length: 24mm
Max aperture: 4

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PROJECT NUMBER

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SHEET TITLE

WAROONA SOLAR FARM
PHOTOMONTAGES SHEET 2

PROJECT NUMBER

60605068-SHT-LD-004

ISO A1 594mm x 841mm

Figure 4: Survey Photo 8. Existing view of the landscape along the Northern boundary of the site. View looking towards the neighbouring farm land with the site along the background (Southeastern perspective), from Buller Road. Distance approximately 1380m from the site boundary.

Figure 8: Survey Photo 8. Proposed solar farm view from the same location without screen planting.

Figure 8: Survey Photo 8. Proposed view from the same location with screen planting along the Northern boundary.

SURVEY PHOTO 8

Photo Taken:
Latitude: -32.873759
Longitude: 115.797911
Height of Camera = approx.1.85m
Direction of camera: approx. 150 degrees Southeast (SE)
Focal length: 24mm
Max aperture: 4

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SHEET TITLE

WAROONA SOLAR FARM
PHOTOMONTAGES SHEET 3

PROJECT NUMBER

60605068-SHT-LD-005

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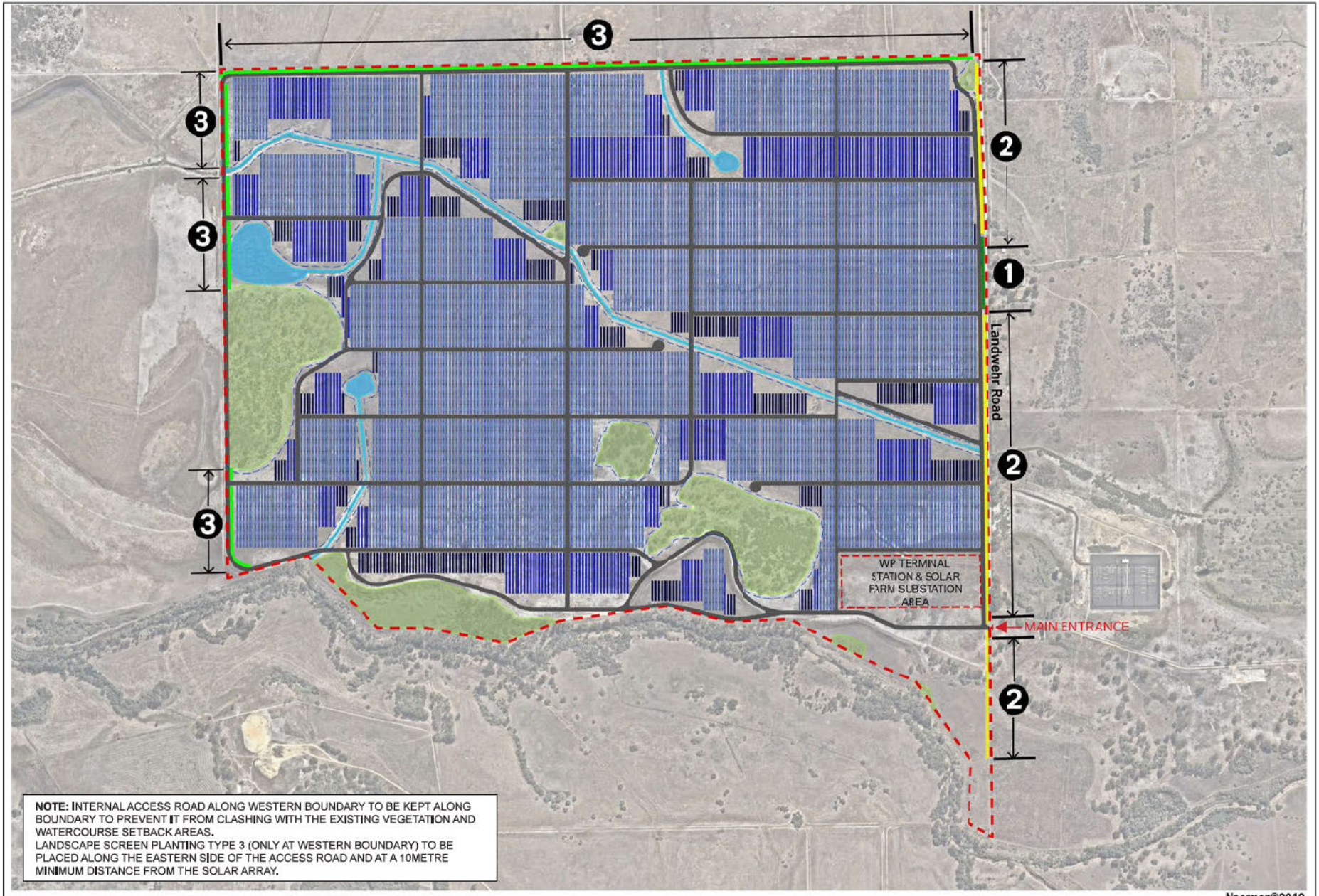
Appendix B

Landscape Concept Plan

D R A F T

Appendix B Landscape Concept Plan

ISO A1 594mm x 841mm



NOTE: INTERNAL ACCESS ROAD ALONG WESTERN BOUNDARY TO BE KEPT ALONG BOUNDARY TO PREVENT IT FROM CLASHING WITH THE EXISTING VEGETATION AND WATERCOURSE SETBACK AREAS.
LANDSCAPE SCREEN PLANTING TYPE 3 (ONLY AT WESTERN BOUNDARY) TO BE PLACED ALONG THE EASTERN SIDE OF THE ACCESS ROAD AND AT A 10METRE MINIMUM DISTANCE FROM THE SOLAR ARRAY.

LEGEND

- PROPERTY BOUNDARY
- INTERNAL ROADS
- EXISTING VEGETATION AREAS TO BE RETAINED
- WATERCOURSE SETBACK / WATER
- SOLAR ARRAY
  - 6 TABLE TRACKER
  - 4 TABLE TRACKER
  - 2 TABLE TRACKER
- 1 — 10M WIDE, 150M LONG PROPERTY FRONT BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING DETAIL
- 2 — 5M WIDE EASTERN BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING DETAIL
- 3 — 5M WIDE NORTHERN & WESTERN BOUNDARY SCREEN PLANTING, REFER TYPICAL PLANTING

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PROJECT NUMBER
60605068

SHEET TITLE
WAROONA SOLAR FARM
LANDSCAPE PLAN

PROJECT NUMBER
60605068-SHT-LD-001

ISO A1 594mm x 841mm

PLANT SCHEDULE

Botanical Name	Common Name	WA Native (Yes/No)	Height (m)	Spread (m)	Installation size	Installation Location and Rate	Proportion	Approx.
Trees								
Allocasuarina fraseriana	Western Sheoak	Y	10	6	30lt	Planting Area 1 & 3	50% in Other Mixes	223
Casuarina obesa	Swamp Sheoak	Y	15	8	30lt	Planting Area 1 & 3	50% in Other Mixes	223
Melaleuca rhaphiophylla	Swamp paperbark	Y	6	3	30lt	ALL	50% in Melaleuca Mixes	522
Melaleuca osullivanii		Y	3.5	2	30lt	ALL	50% in Melaleuca Mixes	522
						Density refer drawing detail		
Shrubs								
Acacia pycnantha	Golden wattle	Y	8	2	130mm	Planting Area 1 and 2	20%	325
Astartea scoparia	Common astartea	Y	2	0.5	130mm	Planting Area 1 and 2	30%	487
Kunzea glabrescens	Spearwood	Y	1.5 to 4	2 to 3	130mm	Planting Area 1 and 2	50%	812
						Density refer drawing detail		
Grasses								
Ficinia nodosa	Knobby Club Rush	Y	1	1	130mm	ALL	40%	14532
Meeboldina cana		Y	0.5 to 1	0.5	130mm	ALL	20%	7266
Lepidosperma longitudinale	Pithy Sword Sedge	Y	2	0.5	130mm	ALL	40%	14532
						Density refer drawing detail		

Note: 1. Plant selection is based on plants that are growing in the area or part of the Swan Coastal Plain Vegetation complex.
2. The plant schedule is subject to further review and confirmation on the appropriate species for the local conditions.

PLANT IMAGES


Casuarina obesa


Allocasuarina fraseriana


Melaleuca rhaphiophylla


Astartea scoparia


Acacia lasiocarpa

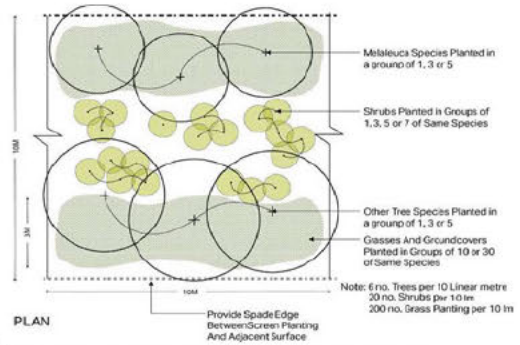

Kunzea glabrescens


Lepidosperma longitudinale

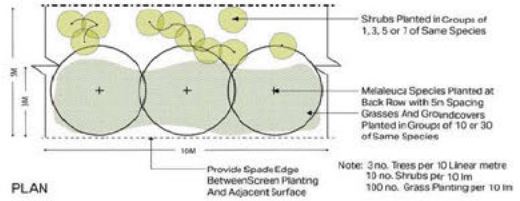

Ficinia nodosa

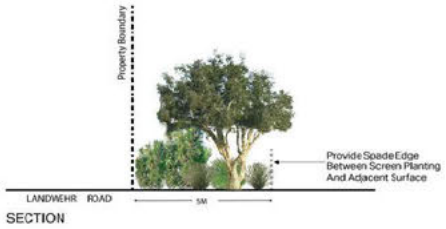

Meeboldina cana

TYPICAL PLANTING DETAILS

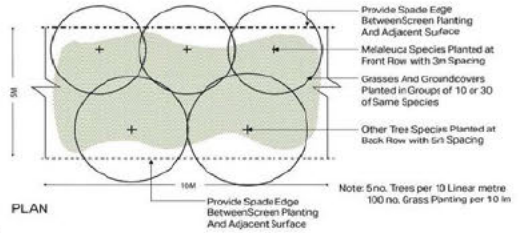


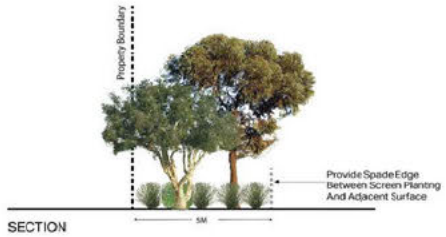
1 TYPICAL PLANTING DETAIL 1 - Property Front (Approx. 150m)





2 TYPICAL PLANTING DETAIL 2 - Eastern Boundary





3 TYPICAL PLANTING DETAIL 3 - Northern & Western Boundary

Note: Along Western Boundary, Screen Planting to be relocated along the eastern side of the access road, allowing for the road to be located outside of the watercourse and existing vegetation setbacks.

AECOM

PROJECT
WAROONA
SOLAR FARM
CONCEPT DESIGN

WAROONA
Western Australia

CLIENT
SE Waroona
Development Pty Ltd
Level 27, 150 Lonsdale Street
Melbourne, VIC 3000

South Energy

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AECOM Australia Pty Ltd
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PROJECT NUMBER
60605068

SHEET TITLE
WAROONA SOLAR FARM
PLANT SCHEDULE, IMAGES AND DETAILS

PROJECT NUMBER
60605068-SHT-LD-002

D R A F T

Appendix D

Ecological Assessment

AECOM Imagine it. Delivered.

SE Waroona Development Pty Ltd (South Energy)
14-Aug-2019

Waroona Solar Farm

Ecology Assessment

Waroona Solar Farm

Ecology Assessment

Client: SE Waroona Development Pty Ltd (South Energy)

ABN: 64 628 948 993

Prepared by

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14-Aug-2019

Job No.: 60590394

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Quality Information

Document	Waroona Solar Farm
Ref	60590394
Date	14-Aug-2019
Prepared by	[redacted]
Reviewed by	[redacted]

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	31-Jul-2019	Issued	[redacted]	
1	09-Aug-2019	Issued	[redacted]	
2	14-Aug-2019	Issued	[redacted]	[redacted]

Table of Contents

Figures

Tables

Executive Summary

An Ecological and targeted Black Cockatoo survey was undertaken for South Energy on behalf of SE Waroona Development Pty Ltd to determine the environmental constraints for a proposed Solar Farm (referred to as Waroona Solar Farm Project [the Project]). The Waroona Solar Farm Project includes a Project Area of 308 ha, located approximately eight kilometres west of Wagerup in the Shire of Waroona.

A preliminary site investigation including desktop assessment was undertaken by Ecologists Jared Leigh and Laura Fisher on 31 January 2019. This survey determined that no Threatened or Priority flora listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Biodiversity Conservation Act 2016* (BC Act), or listed by DBCA were likely to occur and no Threatened Ecological Communities occurred in the Project Area. Potential breeding and foraging habitat for three Black Cockatoo species (including Baudin's Cockatoo *Calyptorhynchus baudinii*, Carnaby's Cockatoo *Calyptorhynchus latirostris,* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso)* listed under the EPBC Act was mapped, and these species have the potential to utilise the Survey Area. Seven other threatened fauna species may potentially utilise the habitats within Survey Area, though the habitats present are generally poor quality, limited, isolated and highly modified.

A flora and vegetation assessment and targeted Black Cockatoo survey was undertaken by Ecologists Floora de Wit and Laura Fisher on 20 June 2019. At this time large patches of native vegetation were proposed to be retained and were excluded from the field survey. Traverses were walked through native vegetation to record general characteristics of the patch to inform the vegetation community and condition mapping. All potential Black Cockatoo breeding trees within the Survey Area were assessed and mapped and foraging quality was determined for discreet patches of native vegetation.

Six vegetation communities were recorded and mapped within the Survey Area largely comprising native trees over common pasture weeds surrounded by paddock. Of the 18.98 ha of native vegetation, 6.85 ha was mapped as Degraded and 12.13 ha was mapped as Completely Degraded. Vegetation condition reflects the current agriculture land use. Fauna habitats mapped included Paddock, Riparian and Drainage, Stags, and Mixed Trees. These habitats have the potential to be utilised by ten threatened fauna species, although they are generally poor quality, isolated and highly modified.

The Survey Area contains 201 potential Black Cockatoo breeding trees (i.e. DBH >500mm), of which 22 contain hollows potentially suitable for use by Black Cockatoos. Of these, 21 trees were dead old trees with no vegetation cover nearby, therefore their utilisation by Black Cockatoos is considered limited. The Black Cockatoo foraging assessment determined the presence of a total of:

- 1.80 ha of High Quality and 2.59 ha of Quality Carnaby's Cockatoo and Baudin's Cockatoo foraging habitat
- 3.75 ha of Quality and 0.64 ha of Low Quality Forest Red-tailed Black Cockatoo foraging habitat.

The potential presence of seven other threatened fauna species (apart from the three Black Cockatoo species), though habitat for these species is generally limited, of poor quality and highly modified.

The Survey Area is considered to have low biodiversity. Remnant patches of native vegetation are significantly altered and almost completely devoid of native understorey species. A large proportion of native trees were dead which may be a reflection of one or more factors including dieback, altered groundwater conditions, altered fire regimes, and salinity. It is likely that remaining living trees play an important role in hydrological function and therefore clearing of living native trees should be avoided where possible. Taking this into account, the following is recommended:

- Retain native vegetation, Quality and High Quality Black Cockatoo foraging habitat and Black Cockatoo breeding and potential breeding trees where possible.
- Areas supporting both hollow bearing Black Cockatoo breeding trees and good quality foraging habitat for Black Cockatoos should be prioritised. These generally include vegetation communities CcApAc, EmKgAc and CcJp, which also aids in local flood mitigation of the Harvey River.

- Native Vegetation Clearing Permit under Section 51E of the *Environmental Protection Act 1986* (EP Act)
- Hold a pre-referral meeting with the Department of the Environment and Energy (DoEE) to confirm whether referral under the *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act*)* is required, due to potential impacts to the three threatened Black Cockatoo species if clearing of habitat is unavoidable.

1.0 Introduction

1.1 Context

South Energy on behalf of SE Waroona Development Pty Ltd is considering the potential for development of a solar farm (referred to as the Waroona Solar Farm Project [the Project]), at a site near Waroona in the southwest of Western Australia. The Project is located approximately 105 kilometres (km) south of Perth and eight kilometres west of Wagerup, in the Shire of Waroona (Figure 1). The Project site is bordered by Landwehr Road and the Harvey River and is located on a parcel of pastoral land 308 hectares (ha).

South Energy is in the site selection phase of this Project and detailed design information is not yet available. A Survey Area was defined using cadastral boundaries which was further refined to exclude several patches of remnant vegetation identified as environmental values to be retained by South Energy. The total Survey Area is 282.5 ha.

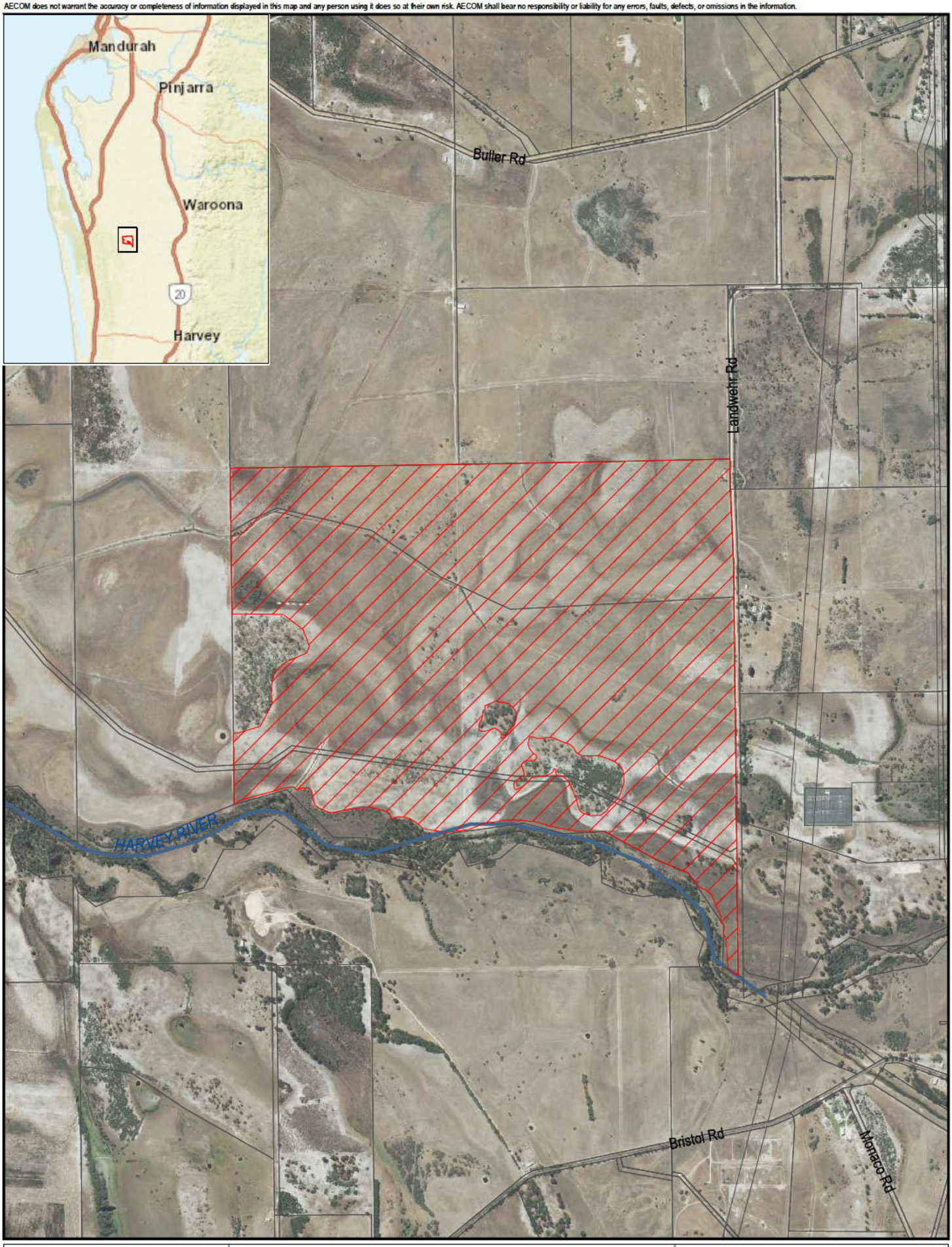
To inform the first stage of the planning and approvals process, AECOM was engaged by South Energy to undertake ecological surveys for the Project to define the environmental values of the Survey Area. A preliminary site investigation and detailed desktop review was undertaken for the Project in January 2019. This determined that Black Cockatoo potential breeding and foraging habitat was present and required a targeted survey to assess and quantify these values. This Targeted Black Cockatoo survey was completed in June 2019.

1.2 Purpose and Scope

The purpose of this report is to examine the existing environment within the Survey Area and identify the extent of any environmental values that may constrain the suitability of the site for solar farm development. Potential constraints assessed include conservation significant fauna habitat, flora species, and vegetation communities.

The scope of works for the ecological survey was to:

- Complete a desktop review to identify Threatened or Priority flora, fauna or ecological communities that may potentially occur within, or in close proximity to the Survey Area
- Undertake a field survey to:
    - verify the results of the desktop review
    - note evidence of any conservation significant biota that were not identified by the desktop review
    - investigate the presence (or likely presence) of specific Commonwealth and State-listed threatened flora and fauna species and communities
    - map and describe the flora and vegetation values including mapping vegetation communities and condition
    - identify and map potential Black Cockatoo breeding trees and foraging habitat within the Survey Area.
- Produce a technical report that includes the January and June 2019 assessments including methods, results and potential environmental constraints of the Survey Area.



PROJECT ID 60605068
CREATED BY
APPROVED BY
LAST MODIFIED 11 JUL 2019

AECOM
www.aecom.com

LEGEND
Survey Area
Cadastre

DATUM GDA 1994, PROJECTION MGA ZONE 50
0 150 300 450 600
metres
1:20,000 when printed at A4

Data sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land

Location of the Project and the Survey Area Extent

SOUTH ENERGY

WAROONA SOLAR FARM - ECOLOGICAL ASSESSMENT

Figure 1

Map Document: G:\GIS_Projects\WaroonaSolarFarm\02_MXDs\04_EcologicalAssessment\G60605068_Fig1_ProjectLocation.mxd (wyattk2)

A4 size

2.0 Legislative Framework

Table 1 summarises the key legislation and guidance governing the protection and management of Western Australia's conservation significant flora, fauna and communities.

Table 1 Relevant Legislation, Regulations and Guidance

Legislation	Purpose
Commonwealth of Australia	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity.
EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species, (DSEWPAC, 2012)	These guidelines are intended to assist proponents in determining whether an action needs to be referred to the Australian Government. Definitions of habitat are provided as are criteria used to judge significant impact for these Black Cockatoo species.
Revised Draft Referral Guideline for Three Threatened Black Cockatoo Species (2017).	This guideline outlines important information and requirements for proponents, particularly on habitat quality, survey expectations, standards for mitigating impacts and significant impacts.
Western Australia	
Wildlife Conservation Act 1950 (WC Act) to be superseded by the *Biodiversity Conservation Act 2016* in January 2019.	Provides for the conservation and protection of Western Australia's wildlife.
Biodiversity Conservation Act 2016 (BC Act)	This Act will replace both the WC Act and the *Sandalwood Act 1929*. On 3 December 2016, several parts of the new Act were proclaimed by the State Governor in the Government Gazette. Provisions that replace those existing under the WC Act and *Sandalwood Act 1929* (including threatened species listings and controls over the taking and keeping of native species) and their associated Regulations have come into effect on 1 January 2019.
Environmental Protection Act 1986 (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a)	Provides guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in EIA.
EPA Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b)	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial fauna.
EPA Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna, (EPA, 2016c)	Provides advice on fauna sampling techniques and methodologies for different regions of the State and the analysis, interpretation and reporting requirements for EIA.

2.1 Federal Legislation – *Environment Protection and Biodiversity Conservation Act 1999*

2.1.1 Matters of National Environmental Significant

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the main piece of Federal legislation protecting biodiversity in Australia. All Matters of National Environmental Significance (MNES) are listed under the EPBC Act. These include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

2.1.2 Flora and Fauna

Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 2.

Table 2 Categories of Species Listed under Schedule 179 of the EPBC Act

Conservation	Code Category
Ex	**Extinct Taxa** which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Conservation	Code Category
CD	**Conservation Dependent** Taxa which at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered the following subparagraphs are satisfied: - the species is a species of fish - the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised the plan of management is in force under a law of the Commonwealth or of a State or Territory cessation of the plan of management would adversely affect the conservation status of the species.

2.1.3 Vegetation Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 3.

Table 3 Categories of TECs that are listed under the EPBC Act

Code	Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

2.2 Western Australian Legislation

2.2.1 Flora and Fauna

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the WC Act. These categories are defined in Table 4.

Table 4 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Code	Category
CR	**Critically Endangered Species** Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	**Endangered Species** Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora
VU	**Vulnerable Species** Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	**Presumed Extinct Species** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
IA	**Migratory birds protected under an international agreement** Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.
CD	Special conservation
OS	Special protection for reasons other than those already mentioned

Species that have not yet been adequately surveyed to warrant being listed under the WC Act, or are otherwise data deficient, are added to a Priority Lists under Priorities 1, 2 or 3 by the State Minister for Environment. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. Categories and definitions of Priority Flora and Fauna species are provided in Table 5.

Table 5 Conservation codes for WA flora and fauna as listed by DPaW and endorsed by the Minister for Environment

Code	Category
P1	**Priority One – Poorly Known Species** Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	**Priority Two – Poorly Known Species** Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	**Priority Three – Poorly Known Species** Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** a. Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. b. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

2.2.2 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the Bam Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1), and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms, and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.

Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:

- C1 Exclusion - Organisms which should be excluded from part or all of Western Australia.
- C2 Eradication - Organisms which should be eradicated from part or all of Western Australia.
- C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

2.2.3 Communities of Local, Regional and National Significance

Significant flora and vegetation units need to take into account a number of other features other than statutory listings in accordance with the Flora and Vegetation Environmental Factor Guideline (EPA, 2016a). These include the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- A role as a refuge
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

3.0 Existing Environment

3.1 Climate

The Survey Area is situated in southwest WA which has a Mediterranean type climate. A Mediterranean climate is characterised by warm to hot dry summers and mild to cool wet winters. The Mediterranean climate in Australia is a result of the Indian Ocean High, a high pressure cell that shifts towards the poles in summer and the equator in winter, playing a major role in the formation of the deserts of Western Australia. Precipitation occurs during winter months, with the possibility of some summer storms.

The nearest Bureau of Meteorology (BoM) weather station is Wagerup Refinery (Station ID 009538) located 7 km south of the Survey Area. Rainfall in the months leading up to both the January and June 2019 surveys were lower than the mean (Figure 2). The variation in rainfall in the months preceding the survey is not considered to have affected the survey results.

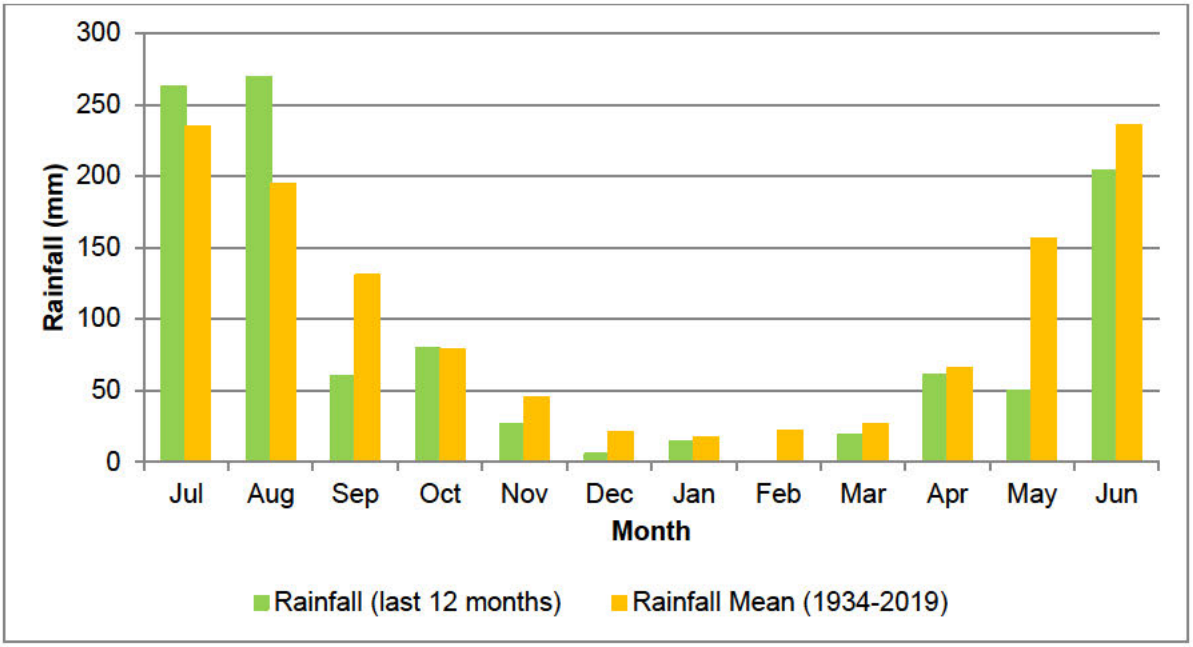


Figure 2 Rainfall recorded at the Wagerup Refinery (Station 009538)

3.2 IBRA Region

The Swan Coastal Plain bioregion, described in CALM (2002), includes Perth and the outer suburbs (excluding the Hills suburbs). The Swan Coastal Plain consists of the Dandaragan Plateau and the Perth Coastal Plain and is comprised of a narrow belt less than 30km wide of Aeolian, alluvial and colluvial deposits of Holocene or Pleistocene age (Gibson et al 1994). A complex series of seasonal fresh water wetlands, alluvial river flats, coastal limestone and several offshore islands are included in the bioregion. Younger sandy areas and limestone are dominated by heath and/or tuart woodlands, while *Banksia* and jarrah-*Banksia* woodlands are found on the older dune systems. The outwash plains at the foot of the Darling Escarpment were once dominated by *Casuarina obesa*-marri woodlands and Melaleuca shrublands. Extensive clearing has occurred on the Swan Coastal Plain for urban and agricultural development. The region is divided into the Dandaragan Plateau and the Swan Coastal Plain subregions.

The Swan Coastal Plain subregion, described by Mitchell et al. (2002), is a low-lying coastal plain covered with woodlands dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. The area includes a complex series of seasonal wetlands and includes Rottnest, Carnac and Garden Islands. Land use is predominantly cultivation, Conservation, urban and rural residential. The area contains a number of rare features including Holocene dunes and wetlands and a large number of rare and threatened species and ecological communities.

3.3 Soils and Geology

Purdie *et al.* (2004) broadly mapped two land systems within the Survey Area:

- Bassendean System (212Bs) - sand dunes and sandplains with pale deep sand, semi-wet and wet soil. This covers most of the Survey Area.
- Pinjarra System (213Pj) - Poorly drained coastal plain with variable alluvial and aeolian soils. This system presents the alluvial plain of the Harvey River located along the southern margin of the Survey Area, as well as a small depression in the north eastern corner of the Survey Area.

Land systems in the Survey Area can be broken down further into nine sub-systems that form a mosaic of sandplains, low dunes and depressions with varying drainage (In some places depressions may create poorly defined streams. Where the Pinjarra System is present, clays and duplex soils are more prevalent. These form a defined channel and banks at the Harvey River.

3.4 Vegetation

Pre-European vegetation mapping has been undertaken by Beard (1974). This mapping shows one vegetation association within the Survey Area, described as Association 1000 Low forest or woodland. Mosaic: medium forest; Jarrah-Marri / low woodland; *Banksia* / Low forest; Teatree (*Melaleuca* spp.).

Heddle *et al.* (1980) conducted vegetation complex mapping for the Swan Coastal Plain at a scale of 1:250,000. The mapping shows three vegetation types (Table 6) including Serpentine River, Cannington and Southern River complex.

Table 6 Vegetation complex mapping in the Survey Area completed by Heddle *et al.* (1980)

Landform Unit	Complex	Description
Pinjarra Plain	35 Serpentine River Complex	Closed scrub of Melaleuca species and fringing woodland of Eucalyptus rudis (Flooded Gum) - Melaleuca rhaphiophylla (Swamp Paperbark) along streams.
Combination Bassendean Dunes and Pinjarra Plain	40 Cannington Complex	Mosaic of vegetation from adjacent vegetation complexes of Bassendean, Karrakatta, Southern River and Vasse.
	42 Southern River Complex	Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.

4.0 Methods

The ecological assessment builds on work completed in January 2019. This section describes all the survey effort conducted to-date including the desktop review and the two field surveys.

4.1 Desktop Review

A detailed desktop review was undertaken to define the existing environment and identify potential matters of conservation significance to target during the field survey.

The desktop review was informed by publicly available government databases including Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Museum's NatureMap (115° 48' 11" E, 32° 53' 40" S) and EPBC Act Protected Matters Search Tool (PMST). A buffer distance of 10 km was used for database searches and is considered appropriate for detecting conservation significant species in the south west region of Western Australia.

The likelihood of occurrence was determined for all conservation significant species and communities identified, using categories outlined in Table 7.

Table 7 Categories of likelihood of occurrence for species and communities

Likelihood Category	Flora	Fauna	Communities
Likely to occur	Habitat is present in the Survey Area and the species has been recorded in close proximity to the Survey Area.	Survey Area is within the known distribution of the species, habitat is present in the Survey Area and the species has been recorded in close proximity to the Survey Area.	Known occurrences of the community in close proximity to the Survey Area. Vegetation within the known occurrence appears to be congruent with vegetation in the Survey Area based on aerial imagery. Geographic location is similar to the Survey Area.
May occur	Habitat may be present and/or the species has been recorded in close proximity to the Survey Area.	Survey Area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the Survey Area.	Known occurrence of the community in the local area, and/or vegetation within known occurrence appears to be congruent with vegetation in the Survey Area based on aerial imagery. Geographic location is similar to the Survey Area.
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the Survey Area.	Survey Area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the Survey Area.	Known occurrence of the community in close proximity to the Survey Area however geographic location does not occur in Survey Area.

4.2 Field Survey

4.2.1 Preliminary Site Assessment

A preliminary site assessment was conducted on 31 January 2019 by Ecologists Jared Leigh and Laura Fisher. Patches of remnant native vegetation were characterised including vegetation association, condition, and potential for utilisation by significant fauna species. Desktop review results were verified including confirmation of the absence of significant flora species and vegetation communities. An inventory of fauna species observed was also compiled.

4.2.2 Reconnaissance Flora and Vegetation Assessment

The flora and vegetation assessment included collecting data from traverses in areas of remnant native vegetation. The survey was completed by Ecologists Floora de Wit and Laura Fisher on 20 June 2019.

Five traverses were completed in areas of remnant native vegetation. Traverses included walking through the patch on foot and recording patch characteristics including landform, flora species and community complexity, and evidence of disturbance, Traverses were considered suitable for capturing the floristic data for the Project as all patches were mostly devoid of native vegetation species. Quadrats was not considered an efficient method for capturing floristic data for this Project.

Each traverse was given a unique site number, and the following parameters recorded:

- date
- location (accuracy of 5 m)
- soil details (type, colour, moisture)
- landform
- vegetation condition using the Keighery (1994) scale and description of disturbance
- fire history
- species list
  - estimated height
  - estimated percentage cover (for trees both percentage within quadrat and within community was recorded to enable better description of vegetation community).

4.2.3 Targeted Black Cockatoo Survey

A targeted Black Cockatoo survey was conducted to identify potential breeding, roosting and foraging habitat for the three threatened Black Cockatoo species that are likely to occur in the Survey Area. These are Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered under the EPBC Act and under the WC Act), the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable under the EPBC Act and under the WC Act) and Baudin's Cockatoo *Calyptorhynchus baudinii* (Endangered under the EPBC Act and under the WC Act). The survey was conducted on 20 June 2019 in accordance with DSEWPaC (2012) and DotEE (2017) by Ecologists Floora de Wit and Laura Fisher.

4.2.3.1 Breeding Habitat

The Black Cockatoo breeding habitat assessment focussed on quantifying breeding and potential breeding trees within the Survey Area. Table 8 defines breeding habitat and identifies those trees that Black Cockatoos will utilise as breeding trees, according to DSEWPaC (2012).

The following information was collected for all potential breeding trees with suitable hollows or a Diameter at Breast Height (DBH) >500 mm (*Eucalyptus wandoo* >300 mm). Details collected for each tree included:

- location
- tree species
- DBH
- number of potentially suitable hollows

- hollow details – including dimensions, height from ground, direction, type of hollow, evidence of use, etc.

Table 8 Potential breeding habitat trees for Black Cockatoo species

Habitat	Carnaby's Cockatoo	Forest Red-Tailed Black Cockatoo	Baudin's Cockatoo
Specific breeding habitat	Generally in woodland or forest, but also breeds in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of salmon gum *E. salmonophloia*, wandoo, tuart, jarrah *E. marginata*, flooded gum *E. rudis*, york gum *E. loxophleba subsp. loxophleba*, powderbark *E. accedens*, karri and marri.	Generally in woodland or forest, but may also breed in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of marri, karri, wandoo, bullich *E. megacarpa*, blackbutt *E. patens*, tuart and jarrah.	Generally in woodland or forest, but may also breed in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of karri *Eucalyptus diversicolor*, marri *Corymbia calophylla*, wandoo *E.wandoo* and tuart *E. gomphocephala*.
Definition of breeding habitat	'Breeding habitat' is defined in these referral guidelines as trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable DBH to develop a nest hollow. For most tree species, suitable DBH is 500 mm. Note that *E. wandoo* is DBH >300 mm.		

4.2.3.2 Roosting Habitat

Table 9 defines the suitable trees that the three Western Australian Black Cockatoo species may utilise as roosting trees. Both white-tailed Black Cockatoo species roost in or near riparian environments or near other permanent water sources. The Forest Red-Tailed Black Cockatoo prefers the edges of forests for roosting (DSEWPaC, 2012). Potential roosting trees were searched for and assessed during the field survey.

Evidence of roosting usually involves large amounts of bird scat beneath a large, mature tree, with a significant amount of broken branches, twigs etc. on the ground. Roosting sites were searched for throughout the Survey Area.

Table 9 Suitable Roosting Trees for the Three Western Australian Threatened Black Cockatoo Species

Carnaby's Cockatoo	Forest Red-Tailed Black Cockatoo	Baudin's Cockatoo
Generally in or near riparian environments or natural and artificial permanent water sources. Flat-topped yate *E. occidentalis*, salmon gum, wandoo, marri, karri, blackbutt, tuart, introduced eucalypts (for example blue gum) and introduced pines.	Tall jarrah, marri, blackbutt, tuart and introduced eucalypt trees within or on the edges of forests.	Generally in or near riparian environments or other permanent water sources. Jarrah, marri, flooded gum, blackbutt *E. patens*, tuart, and introduced eucalypts including blue gum *E. globulus*, and lemon scented gum *Corymbia citriodora*.

Source: DSEWPaC (2012).

4.2.3.3 Foraging Habitat

The quality of foraging habitat not only reflects the availability of food sources, but also the proximity to reliable water sources, connectivity to other suitable habitat, presence of breeding and potential breeding trees, and proximity to confirmed roost and breeding sites (amongst others). These parameters were utilised by the DotEE (2017) to produce a draft quality of foraging habitat scoring system, which has been slightly amended by AECOM (Table 12). This scoring system was utilised to

assess potential foraging habitat for Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo throughout the Survey Area.

The scoring tool is used by initially defining the quality of the overall habitat present (i.e. Very High Quality, High Quality, Quality and Low Quality) and then adding or subtracting points from this depending on the ecological values of the habitat (i.e. proximity to water, proximity to a known roost site, evidence of foraging material etc.). This determines an overall quantitative rating. Table 10 defines the levels of foraging habitat quality used during the assessment.

Table 11 defines the foraging and common food items for the three Western Australian Black Cockatoo species.

Table 10 Black Cockatoo Foraging Assessment Scoring

Score	Foraging Quality
1 – 3	Low Quality
4 – 6	Quality
7 – 8	High Quality
>8	Very High Quality

Table 11 Foraging and Common Food Items for Black Cockatoo Species

Species	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo
Foraging	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp. Forages in pine plantations (*Pinus* spp.), eucalypt woodland and forest that contains foraging species. Also individual trees and small stands of these species.	Jarrah and marri woodlands and forest, and edges of karri forests including wandoo and blackbutt, within the range of the subspecies.	Eucalypt woodlands and forest, and proteaceous woodland and heath. During the breeding season feed primarily on native vegetation, particularly marri. Outside the breeding season, may feed in fruit orchards (mostly apple and pear, but also persimmon) and tips of *Pinus* spp.
Foraging: common food items	Seeds, flowers and nectar of native proteaceous plant species (for example, *Banksia* spp., *Hakea* spp., *Dryandra* spp, and *Grevillea* spp), eucalypts and Callistemon. Also seeds of introduced species including *Pinus* spp., *Erodium* spp., wild radish, canola, almonds and pecan nuts; insects and insect larvae; occasionally flesh and juice of apples and persimmons.	Mostly seeds of marri and jarrah, also *Eucalyptus caesia*, *illyarrie E. erythrocorys* and some introduced eucalypts such as river red gum *E. camaldulensis* and flooded gum *E. grandis*, *Allocasuarina* cones, fruits of snottygobble *Persoonia longifolia* and mountain marri *Corymbia haematoxylon*. On the Swan Coastal Plain, often feed on introduced cape lilac *Melia azedarach*.	Mostly marri (seeds, flowers, nectar and grubs) and proteaceous trees and shrubs. Also other native seeds and introduced fruits; insects and insect larvae; pith of kangaroo paw *Anigozanthos flavidus*; juice of ripe persimmons; tips of *Pinus* spp. And seeds of apples and pears.

Source: DSEWPaC (2012).

Table 12 Quality of Foraging Habitat Assessment Tool

Initial Score	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo
10	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing
7	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (e.g. *Banksia* sp., *Hakea* sp. and *Grevillea* sp.) as well as eucalypt (not mallee) woodland and forest that is dominated by foraging species. Does not include orchards, canola, or areas under a RFA	Jarrah and Marri woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies. Does not include areas under a RFA	Eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri. Does not include orchards or areas under RFA
5	Pine plantation, mallee eucalypts, introduced eucalypts and /or native vegetation with foraging species that are not dominant	Introduced eucalypts, introduced Cape lilac (*Melia acedarach*) and /or native vegetation with foraging species that are not dominant	Pine plantation or introduced eucalypts
1	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)
Additions: Context adjustor – attributes improving habitat quality			
+3	Is within the Swan Coastal Plain	Jarrah and/or Marri shows good recruitment (i.e. evidence of young trees)	Is within the known foraging area
+3	Contains trees known to be used for breeding and / or with suitable nest hollows	Contains trees known to be used for breeding and / or with suitable nest hollows	Contains trees known to be used for breeding
+2	Primarily comprises Marri	Primarily contains Marri and / or Jarrah	Primarily contains marri
+2	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo)		
+1	Known to be a large or key roosting site		
Subtractions: Context adjustor – attributes reducing habitat quality			
-2	Does not contain evidence of foraging by species		
-2	No other foraging habitat within 6 km		
-1	Is >12km from known roosting site		
-1	Is >12 km from known breeding location		
-1	Is >2 km from watering point		
-1	Disease present (e.g. *Phytophthora cinnamomi* or Marri canker)		

Source: DotEE (2017) – amended by AECOM

4.3 Assumptions and Limitations

Limitations are inherent with any ecological assessment. The limitations associated with the ecological assessment are outlined in Table 13. The limitation assessment scale ranges from "not", "minor", "moderate", "significant".

Table 13 Limitations of the assessment

Limitation	Assessment
Availability of contextual information on the region	**Not a limitation** Sufficient contextual information is available on the Swan Coastal Plain.
Competency/experience of consultant conducting survey	**Not a limitation** Jared is an ecologist with over 15 years' experience in the environmental industry who has conducted fauna surveys in a range of bioregions within Western Australia. Floora is an ecologist with over 10 years' experience conducting surveys of similar scope. Laura is an ecologist with over two years' experience in the environmental industry conducting surveys of similar scope.
Scope (i.e. what life forms were sampled)	**Minor limitation** All areas of potential foraging habitat were inspected and every potential breeding tree within the Survey Area was assessed for suitability. Due to size of some trees, vision of the entire tree was not always possible when looking for hollows, and in this case the precautionary principle was utilised.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Minor Limitation** Floristic data was collected from all patches of native vegetation within the Survey Area. No direct or indirect evidence of the three Black Cockatoos were recorded during the survey. Potential Baudin's Cockatoo *Calyptorhynchus baudinii* foraging evidence was recorded under a Marri tree in the January 2019 survey on a selection of Marri nuts. This cannot be confirmed with confidence due to the similarities of Baudin's foraging markings comparative to other bird species. Fauna habitat mapping was conducted at a broad-scale. Mapping was conducted using hand-held computer (Samsung tablet) units and aerial photo interpretation. The accuracy of the mapping is subject to the accuracy of the unit and access to satellite information (generally < 6 metres). As such, these points should not be relied on for detailed design purposes. Floristic data was collected out of the defined 'ideal survey season'. Additional spring surveys are unlikely to identify additional significant environmental values that were not able to be detected during the January and June survey events.
Sources of information	**Minor limitation** DBCA database, Naturemap, EPBC Act PMST, DoEE (2017) and DSEWPaC (2012) were utilised to inform the surveys.
Completeness (was relevant area fully surveyed)	**Not a limitation** The objectives of the surveys were met. Only areas included in the Survey Area were surveyed to assess their environmental values. If the areas of native vegetation outside the Survey Area require clearing an additional survey will be required.

Limitation	Assessment
Remoteness and/or access problems	**Minor limitation** The majority of the Survey Area was traversed on-ground and was accessible. One isolated patch in the northwest corner of the Survey Area was isolated from the main paddock by a hand-made drain which was full of water at the time of the June 2019 survey. Black Cockatoo assessments were conducted from the edge and are considered an adequate representation of the patch.
Timing, weather, season, cycle	**Not a limitation** The Survey Area is within the modelled distribution of all three Black Cockatoo species. The survey was completed outside the regular flowering season for species on the Swan Coastal Plain. However, due to the degradation of the site, an in-season survey is not expected to identify any other significant environmental=.
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	**Not a limitation** The surveys were not disrupted or impacted.
Intensity (was the intensity adequate)	**Not a limitation** The Survey Area was assessed over two days which enabled sufficient time to assess each patch of remnant vegetation and record all potential Black Cockatoo breeding habitat trees.
Resources (degree of expertise available in identification)	**Not a limitation** The resources (time, equipment and expertise) were sufficient for the surveys. All surveyors have sufficient experience in the environmental industry and conducting relevant surveys.

5.0 Desktop Review Results

The PMST identified a number of Matters of National Environmental Significance (MNES) that may occur, or for which suitable habitat may occur within the Survey Area. Results of the PMST search as requested on 25 January 2019 are summarised in Table 14.

Table 14 Summary of PMST Results

MNES	Number of occurrences
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance (Ramsar Sites)	Peel-Yalgorup system, within 10 km of Ramsar
Listed Threatened Ecological Communities and Threatened Species	Two Threatened Ecological Communities: - *Banksia* Woodlands of the Swan Coastal Plain (EPBC: Endangered) - Clay Pans of the Swan Coastal Plain (EPBC: Critically Endangered) 24 listed threatened species including: - 12 listed fauna species - 12 listed flora species
Migratory Species	10 migratory species
Commonwealth Marine Areas	None

5.1 Threatened and Priority Ecological Communities

Two Threatened Ecological Communities (TECs) listed under the EPBC Act were identified in the desktop review, including the Banksia Woodlands of the Swan Coastal Plain (Banksia Woodlands TEC) and the Clay Pans of the Swan Coastal Plain.

The Banksia Woodlands TEC is listed as Endangered under the EPBC Act and relates to three State-listed TECs, and eight Priority Ecological Communities (PECs).

The Banksia Woodlands TEC incorporates woodland of Banksia species with scattered Eucalypts and other tree species over a species rich mix of sclerophyllous shrubs, graminoids, and forbs. The community shows high endemism and considerable local variation in species composition across its range. It is restricted to the southwest of WA on the Swan Coastal Plain. It occurs mainly on deep Bassendean and Spearwood sands or occasionally on Quindalup sands.

The Clay Pans of the Swan Coastal Plain is listed as Critically Endangered under the EPBC Act. The Clay Pans TEC occurs where clay soils form an impermeable layer close to the surface with wetlands forming as a result of rainfall to fill them in winter, drying out to impervious pans in summer (DSEWPaC, 2012). Floristic composition is generally a shrubland over geophytes, herbs and sedges with no specific dominant species common across all occurrences.

The Clay Pans TEC corresponds to four ecological community types in WA including:

- Herb rich saline shrublands in clay pans (FCT07) – Vulnerable
- Herb rich shrublands in clay pans (FCT08) – Vulnerable
- Dense shrublands on clay flats (FCT09) – Vulnerable
- Shrublands on dry clay flats (FCT10a) – Endangered.

5.2 Conservation Significant Flora

A total of 39 Threatened and Priority flora species were identified during the desktop review as potentially occurring within the Survey Area. These include 26 species listed as Priority flora and 13 species listed under the WC Act and EPBC Act.

A review of habitat and spatial data determined that eight species are likely to within the Survey Area (Table 15). After reviewing the habitat present within the Survey Area following the site inspection, the likelihood of these species has been downgraded to 'may occur' or 'unlikely to occur' as no suitable habitat was present. All eight of these species are Threatened flora, listed under the EPBC Act and WC Act. Flora species considered likely to occur within the Survey Area are detailed in Appendix A including their conservation status and habitat.

Table 15 Threatened and Priority flora species that are 'likely to occur' or 'may occur' within the Survey Area

Taxon	State WC Act / DBCA	Federal EPBC Act	Likelihood of Occurrence	Post-Survey Likelihood
Andersonia gracilis	Vulnerable	Endangered	Likely to occur	Unlikely to occur
Diuris micrantha	Vulnerable	Vulnerable	Likely to occur	May occur
Diuris purdiei	Endangered	Endangered	Likely to occur	Unlikely to occur
Drakaea elastica	Critically Endangered	Endangered	Likely to occur	Unlikely to occur
Drakaea micrantha	Endangered	Vulnerable	Likely to occur	Unlikely to occur
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Critically Endangered	Critically Endangered	Likely to occur	Unlikely to occur
Synaphea sp. Pinjarra Plain (A.S. George 17182)	Endangered	Endangered	Likely to occur	Unlikely to occur
Synaphea stenoloba	Critically Endangered	Endangered	Likely to occur	Unlikely to occur

5.3 Conservation Significant Fauna

The desktop review identified 26 conservation significant fauna species that could potentially occur within the Survey Area. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the Survey Area and reviewing the recent records and distribution of the species (Appendix B). The desktop assessment determined that:

- three species are 'likely to occur'
- 13 species 'may occur'
- ten species are 'unlikely to occur'.

After reviewing the habitat present within the Survey Area following the site inspection, the likelihood of these species has been amended, generally due to minimal or poor quality habitat being present. The revised assessment determined that:

- three species are 'likely to occur'
- seven species 'may occur'
- 16 species are 'unlikely to occur'.

Table 16 documents the ten threatened fauna species that 'may occur' or are 'likely to occur' within the Survey Area.

Table 16 Conservation significant fauna species considered as 'likely to occur' or 'may occur' within the Survey Area

Species	State WC Act / DBCA	Federal EPBC Act
Calidris ferruginea Curlew Sandpiper	Critically Endangered	Migratory
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo	Vulnerable	Vulnerable
Calyptorhynchus baudinii Baudin's Cockatoo	Endangered	Vulnerable
Calyptorhynchus latirostris Carnaby's Cockatoo	Endangered	Endangered
Falco peregrinus Peregrine Falcon	Other specially protected fauna	-
Plegadis falcinellus Glossy Ibis	Migratory	Migratory
Tringa nebularia Common greenshank	Migratory	Migratory
Notamacropus Irma Western Brush Wallaby	Priority 4	-
Phascogale tapoatafa subsp. *wambenger* South-western Brush-tailed Phascogale	Species of special conservation interest	Vulnerable
Pseudocheirus occidentalis Western Ringtail Possum	Critically Endangered	Critically Endangered

6.0 Field Survey

6.1 Vegetation

6.1.1 Threatened and Priority Ecological Communities

No TECs or PECs were recorded in the Survey Area.

The Banksia Woodlands TEC was considered during the field survey. None of the patches of remnant native vegetation met the key diagnostic criteria that defines this TEC as outlined in the conservation advice. Furthermore, the significant degradation of vegetation confirms that vegetation is not representative of the Banksia Woodlands TEC.

The Clay Pans TEC incorporates a shrubland over species rich layer of geophytes, herbs and sedges. The degraded condition of the wetlands within the Survey Area has reduced vegetation to common pasture weeds and some native herbs and sedges. The continued eroding processes would consider the area unsuitable for representing the Clay Pans TEC.

6.1.2 Vegetation Communities

Six native vegetation communities were mapped within the Survey Area extending 18.98 ha which represents 6.72% of the total Survey Area (Table 17; Figure 3).

Tree death was prominent throughout all areas of native vegetation. Understorey was predominantly absent with some evidence of regrowth of herbs once inundated areas dried up.

Table 17 Vegetation types mapped within the Survey Area

Code	Description	Details
Cc	*Corymbia calophylla* medium open woodland over pasture weeds and grasses.	Survey effort: N/A. Survey Area: 5.72 ha Condition: Completely Degraded
CcApAc	*Corymbia calophylla* and *Banksia ilicifolia* low to mid open woodland with *Acacia pulchella* low sparse shrubland over **Arctotheca calendula* and **Hypochaeris glabra* low closed forbland.	Survey effort: one traverse (Waroona 02). Survey Area: 1.87 ha. Condition: Completely Degraded – Degraded
CcJp	*Corymbia calophylla* and *Melaleuca rhaphiophylla* tall open trees over *Juncus preissianus and Xanthorrhea preissii* low closed mixed sedge and shrubland.	Survey effort: one traverse (Waroona 05). Survey Area: 1.54 ha Condition: Completely Degraded – Degraded
EmKgAc	*Eucalyptus marginata* and *Banksia ilicifolia* low to mid open woodland with *Kunzea glabrescens and Acacia pulchella low* sparse shrubland over **Arctotheca calendula, *Ehrharta sp. and *Romula rosea* low closed mixed forb and grassland.	Survey effort: one traverse (Waroona 03). Survey Area: 4.42 ha Condition: Completely Degraded – Degraded
Mr	*Melaleuca rhaphiophylla* low open woodland over pasture weeds and grasses.	Survey effort: one traverse (Waroona 01). Survey Area: 3.55 ha Condition: Completely Degraded
MrJp	*Melaleuca rhaphiophylla* low open woodland with *Juncus preissianus* and *Solanum nigrun* low sparse shrubland over **Arctotheca calendula, ?Xanthosia huegelii,* and *Oxalis pes-caprae* low closed forbland.	Survey effort: one traverse (Waroona 04). Survey Area: 1.86 ha Condition: Degraded
Paddock	Cleared paddock comprising common pasture weeds.	Survey Area: 257.5 ha

Code	Description	Details
		Condition: Cleared

6.1.3 Condition

Vegetation condition was mapped as Completely Degraded to Degraded.

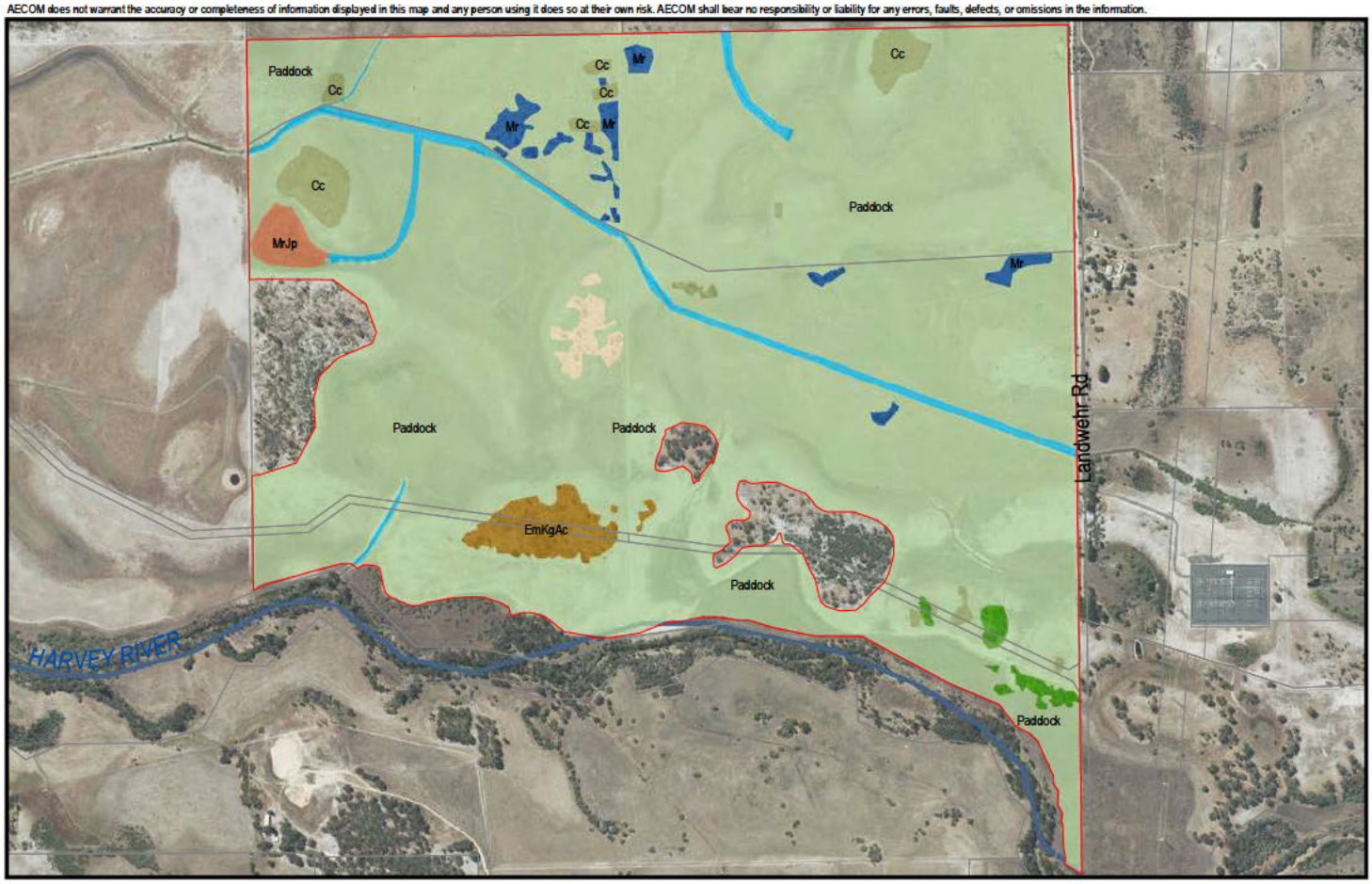
The condition reflects the current land use of agriculture. Areas of remnant native vegetation have not been fenced, therefore cattle grazing has contributed to the ongoing decline of vegetation condition.

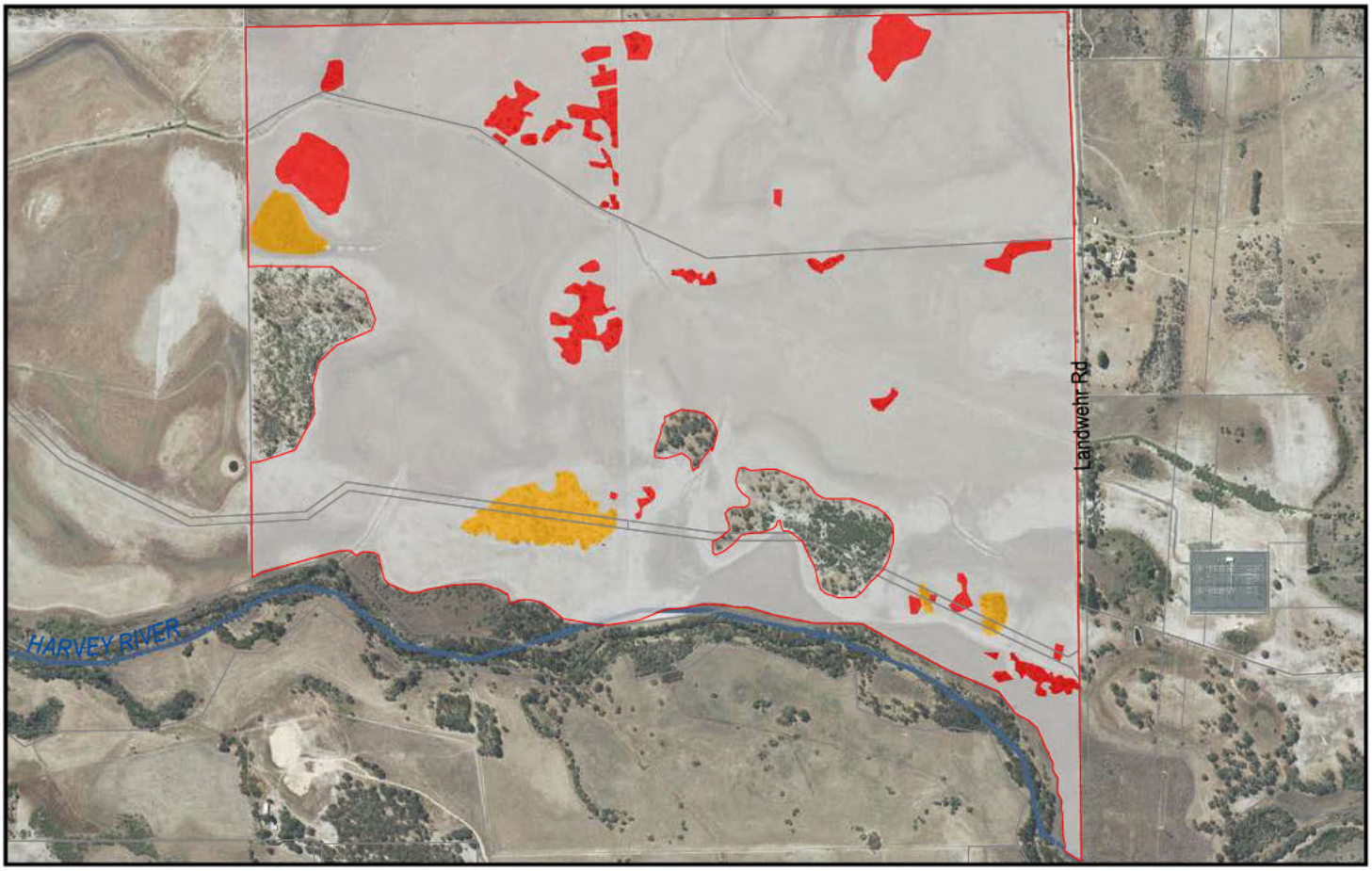
Altered hydrology may be affecting stands of trees, as noted by the numerous dead trees present. At this time we are unable exclude dieback as a contributing factor to vegetation decline.

The extent of the various vegetation condition categories mapped for the Survey Area present in Table 18 and Figure 3.

Table 18 Vegetation condition mapped in the Survey Area

Condition Scale	Survey Area (ha)
Cleared	263.8
Completely Degraded	12.13
Degraded	6.85





PROJECT ID 60605068
CREATED BY KW
APPROVED BY L.Fisher
LAST MODIFIED 30 JUL 2019

AECOM
www.aecom.com

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DATUM GDA 1994, PROJECTION MGA ZONE 50

0 150 300 450 600
metres

1:17,500 when printed at A4

LEGEND

Survey Area
Cadastre

Vegetation Communities
Cc
CcApAc
CcJp

Drainage
EmKgAc
Mr
MrJp
Paddock

Vegetation Condition
Completely Degraded
Degraded
Cleared

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2019).

Vegetation Communities and Condition

SOUTH ENERGY

WAROONA SOLAR FARM - ECOLOGICAL ASSESSMENT

Figure 3

Map Document: G:\GIS_Projects\WaroonaSolarFarm\02_MXDs\05_EcologicalAssessmentUpdated\G60605068_Fig3_VegCommunitiesCondition.mxd (WyattK2)

A4 size

6.2 Fauna

6.2.1 Conservation Significant Fauna

Twenty-five vertebrate fauna species were recorded during the field survey. This comprised 18 bird, one reptile and six mammal species (Table 19). Of these, two were of conservation significance:

- Baudin's Cockatoo (*Calyptorhynchus latirostris*) - listed as Endangered under the EPBC Act and WC Act
- Tree Martin (*Petrochelidon nigricans*) - listed as Marine under the EPBC Act.

Species listed as Marine under the EPBC Act are only considered of conservation significance when recorded within Commonwealth Land. Given the Survey Area does not contain any Commonwealth land the Tree Martin is not considered conservation significant for the purposes of this Project and will not be discussed further.

Table 19 Fauna species recorded during the field survey

Species	Common Name	Status	Observation
Birds			
Anas superciliosa	Pacific Black Duck	Native	Flock of eight birds observed in drainage line to north of Survey Area
Artamus cinereus	Black-faced Woodswallow	Native	Several individuals observed around eucalypts to southeast of Survey Area
Aquila audax	Wedge-tailed Eagle	Native	Two birds observed flying over Survey Area
Barnardius zonarius semitorquatus	Australian Ring-neck Parrot	Native	Observed multiple times throughout Survey Area
Calyptorhynchus latirostris	Baudin's Cockatoo	Native	Possible foraging evidence recorded under Marri tree.
Coracina novaehollandiae	Black-faced Cuckooshrike	Native	One observed in mature eucalypt in paddock
Corvus coronoides	Australian Raven	Native	Heard and seen several times in Survey Area
Cracticus tibicen	Australian Magpie	Native	Common throughout Survey Area
Egretta novaehollandiae	White-faced Heron	Native	Observed flying over Survey Area
Eolophus roseicapilla	Pink and Grey Galah	Native	Two individuals observed in eucalypt
Gerygone fusca	Western Gerygone	Native	Heard in mixed eucalypt stand
Pachycephala rufiventris	Rufous Whistler	Native	Heard in riverine habitat
Pardalotus striatus	Striated Pardalote	Native	Heard in mature trees towards east of Survey Area
Pelecanus conspicillatus	Australian Pelican	Native	Two birds observed flying over Survey Area
Purpureicephalus spurius	Red-capped Parrot	Native	Probably foraging evidence observed beneath Marri to east of Survey Area
Petrochelidon nigricans	Tree Martin	Native	Observed several times throughout Survey Area
Rhipidura albiscapa	Grey Fantail	Native	Observed several times in trees within paddock

Species	Common Name	Status	Observation
Rhipidura leucophrys	Willie Wagtail	Native	Observed several times within native vegetation in and around paddock
Mammals			
Bos taurus	Domestic Cattle	Introduced	Scat and prints observed throughout Survey Area
Macropus fuliginosus	Western Grey Kangaroo	Native	Commonly observed in paddocks
Canis lupis	Feral Dog	Introduced	Tracks observed along tracks to east of Survey Area
Oryctolagus cuniculus	European Wild Rabbit	Introduced	Scat and digging observed in stand of mixed eucalypts
Sus scrofa	Feral Pig	Introduced	Diggings observed adjacent river to southeast of Survey Area
Vuples vulpes	European Red Fox	Introduced	Scat observed several times through Survey Area and one individual observed towards east of Survey Area
Reptiles			
Varanus gouldii	Sand Goanna	Native	Observed under eucalypt

Five introduced fauna species were recorded during the field survey. The species and their legal status under the BAM Act are listed below:

- Domestic Cattle (*Bos taurus*) – Permitted s11
- Feral Dog (*Canis lupis*) - Declared Pest – s22(2) (C3 Exempt)
- European Wild Rabbit (*Oryctolagus cuniculus*) (Feral) – Declared Pest – s22(2)
- Feral Pig (*Sus scrofa*) – Declared Pest – s22(2)
- European Red Fox (*Vulpes vulpes*) - Declared Pest - s22(2) (C3 Exempt).

Refer to Section 2.2.2 for explanations of BAM Act categories.

6.2.2 Fauna Habitats

Four broadly defined fauna habitats were mapped within the Survey Area. These comprise:

- Paddock with Scattered Trees and Drainage Areas: 235.04 ha
- Riparian Vegetation, Dams and Drainage: 31.32 ha
- Mixed Trees: 10.81 ha
- Stags: 5.31 ha

Table 20 describes these four fauna habitats and discusses the conservation significant fauna species that may potentially utilise these habitats, or aspects of these habitats.

Table 20 Broadscale Fauna Habitats of the Survey Area

Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Photo
Paddock with Scattered Trees and Drainage Areas Extent: 235.04 ha	This habitat is predominantly cleared paddocks with scattered individual or clumps of large mature eucalypts (and other vegetation). It also contains multiple drainage lines and lower lying drainage areas of varying size. Some of the large eucalypts contain hollows and may provide significant fauna habitat. These trees may be classified as Black Cockatoo breeding and potential breeding trees, and it is recommended that they are avoided where possible.	• Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) may utilise the mature eucalypts for foraging, roosting and / or breeding habitat • Mammals including the South-western Brush-tailed Phascogale (*Phascogale tapoatafa subsp. wambenger*) and Western Ringtail Possum (*Pseudocheirus occidentalis*) may utilise the mature eucalypts and *Agonis flexuosa* • Western Brush Wallaby (*Notamacropus Irma)* may utilise the habitat • Waterbird species may also utilise aspects of this habitat when damp or flooded.	   
Riparian Vegetation, Dams and Drainage	This fauna habitat contains riparian vegetation, the dams and drainage lines. The riverine habitat contains mature Flooded	• Mammals including the Western Brush Wallaby (*Notamacropus Irma)* may utilise the riverine habitat • Waterbird species may also utilise aspects of this habitat.	

Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Photo
Extent: 31.32 ha	Gums and Paperbarks, with a generally degraded understorey (weeds and feral animals [e.g. Feral Pigs]). Note that only the more significant drainage lines through the paddocks are identified and there are multiple other drainage lines / areas in the paddocks. The area of this habitat to the southeast area of the Survey Area directly north of the river appears to be a flood plain with cracking clays.		

Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Photo
Stags Extent: 5.31 ha	These are areas of mostly mature dead trees (stags) with no understorey.	• Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) may utilise these stags as breeding habitat.	
Mixed Trees Extent: 10.81 ha	This habitat predominantly comprises stands of mature eucalypts (*Eucalyptus marginata and Corymbia calophylla*) over a degraded and mostly cleared understorey. Proteaceous species and *Agonis flexuosa* was observed in several stands. These areas generally contain light grey sandy soils.	• Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) may utilise the mature eucalypts and proteaceous species within this habitat for foraging, roosting and / or breeding habitat • Mammals including the South-western Brush-tailed Phascogale (*Phascogale tapoatafa subsp. wambenger*), Western Ringtail Possum (*Pseudocheirus occidentalis*), and Western Brush Wallaby (*Notamacropus Irma)* may utilise this habitat depending on understorey and species present.	 

6.2.3 Conservation Significant Fauna Species

Based on the desktop assessment and the field survey, Carnaby's Cockatoo (*Calyptorhynchus latirostris),* Forest Red-tailed Black Cockatoo *(Calyptorhynchus banksii naso)* and Baudin's Cockatoo *(Calyptorhynchus baudinii)* are considered to have the potential to utilise habitats within the Survey Area. Breeding and foraging habitat is present.

Marginal, generally poor quality and highly modified habitat also exists for the following species:

- Peregrine Falcon (*Falco peregrinus*) may utilise the larger eucalypts
- Western Brush Wallaby (*Notamacropus Irma*) which may utilise the areas of mixed trees and adjacent paddocks
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa* subsp. *wambenger*) and the Western Ringtail Possum (*Pseudocheirus occidentalis*) which may utilise the areas of mixed trees, though these are generally smaller patches that are very isolated and of poor quality.
- wetland bird species including the Glossy Ibis *(Plegadis falcinellus),* Curlew Sandpiper (*Calidris ferruginea),* Common Greenshank *(Tringa nebularia),* Some of these species may utilise the poor quality drainage and wetland habitats, and areas within the paddocks which are highly modified but likely to flood over winter.

6.3 Black Cockatoos

6.3.1 Breeding and Potential Breeding Trees

The Survey Area contains 201 potential Black Cockatoo breeding trees of suitable DBH, of which 22 contain hollows potentially suitable for use by Black Cockatoos. Refer to Table 21 and Figure 4 for the details of the 22 trees including their location, species, height, DBH and number of suitable hollows.

A comprehensive list of all potential Black Cockatoo breeding trees is provided in Appendix C.

Table 21 Trees with potentially suitable Black Cockatoo hollows within the Survey Area

ID	Longitude	Latitude	Species	Height (m)	DBH (cm)	Number of suitable hollows
5	115.4829	-32.5310	Stag	15	124	1
19	115.4844	-32.5420	Stag	16	85	1
34	115.4839	-32.5356	Stag	18	83	1
42	115.4836	-32.5355	Stag	8	92	1
56	115.4732	-32.5319	Stag	15	97	2
63	115.4758	-32.5350	Stag	25	180	2
75	115.4755	-32.5351	Jarrah (*Eucalyptus marginata*)	22	128	1
79	115.4752	-32.5351	Stag	30	113	1
87	115.4759	-32.5335	Stag	15	124	1
91	115.4759	-32.5337	Stag	18	101	2
92	115.4759	-32.5336	Stag	10	113	1
97	115.4830	-32.5335	Stag	15	125	1
112	115.4829	-32.5314	Stag	24	76	2
114	115.4810	-32.5330	Stag	25	66	1
118	115.4890	-32.5330	Stag	12	98	1
141	1151.4835	-32.5357	Stag	30	222	3
152	115.4732	-32.5322	Stag	15	108	3

ID	Longitude	Latitude	Species	Height (m)	DBH (cm)	Number of suitable hollows
158	115.4759	-32.5346	Stag	8	105	1
170	115.4759	-32.5350	Stag	18	110	1
177	115.4810	-32.5350	Stag	10	87	3
190	115.4759	-32.5331	Stag	15	105	1
197	115.4810	-32.5329	Marri (*Corymbia calophylla)*	25	102	1

6.3.2 Roosting Trees

No roosting trees were identified within the Survey Area.

6.3.3 Foraging Habitat

Black Cockatoo foraging habitat predominantly comprises isolated patches of Marri trees within paddocks. Significant dead trees were recorded in these patches and this has reduced the foraging quality of several patches.

The Survey Area contains Carnaby's Cockatoo (*Calyptorhynchus latirostris)* foraging habitat (Figure 5), comprising:

- 1.80 ha of High Quality foraging habitat
- 2.59 ha of Quality foraging habitat.

No Carnaby's Cockatoo foraging evidence was recorded in the Survey Area however evidence has been recorded nearby.

The Survey Area contains Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* foraging habitat (Figure 5), comprising:

- 3.75 ha of Quality foraging habitat
- 0.64 ha of Low Quality foraging habitat.

No Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* foraging evidence was recorded in the Survey Area.

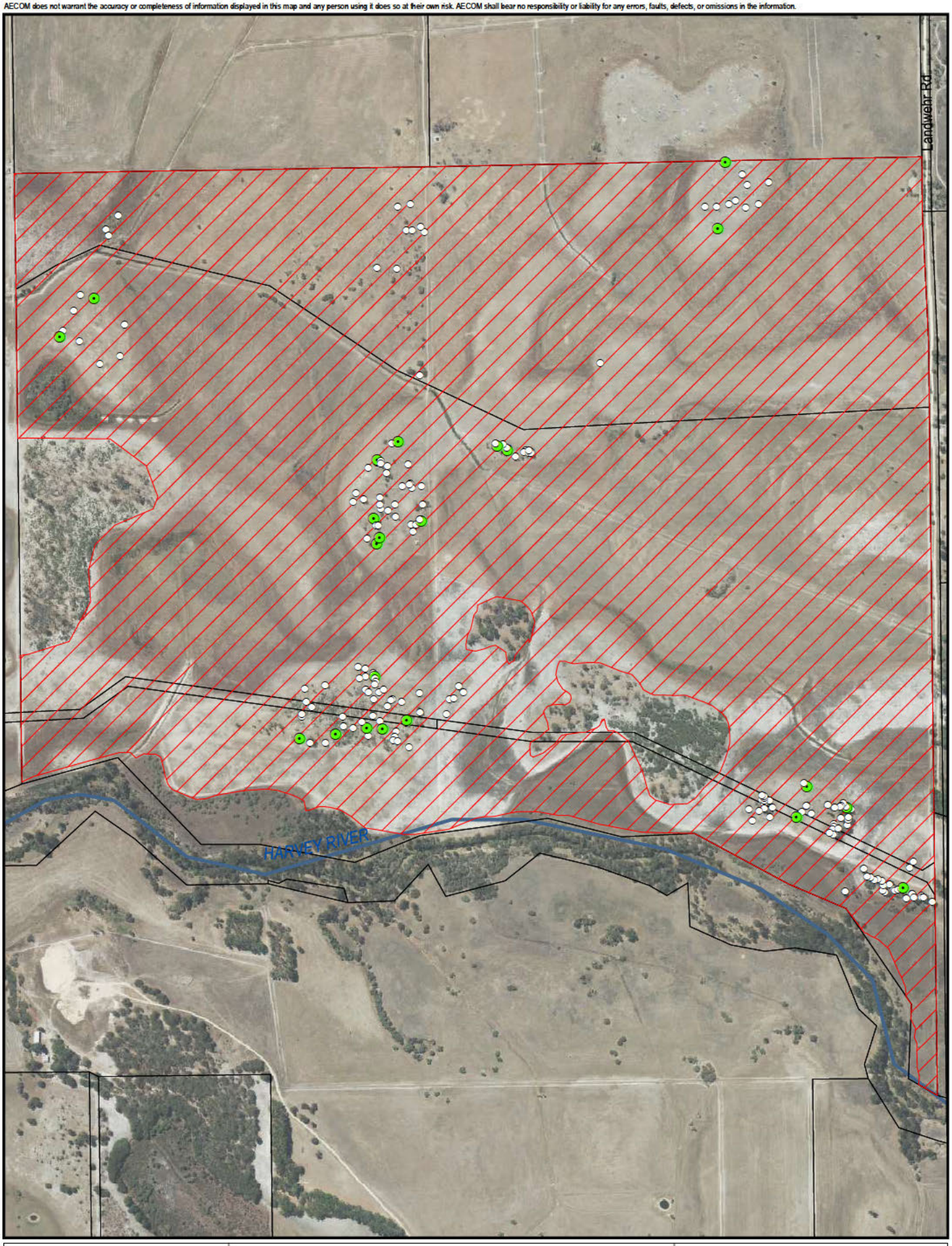
The Survey Area contains Baudin's Cockatoo (*Calyptorhynchus baudinii)* foraging habitat (Figure 5), comprising:

- 1.80 ha of High Quality foraging habitat
- 2.59 ha of Quality foraging habitat.

Potential foraging evidence of the Endangered Baudin's Cockatoo (*Calyptorhynchus latirostris*) was recorded under a Marri tree in the January 2019 survey (Plate 1).

Refer to Appendix D for the foraging quality assessments.

Plate 1 Possible Baudin's Cockatoo foraging evidence



PROJECT ID 60605068
CREATED BY [redacted]
APPROVED BY
LAST MODIFIED 11 JUL 2019

AECOM
www.aecom.com

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DATUM GDA 1994, PROJECTION MGA ZONE 50

0 100 200 300 400
metres

1:11,000 when printed at A4

LEGEND
- Survey Area
- Cadastre

Black Cockatoo Breeding Trees
- Hollows
- No Hollows

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2019).

Potential Black Cockatoo Breeding Trees

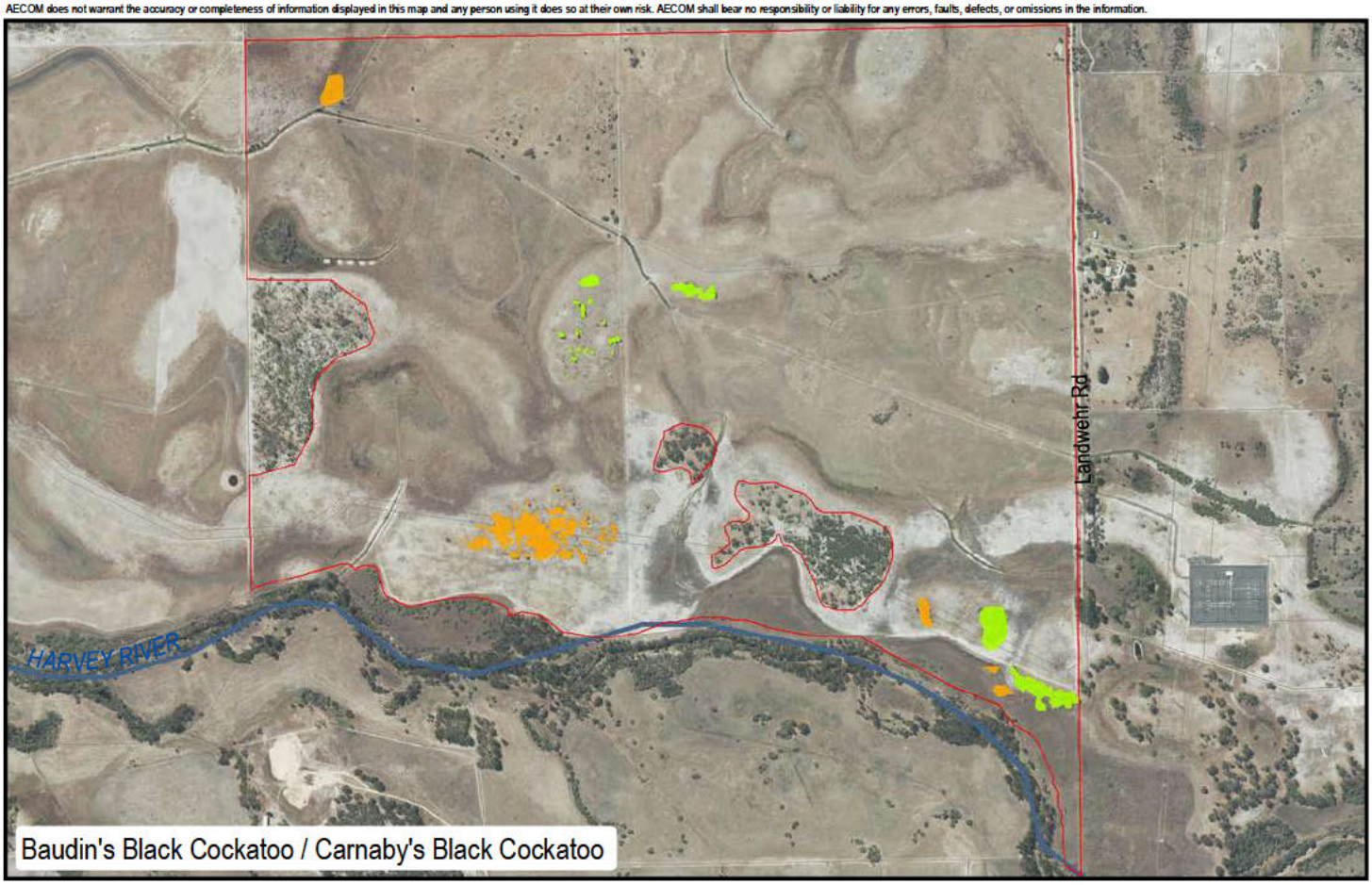
SOUTH ENERGY

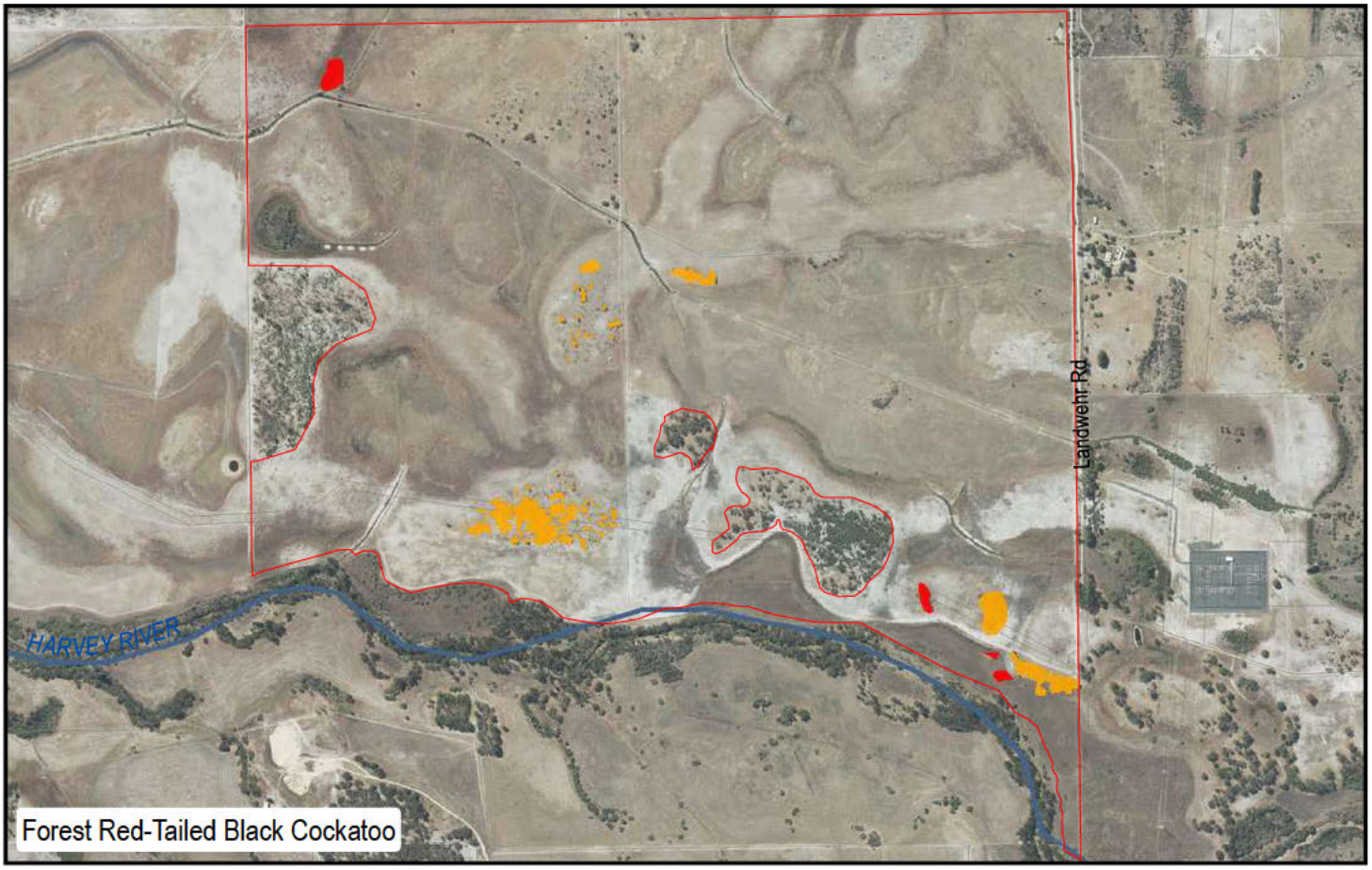
WAROONA SOLAR FARM - ECOLOGICAL ASSESSMENT

Figure 4

Map Document: G:\GIS_Projects\WaroonaSolarFarm\02_MXDs\04_EcologicalAssessment\G60605068_Fig4_PotentialBlackCockatooBreedingTrees.mxd (wyattk2)

A4 size





PROJECT ID 60605068
CREATED BY KW
APPROVED BY J.Leigh
LAST MODIFIED 30 JUL 2019

AECOM
www.aecom.com

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DATUM GDA 1994, PROJECTION MGA ZONE 50

0 150 300 450 600
metres

1:17,500 when printed at A4

LEGEND

Black Cockatoo Foraging Quality
- High Quality
- Quality
- Low Quality

- Survey Area
- Cadastre

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2019).

Black Cockatoo Foraging Habitat

SOUTH ENERGY

WAROONA SOLAR FARM - ECOLOGICAL ASSESSMENT

Figure 5

Map Document: G:\GIS_Projects\WaroonaSolarFarm\02_MXDs\05_EcologicalAssessmentUpdated\G60605068_Fig5_BlackCockatooForagingHabitat.mxd (WyattK2)

A4 size

7.0 Conclusion

7.1 Summary

An ecological assessment was undertaken for the Waroona Solar Farm Project by two AECOM Ecologists. The ecological survey identified the following environmental values:

- Eight significant flora species were considered likely to occur in the Survey Area. The likelihood of these species was downgraded to 'may occur' or 'unlikely to occur' following the site inspection as no suitable habitat was present.
- A total of 18.98 ha of remnant native vegetation was mapped, varying in condition between Completely Degraded to Degraded. None of this vegetation represented a TEC or PEC.
- 22 trees containing potentially suitable breeding hollows for Black Cockatoos, with a further 179 potential breeding trees (with a suitable DBH and no potentially suitable hollows).
- A total of 4.39 ha of High Quality and Quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo, and a total of 4.39 ha of Quality and Low Quality foraging habitat for the Forest Red-tailed Black Cockatoo.
- The potential presence of seven other threatened fauna species (apart from the three Black Cockatoo species), though habitat for these species is generally limited, of poor quality and highly modified.

A constraint for the Project is the presence of foraging and breeding habitat for the three Western Australian Threatened Black Cockatoo species. This is discussed further in Section 7.2.

The survey effort for the Project is considered suitable for assessing the environmental values of the Survey Area.

7.2 Recommendations

It is recommended that South Energy retain native vegetation, Quality and High Quality Black Cockatoo foraging habitat and Black Cockatoo breeding and potential breeding trees where possible. Areas supporting both hollow bearing Black Cockatoo breeding trees and good quality Black Cockatoo foraging habitat should be prioritised. These generally include vegetation communities CcApAc, EmKgAc and CcJp (refer to Figure 3), which also aid in local flood mitigation of the Harvey River.

Clearing of more than one hectare of Quality (and above) Black Cockatoo foraging habitat, or any breeding habitat, has the potential to require a referral under the EPBC Act. We would recommend refining the Project footprint to minimise potential impacts to these areas, and / or hold a pre-referral meeting with the DoEE to confirm the requirement for a referral under the EPBC Act.

Planting areas onsite with Black Cockatoo foraging habitat and erecting Black Cockatoo nesting boxes are options for offsetting the clearing of Black Cockatoo breeding and foraging habitat. An initial assessment has determined that at least eight hectares of land is potentially available and suitable for planting of foraging species. This area is likely to be an underestimation depending on the ability to plant near infrastructure. An additional approximately seven hectares could potentially be planted with foraging species, but further investigation would be required to assess the suitability of this land due to its probable flooding and heavy clay nature. Flora species recommended to plant for Black Cockatoo foraging habitat would include *Banksia sessilis, B. ilicifolia, Allocasuarina fraseriana*, *Corymbia calophylla* and *Eucalyptus marginata,* as well as most locally endemic proteaceous species.

Clearing of native vegetation in Western Australia can also require a Native Vegetation Clearing Permit under Part V of the EP Act. This may need to be obtained prior to the clearing of the native vegetation in the Survey Area.

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Appendix A

Flora Desktop Results

Appendix A Flora Desktop Results

Taxon	State WC Act / DBCA	Federal EPBC Act	Source	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
Andersonia gracilis	VU	EN	PMST	*Andersonia gracilis* is currently known from the Badgingarra, Dandaragan and Kenwick areas where it is found on seasonally damp, black sandy clay flats near or on the margins of swamps, often on duplex soils supporting low open heath vegetation with species such as *Calothamnus hirsutus, Verticordia densiflora* and *Kunzea recurva* over sedges.	Likely to occur	Unlikely to occur
Acacia flagelliformis	P4		Naturemap	Sandy soils. Winter-wet areas.	May occur	May occur
Acacia semitrullata	P4		Naturemap	White / grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	May occur	May occur
Aponogeton hexatepalus	P4		Naturemap	Mud. Freshwater: ponds, rivers, claypans.	Unlikely to occur	Unlikely to occur
Blennospora doliiformis	P3		Naturemap	Grey or red clay soils over ironstone. Seasonally-wet flats.	Unlikely to occur	Unlikely to occur
Boronia capitata subsp. gracilis	P3		Naturemap	White / grey or black sand. Winter-wet swamps, hillslopes.	May occur	May occur
Caladenia huegelii	CR	EN	PMST	*Caladenia huegelii* is found on the Swan Coastal Plain within 20 km of the coast; from just north of Perth to the Busselton area over a distance of over 250 km. Throughout its range the species tends to favour areas of thick undergrowth. Soil is usually deep grey-white sand associated with the Bassendean sand-dune system. However, rare plants have been known to extend into the Spearwood system (in which calcareous yellow sands dominate) in some areas.	Unlikely to occur	Unlikely to occur
Caladenia speciosa	P4		Naturemap	White, grey or black sand.	May occur	May occur
Carex tereticaulis	P3		Naturemap	Black peaty sand.	Unlikely to occur	Unlikely to occur
Chamaescilla gibsonii	P3		Naturemap	Winter-wet flats, shallow water-filled claypans.	May occur	May occur

Taxon	State WC Act / DBCA	Federal EPBC Act	Source	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
Chamelaucium sp. Gingin (N.G.Marchant 6)	VU	EN	PMST	*Chamelaucium* sp. Gingin is endemic to Western Australia and is confined to the Gingin / Chittering area, where it is known from a range of only 3 km. There are six populations of this species which are highly fragmented. The species occurs on white/yellow sand supporting open low woodland with *Eucalyptus todtiana, Banksia attenuata* and Hibbertia sp.	Unlikely to occur	Unlikely to occur
Conostylis pauciflora subsp. pauciflora	P4		Naturemap	Grey sand, limestone. Hillslopes, consolidated dunes.	Unlikely to occur	Unlikely to occur
Diuris micrantha	VU	VU	Naturemap / PMST	*Diuris micrantha* is found from east of Kwinana and south towards the Frankland area. The species is known from seven populations and is found on dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps.	Likely to occur	May occur
Diuris purdiei	EN	EN	Naturemap	*Diuris purdiei* occurs from the south of Perth to near the Whicher Range. It grows in sand to sandy clay soils in areas subject to winter inundation, amongst native sedges and dense heath with scattered emergent *Melaleuca preissiana, Eucalyptus calophylla, E. marginate and Nuytsia floribunda*.	Likely to occur	Unlikely to occur
Drakaea elastica	CE	EN	Naturemap	*Drakaea elastica* occurs on the Swan Coastal Plain over a range of 350 km from Cataby in the north to Busselton in the south. The species is known from 42 populations and occurs on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps, typically in *banksia* woodland or spearwood thicket vegetation.	Likely to occur	Unlikely to occur
Drakaea micrantha	EN	VU	Naturemap	The Dwarf Hammer-orchid is known from 32 populations that occur from Perth to Albany. The species is usually found in cleared fire breaks or open sandy patches that have been disturbed. The species occurs in infertile grey sands in *Banksia*, Jarrah and Common Sheoak woodland or forest.	Likely to occur	Unlikely to occur
Eleocharis keigheryi	VU	VU	PMST	*Eleocharis keigheryi* is known from 15 populations that occur between north of Eneabba and south-east to Qualeup. The species grows in clay or sandy loam, emergent in freshwater creeks and claypans.	May occur	May occur
Eucalyptus x balanites	CE	EN	PMST	*Eucalyptus balanites* is known from two populations, separated by 210 km. These two populations occur in Badgingarra National Park and City of Armadale. The species grows on light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands, open mallee woosland over shrubland or heathland with emergent mallees.	Unlikely to occur	Unlikely to occur

Taxon	State WC Act / DBCA	Federal EPBC Act	Source	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
Galium leptogonium	P3		Naturemap	No information available.	May occur	
Gastrolobium sp. Harvey (G.J. Keighery 16821)	P2		Naturemap	Black peaty sandy clay, brown sandy clay. Winter-wet flats, margins of billabongs.	May occur	Unlikely to occur
Haloragis aculeolata	P2		Naturemap	Black sand or clay over limestone. Winter-wet flats.	May occur	Unlikely to occur
Haloragis scoparia	P1		Naturemap	There is no information available for this species.	May occur	
Hemigenia microphylla	P3		Naturemap	Sandy clay, peaty clay, granite. Winter-wet depressions.	May occur	
Hibbertia spicata subsp. leptotheca	P3		Naturemap	Near-coastal limestone ridges, outcrops and cliffs.	Unlikely to occur	Unlikely to occur
Platysace filiformis	P3		Naturemap	Frequently on lateritic gravelly soils. Often in moist areas.	May occur	Unlikely to occur
Platysace ramosissima	P3		Naturemap	Sandy soils.	May occur	
Pterostylis frenchii	P2		Naturemap	Calcareous sand with limestone, laterite. Faltlands and gentle slopes.	May occur	Unlikely to occur
Schoenus natans	P4		Naturemap	Winter-wet depressions.	May occur	
Schoenus sp. Waroona (G.J. Keighery 12235)	P3		Naturemap	Clay or sandy clay. Winter-wet flats.	May occur	
Sphaerolobium calcicola	P3		Naturemap	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Unlikely to occur	Unlikely to occur
Stylidium longitubum	P4		Naturemap	Sandy clay, clay. Seasonal wetlands.	May occur	
Stylidium trudgenii	P3		Naturemap	Margins of winter-wet swamps, depressions.	May occur	
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CE	CE	PMST	*Synaphea* sp. Fairbridge Farm (D. Papenfus 696) is known from five populations that occur from Serpentine to Dardanup, south of Perth. The species grows in grey, clayey sand with lateritic pebbles in low woodland areas near winter flats.	Likely to occur	Unlikely to occur

Taxon	State WC Act / DBCA	Federal EPBC Act	Source	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
Synaphea odocoileops	P1		Naturemap	Brown-orange loam and sandy clay, granite. Swamps, winter-wet areas.	May occur	May occur
Synaphea sp. Pinjarra Plain (A.S. George 17182)	EN	EN	PMST	*Synaphea* sp. Pinjarra Plain (A.S. George 17182) is known from 12 populations in six locations occurring from Mundijong to West Coolup over a range of 54 km. The species grows on flat terrain on grey-brown sandy loams or heavier brown clay-sand overlain by laterite pebbles. The species occurs more often on boundaries of seasonal wetlands, in soils with moderate drainage.	Likely to occur	Unlikely to occur
Synaphea sp. Serpentine (G.R. Brand 103)	CE	CE	PMST	*Synaphea* sp. Serpentine (G.R. Brand 103) is known from six populations that occur from Byford to Serpentine over a range of 18 km. The species grows predominantly on flat terrain on grey-brown sandy loams to clay in seasonally wet areas.	May occur	May occur
Synaphea stenoloba	CE	EN	Naturemap / PMST	*Synaphea stenoloba* is known from 11 subpopulations that occur from south of Perth, from Pinjarra to Boyanup. The species grows in loamy soils in low lying areas that are occasionally inundated. Associated vegetation is generally swampy heath to 1 m high with scattered emergent *Nuytsia floribunda*.	Likely to occur	Unlikely to occur
Triglochin trichophora	P4		Naturemap	Sand, limestone. Swamps.	May occur	May occur
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4		Naturemap	No information available.	May occur	May occur

Appendix B

Potentially Occurring Fauna Species

Appendix B Fauna Species that may occur in the Survey Area

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Birds							
Botaurus poiciloptilus Australasian Bittern	+		Endangered	EN	The Australasian Bittern is a large thick-necked bird, growing to a length of 66 to 76 cm. The Australasian Bittern occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. There are currently two known sub-populations including the south-eastern and the south-western sub-populations. It's preferred habitat is comprised of wetlands with tall dense vegetation where it forages in still, shallow water up to 0.3 m deep, edges of pools or waterways, or from platforms or mats of vegetation over deep water. Freshwater habitats dominated by sedges, rushes and reeds are preferred.	May occur	Unlikely to occur
Calidris canutus Red Knot	+		Endangered (Marine)	VU	The Red Knot is a widely distributed marine and migratory species. It is common In the north-west of Western Australia with populations in the tens of thousands recorded at 80-mile Beach, not far from the study area (Bamford et al. 2008). The species mainly inhabits intertidal mudflats, sand flats, in estuaries, bays and lagoons. They are occasionally seen on inland salt lakes and wetlands but hardly every use freshwater swamps.	Unlikely to occur	Unlikely to occur
Calidris ferruginea Curlew Sandpiper	+		Migratory & Marine (Bonn, CAMBA, JAMBA, ROKAMBA)	CE	The Curlew Sandpiper is a small, slim weighing 57 g. In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. In Western Australia, they are widespread around coastal and sub coastal plains from Cape Arid to the south-west Kimberley.	May occur	May occur

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Calidris ruficollis Red-necked Stint		+	Migratory & Marine (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	The Red-necked Stint is the smallest wader in Australia and is distributed along most of the Australian coastline, with the greatest densities in Victoria and Tasmania. The nearest internationally important site for the species is the Alfred Cove Nature Reserve on the Swan River (DotE, 2015).	May occur	Unlikely to occur
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo	+	+	Vulnerable	VU	The Forest red-tailed Black Cockatoo requires tree hollows of Karri (*E. diversicolor*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*) forests to nest and breed. Flocks move out onto the Swan Coastal Plain in search of food from exotic trees such as the White Cedar (Johnstone et al, 2010). The foraging habitat for the species consists of Jarrah and Marri woodlands and forest within its range.	Likely to occur	Likely to occur
Calyptorhynchus baudinii Baudin's Cockatoo	+	+	Vulnerable	EN	Habitat critical to the survival of this species includes forests of Karri (*E. diversicolor*), Jarrah (E. *marginata*) and Marri (*C. calophylla*), in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and continues south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al,* 2010).	Likely to occur	Likely to occur
Calyptorhynchus latirostris Carnaby's Cockatoo	+	+	Endangered	EN	Carnaby's Cockatoo is a postnuptial nomad and typically moves west soon after breeding. The species nests in hollows of smooth-barked eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia)* and Wandoo (*E. Wandoo)* but is not limited to these eucalypts. Diet consists of an array of Proteaceous and Eucalypt species prevalent on the Swan Coastal Plain. Foraging habitat, including *banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al.,* 2010).	Likely to occur	Likely to occur

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Falco peregrinus Peregrine Falcon		+		S	A well-known falcon, the Peregrine inhabits a vast array of environs in Australia. Usually uncommon and migratory (Pizzey & Knight, 2007). This species lays its eggs in recesses of cliff faces, tree hollows or large abandoned nests (Bamford, 2008).	May occur	May occur
Leipoa ocellata Malleefowl	+		Vulnerable	VU	Mallefowl is found in semi-arid to arid shrublands and low woodlands of Australia's interior, particularly areas dominated by mallee trees and/or *Acacia* shrubs. The species is highly sensitive to grazing by sheep and other herbivores, and altered fire regimes (Benshemesh, 2007).	Unlikely to occur	Unlikely to occur
Numenius madagascariensis Eastern Curlew	+		Critically Endangered (Marine)	VU	The Eastern Curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. It takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. (DotEE, 2019).	May occur	Unlikely to occur
Oxyura australis Blue-billed Duck		+		P4	The Blue-billed Duck is endemic to south eastern and south western Australia. It prefers deep water in large permanent wetlands and swamps with aquatic vegetation. This species of duck is fully aquatic and rarely comes onto land (OEH, 2015).	Unlikely to occur	Unlikely to occur
Plegadis falcinellus Glossy Ibis		+	Migratory & Marine (Bonn)	IA	The Glossy Ibis occupies well vegetated wetlands, wet pastures, floodwaters, brackish wetlands and mudflats. This species is a non-breeding visitor to south-west Western Australia (Pizzey & Knight, 2007).	May occur	May occur
Rostratula australis Australian Painted-snipe	+		Endangered (Marine)	EN	The Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotE, 2015) This species is a very rare summer visitor to the south-west of Western Australia. Breeding habitat in Western Australia is not quite known however a nest located near Moora was located in a tussock beside a swamp (Johnstone & Storr, 1998).	Unlikely to occur	Unlikely to occur

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Thinornis rubricollis Hooded Plover		+		P4	The Hooded Plover is a medium-sized sandy-brown plover. It has a black head and a white nape, and the black hindneck collar extends around and forks onto the breast. West of the Nullarbor Plain, Hooded Plovers are also often recorded on ocean beaches, but they are just as likely to be seen foraging at salt lakes, sometimes hundreds of kilometres from the coast (http://birdlife.org.au/bird-profile/hooded-plover, accessed Nov 2018).	Unlikely to occur	Unlikely to occur
Tringa nebularia May		+	Migratory & Marine (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	The Common Greenshank is a largely built wader, weighing up to 190 g for both sexes. The species is found in inland wetlands and sheltered coastal habitats (DotEE, 2018).	May occur	May occur
Mammals							
Dasyurus geoffroii Chuditch, Western Quoll	+	+	Vulnerable	VU	Following European settlement, the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). Most records are found in the contiguous Jarrah forests of the south west of Western Australia (DotEE, 2018).	Unlikely to occur	Unlikely to occur
Hydromys chrysogaster Water-rat		+		P4	The Water Rat is one of the few Australian mammals adapted to the aquatic environment. It has a streamlined body and broad, partially webbed hind feet. The species occurs in the vicinity of permanent bodies of fresh or brackish water. Dens are made at the end of tunnels in banks and occasionally in logs (Van Dyck & Strahan, 2008).	May occur	Unlikely to occur
Isoodon fusciventer Quenda		+		P4	The Quenda or Southern Brown Bandicoot exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	May occur	Unlikely to occur

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Notamacropus Irma Western Brush Wallaby		+		P4	The Western Brush-wallaby occurs in the south-west of Western Australia. Its preferred habitat consists of open sclerophyll forest or woodland and favours open flats over scrub thickets. It is also found in larger areas of mallee and heathland in the wheat belt and is uncommon in wet sclerophyll forest (Van Dyck & Strahan, 2008).	May occur	May occur
Phascogale tapoatafa subsp. *wambenger* South-western Brush-tailed Phascogale		+	Vulnerable	CD	In the south-west, the Brush-tailed Phascogale has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees. Records are less common in high rainfall areas (DBCA, 2012).	May occur	May occur
Pseudocheirus occidentalis Western Ringtail Possum	+	+	Critically Endangered	CE	This species is restricted to the south-west corner of Western Australia. Closer to the coast it is closely associated with Peppermint (*Agonis flexuosa*) forest and woodland and Tuart (*Eucalyptus gomphocephala*) with a peppermint mid-story. Further from the coast the species is found in Jarrah (*Eucalyptus marginata*), Wandoo (*Eucalyptus wandoo*) and Marri (*Corymbia calophylla*) forest (Van Dyck & Strahan, 2008).	May occur	May occur
Other							
Ctenotus ora Coastal Plains Skink		+		P3	The Coastal Plains Skink is restricted to the dunes of the Swan Coastal Plain in heath in sandy soil. The species has a preference for sandy substrates with low vegetation with open eucalyptus woodland over *banksia*. It is known to occur as far north as Pinjarra and south as far as Yallingup Brook, where it occupies coastal dunes (Kay & Keogh, 2012).	Unlikely to occur	Unlikely to occur
Falsistrellus mackenziei Western False Pipistrelle		+		P4	Western False Pipistrelles live mainly in wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts. They roost in hollows in old trees, branches and stumps, in colonies of 5 to 30 bats (OEH, 2015).	Unlikely to occur	Unlikely to occur

Species	Source		Commonwealth *EPBC Act*	State *WC Act*	Habitat	Likelihood of Occurrence	Post-Survey Likelihood
	EPBC	DBCA					
Geotria Australia Pouched Lamprey		+		P3	Adults spawn in the headwaters of freshwater rivers and streams. When the larvae hatch, they drift downstream and burrow into soft muddy sediments. After metamorphosis the young adults migrate downstream to estuaries and coastal waters where they feed (Bray & Gomon, 2018).	Unlikely to occur	Unlikely to occur
Idiosoma nigrum Swan Coastal Plain Shield-backed trapdoor spider		+		P3	This species can be found in burrows of heavy clay soils in areas of open York Gum (*Eucalyptus loxophleba*), Salmon Gum (*E. salmonophloia*) and Wandoo *E. wandoo*) woodland, where Acacia acuminata forms a sparse understorey (Avon Catchment Council, 2007).	Unlikely to occur	Unlikely to occur
Westralunio carteri Carter's Freshwater Mussel	+		Vulnerable	VU	This bivalve species is the only mussel species known to inhabit freshwater systems of south-west Western Australia (Klunzinger *et al.*, 2014).	May occur	Unlikely to occur

Appendix C

Potential Black Cockatoo Trees within the Survey Area

Appendix C Potential Black Cockatoo Trees within the Survey Area

Table 22 Potential Black Cockatoo breeding trees within the Survey Area

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
0	Stag	12	86	0	
1	Stag	18	88	0	
2	Stag	18	74	0	
3	Stag	14	106	0	
4	Stag	15	124	1	
5	Stag	8	138	0	
6	Stag	15	102	0	
7	Stag	17	64	0	
8	Marri (*Corymbia calophylla*)	18	66	0	
9	Stag	18	56	0	
10	Marri (*Corymbia calophylla*)	30	83	0	
11	Stag	16	64	0	
12	Stag	16	58	0	
13	Marri (*Corymbia calophylla*)	22	81	0	
14	Stag	5	146	0	
15	Marri (*Corymbia calophylla*)	30	102	0	
16	Marri (*Corymbia calophylla*)	20	55	0	
17	Marri (*Corymbia calophylla*)	35	69	0	
18	Stag	16	85	1	
19	Marri (*Corymbia calophylla*)	20	54	0	
20	Marri (*Corymbia calophylla*)	18	55	0	
21	Marri (*Corymbia calophylla*)	20	53	0	
22	Marri (*Corymbia calophylla*)	20	60	0	
23	Marri (*Corymbia calophylla*)	30	81	0	
24	Marri (*Corymbia calophylla*)	18	53	0	
25	Marri (*Corymbia calophylla*)	20	53	0	

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
26	Marri (*Corymbia calophylla*)	30	101	0	
27	Marri (*Corymbia calophylla*)	18	64	0	
28	Marri (*Corymbia calophylla*)	20	75	0	
29	Marri (*Corymbia calophylla*)	25	71	0	
30	Marri (*Corymbia calophylla*)	25	81	0	
31	Marri (*Corymbia calophylla*)	22	62	0	
32	Marri (*Corymbia calophylla*)	20	57	0	
33	Stag	18	83	1	
34	Marri (*Corymbia calophylla*)	25	73	0	
35	Marri (*Corymbia calophylla*)	22	57	0	
36	Marri (*Corymbia calophylla*)	20	56	0	
37	Marri (*Corymbia calophylla*)	20	60	0	
38	Stag	20	54	0	
39	Marri (*Corymbia calophylla*)	25	97	0	
40	Stag	16	89	0	
41	Stag	8	92	1	
42	Stag	20	98	0	
43	Marri (*Corymbia calophylla*)	25	67	0	
44	Marri (*Corymbia calophylla*)	25	85	0	
45	Stag	8	103	0	
46	Marri (*Corymbia calophylla*)	30	76	0	
47	Stag	12	59	0	
48	Stag	20	96	0	
49	Marri (*Corymbia calophylla*)	20	77	0	
50	Stag	30	190	0	
51	Stag	20	136	0	
52	Stag	20	113	0	
53	Stag	30	105	0	
54	Stag	25	94	0	1 hollow too deep

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
55	Stag	15	97	2	
56	Jarrah (*Eucalyptus marginata*)	30	110	0	
57	Jarrah (*Eucalyptus marginata*)	8	89	0	
58	Stag	20	90	0	
59	Stag	6	81	0	1 hollow too shallow
60	Stag	5	89	0	
61	Jarrah (*Eucalyptus marginata*)	30	152	0	
62	Stag	25	180	2	1 additional hollow looks deep
63	Stag	10	146	0	
64	Stag	25	113	0	Bees, many small hollows
65	Stag	25	94	0	
66	Stag	17	62	0	
67	Stag	18	133	0	
68	Jarrah (*Eucalyptus marginata*)	20	85	0	
69	Stag	30	117	0	Hollow used by Gallahs and bees
70	Stag	20	53	0	
71	Stag	16	55	0	
72	Stag	20	102	0	
73	*Eucalyptus accedens*	8	88	0	
74	Jarrah (*Eucalyptus marginata*)	0	112	0	
75	Jarrah (*Eucalyptus marginata*)	22	128	1	1 hollow, looks deep
76	Jarrah (*Eucalyptus marginata*)	18	104	0	
77	Jarrah (*Eucalyptus marginata*)	20	116	0	
78	Stag	30	113	1	
79	Stag	18	112	0	
80	Stag	20	86	0	
81	Stag	18	73	0	
82	Jarrah (*Eucalyptus marginata*)	20	65	0	
83	Jarrah (*Eucalyptus marginata*)	18	72	0	
84	Stag	14	149	0	
85	Stag	16	111	0	

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
86	Stag	15	124	1	
87	Jarrah (*Eucalyptus marginata*)	20	76	0	
88	Stag	25	83	0	
89	Stag	18	103	0	
90	Stag	18	101	2	
91	Stag	10	113	1	
92	Jarrah (*Eucalyptus marginata*)	12	110	0	
93	Stag	25	103	0	
94	Stag	8	130	0	
95	Stag	17	75	0	
96	Stag	15	125	1	
97	Marri (*Corymbia calophylla*)	18	62	0	
98	Marri (*Corymbia calophylla*)	18	62	0	
99	Stag	5	99	0	
100	Stag	13	52	0	
101	Stag	15	65	0	
102	Stag	12	60	0	
103	Stag	18	62	0	
104	Stag	16	75	0	
105	Stag	12	56	0	
106	Stag	14	68	0	
107	Stag	12	87	0	
108	Stag	16	80	0	
109	Stag	10	76	0	
110	Stag	24	100	0	
111	Stag	24	76	2	
112	Stag	15	67	0	
113	Stag	25	66	1	
114	Marri (*Corymbia calophylla*)	22	54	0	
115	Marri (*Corymbia calophylla*)	25	78	0	
116	Stag	20	85	0	
117	Stag	12	98	1	
118	Stag	10	73	0	
119	Stag	10	169	0	

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
120	Marri (*Corymbia calophylla*)	25	73	0	
121	Marri (*Corymbia calophylla*)	26	90	0	
122	Marri (*Corymbia calophylla*)	24	83	0	
123	Marri (*Corymbia calophylla*)	22	63	0	
124	Stag	14	51	0	
125	Stag	15	54	0	
126	Stag	24	133	0	
127	Stag	15	105	0	
128	Marri (*Corymbia calophylla*)	22	61	0	
129	Marri (*Corymbia calophylla*)	22	171	0	
130	Marri (*Corymbia calophylla*)	24	68	0	
131	Stag	20	160	0	1 hollow used by bees
132	Stag	4	180	0	
133	Stag	18	146	0	
134	Marri (*Corymbia calophylla*)	25	99	0	
135	Marri (*Corymbia calophylla*)	25	73	0	
136	Marri (*Corymbia calophylla*)	20	57	0	
137	Stag	18	81	0	
138	Stag	14	86	0	
139	Stag	15	148	0	
140	Stag	30	222	3	
141	Stag	18	51	0	
142	Marri (*Corymbia calophylla*)	12	59	0	
143	Marri (*Corymbia calophylla*)	20	99	0	
144	Stag	7	60	0	
145	Stag	12	99	0	
146	Stag	30	86	0	Hollow used by bees
147	Stag	20	54	0	
148	Stag	18	66	0	
149	Stag	24	81	0	
150	Stag	6	67	0	

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
151	Stag	15	108	3	
152	Stag	6	121	0	
153	Stag	20	143	0	
154	Stag	24	99	0	
155	Stag	20	85	0	2 hollows. Facing up on very burnt trunk. Can't assess. Unlikely to be suitable for BCs
156	Stag	6	67	0	
157	Stag	8	105	1	
158	Stag	14	57	0	
159	Stag	12	177	0	
160	Jarrah (*Eucalyptus marginata*)	24	61	0	
161	Stag	10	90	0	
162	Stag	14	113	0	
163	Stag	10	60	0	
164	Stag	16	71	0	
165	Stag	12	132	0	3 hollows. Used by bees. Unable to assess. Unlikely to be suitable for BCs.
166	Jarrah (*Eucalyptus marginata*)	12	51	0	
167	Stag	18	96	0	
168	Stag	8	97	0	
169	Stag	18	110	1	
170	Stag	12	59	0	
171	Stag	8	56	0	
172	Stag	8	99	0	
173	Jarrah (*Eucalyptus marginata*)	14	83	0	
174	Stag	14	62	0	
175	Stag	12	50	0	
176	Stag	10	87	3	
177	Jarrah (*Eucalyptus marginata*)	22	71	0	
178	Stag	18	98	0	
179	Stag	3	131	0	
180	Stag	10	108	0	
181	Stag	16	59	0	
182	Stag	8	104	0	

FID	Species	Tree Height	DBH	Suitable Hollows	Hollow Comments
183	Marri (*Corymbia calophylla*)	18	76	0	
184	Stag	14	165	0	
185	Marri (*Corymbia calophylla*)	24	98	0	
186	Stag	8	76	0	
187	Marri (*Corymbia calophylla*)	14	63.5	0	
188	Marri (*Corymbia calophylla*)	14	60	0	
189	Stag	15	105	1	
190	Stag	14	94	0	
191	Marri (*Corymbia calophylla*)	12	63	0	
192	Marri (*Corymbia calophylla*)	18	99	0	
193	Marri (*Corymbia calophylla*)	16	64	0	
194	Stag	16	74	0	
195	Stag	12	68	0	
196	Marri (*Corymbia calophylla*)	25	102	1	
197	Stag	14	62	0	
198	Marri (*Corymbia calophylla*)	0	0	0	unable to access paddock
199	Marri (*Corymbia calophylla*)	0	0	0	unable to access paddock
200	Marri (*Corymbia calophylla*)	0	0	0	unable to access paddock

Appendix D

Black Cockatoo Foraging Habitat

Appendix D Carnaby's Cockatoo Foraging Habitat

Table 23 Carnaby's Cockatoo foraging habitat

Initial score	Is within the Swan Coastal Plain? (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (+2)	Known to be large or key roosting site (+2)	Does not contain evidence of foraging by species (-2)	No other foraging habitat within 6 km (-2)	Is > 12 km from known breeding location (-1)	Is >12km from known roosting site (-1)	Is >2km from watering point (-1)	Disease Present (-1)	Final Score	Comments
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality Cc (hollows)
1	3	0	2	2	0	-2	0	0	0	0	-1	5	Quality Cc (no hollows)
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality CcApAc (hollows)
1	3	3	0	2	0	-2	0	0	0	0	-1	6	Quality EmKgPo (hollows)
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality CcJp (hollows)
1	3	0	2	2	0	-2	0	0	0	0	-1	5	Quality CcJp (no hollows)

Appendix D Forest Red-tailed Black Cockatoo Foraging Habitat

Table 24 Forest Red-tail Black Cockatoo Foraging Habitat

Initial score	Jarrah and/or Marri shows good recruitment (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily Contains Marri / jarrah (+2)	Contains trees with potential to be used for breeding (+2)	Known to be large or key roosting site (+2)	Does not contain evidence of foraging by species (-2)	No other foraging habitat within 6 km (-2)	Is > 12 km from known breeding location (-1)	Is >12km from known roosting site (-1)	Is >2km from watering point (-1)	Disease Present (-1)	Final Score	Comments
1	0	3	2	2	0	-2	0	0	0	0	-1	5	Quality Cc (hollows)
1	0	0	2	2	0	-2	0	0	0	0	-1	2	Low Quality Cc (no hollows)
1	0	3	2	2	0	-2	0	0	0	0	-1	5	Quality CcApAc (hollows)
1	0	3	2	2	0	-2	0	0	0	0	-1	5	Low Quality EmKgPo (hollows)
1	0	3	2	2	0	-2	0	0	0	0	-1	5	Quality CcJp (hollows)
1	0	0	2	2	0	-2	0	0	0	0	-1	2	Low Quality CcJp (no hollows)

Appendix D Baudin's Cockatoo Foraging Habitat

Table 25 Baudin's Cockatoo Foraging Habitat

Initial score	Is within the known foraging area (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (+2)	Known to be large or key roosting site (+2)	Does not contain evidence of foraging by species (-2)	No other foraging habitat within 6 km (-2)	Is > 12 km from known breeding location (-1)	Is >12km from known roosting site (-1)	Is >2km from watering point (-1)	Disease Present (-1)	Final Score	Comments
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality Cc (hollows)
1	3	0	2	2	0	-2	0	0	0	0	-1	5	Quality Cc (no hollows)
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality CcApAc (hollows)
1	3	3	0	2	0	-2	0	0	0	0	-1	6	Quality EmKgPo (hollows)
1	3	3	2	2	0	-2	0	0	0	0	-1	8	High Quality CcJp (hollows)
1	3	0	2	2	0	-2	0	0	0	0	-1	5	Quality CcJp (no hollows)

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