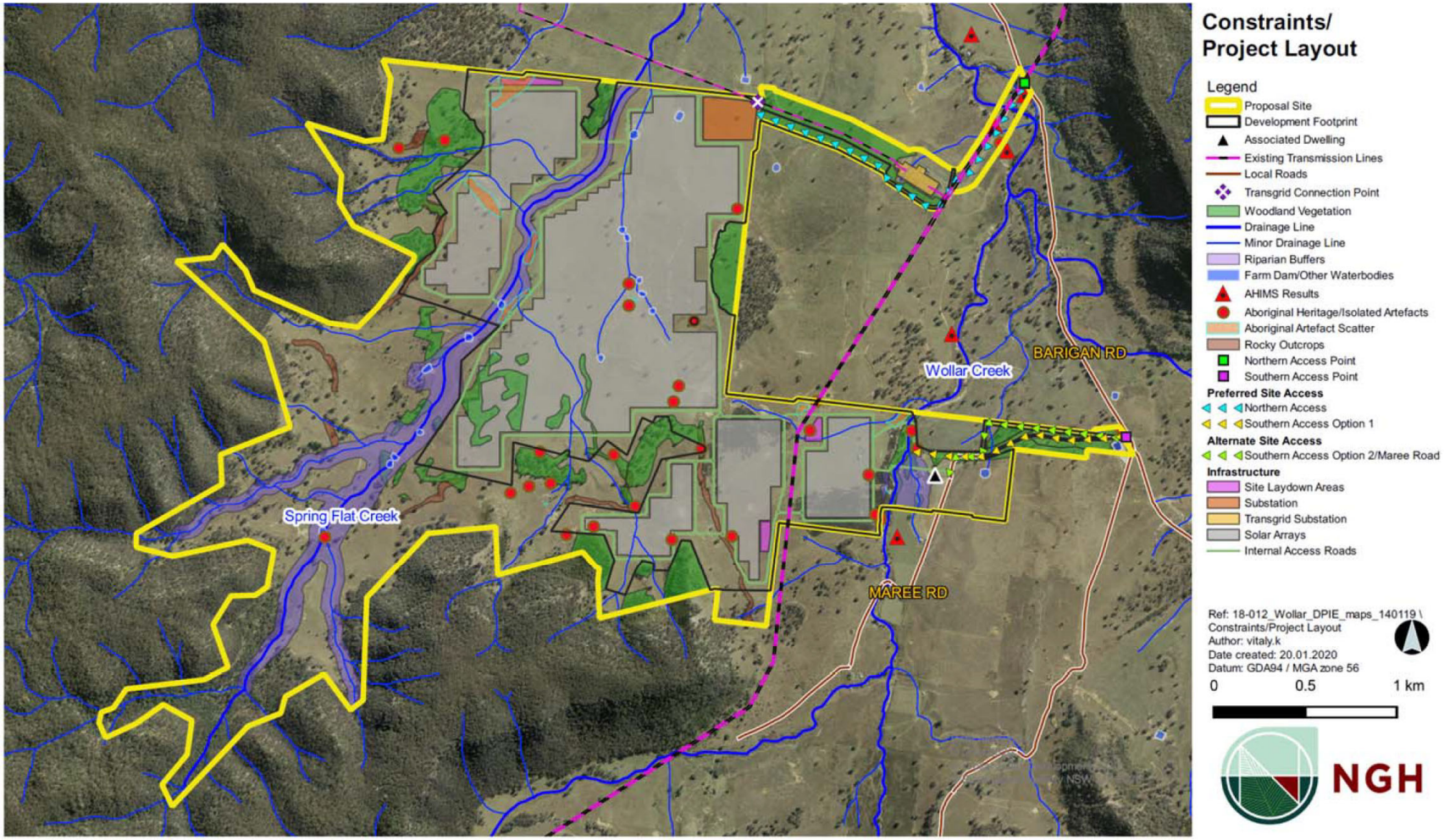
Appendix A **CONSENTED LAYOUT**


Constraints/
Project Layout
Legend
Proposal Site
Development Footprint
Associated Dwelling
Existing Transmission Lines
Local Roads
Transgrid Connection Point
Woodland Vegetation
Drainage Line
Minor Drainage Line
Riparian Buffers
Farm Dam/Other Waterbodies
AHIMS Results
Aboriginal Heritage/Isolated Artefacts
Aboriginal Artefact Scatter
Rocky Outcrops
Northern Access Point
Southern Access Point
Preferred Site Access
Northern Access
Southern Access Option 1
Alternate Site Access
Southern Access Option 2/Maree Road
Infrastructure
Site Laydown Areas
Substation
Transgrid Substation
Solar Arrays
Internal Access Roads
Spring Flat Creek
Wollar Creek
BARIGAN RD
MAREE RD
Ref: 18-012_Wollar_DPIE_maps_140119 \
Constraints/Project Layout
Author: vitaly.k
Date created: 20.01.2020
Datum: GDA94 / MGA zone 56
0
0.5
1 km
NGH

Appendix B **REVIEW OF MODIFICATIONS AGAINST CONSENTED PROJECT**

B.1 NATURE OF THE DEVELOPMENT

TransGrid have advised that there is a need to realign the proposed access road through the TransGrid substation lot. The proposed access road would be shifted to the lot boundary, further away from the existing substation. This would allow additional space for potential future substation expansion.

The onsite substation has approved in the project's EIS but not yet constructed. The site of the onsite substation would be subdivided, and the land would be controlled by TransGrid. This would allow greater flexibility for future management of the onsite substation site

The project is considered 'substantially the same development':

> *…the construction, operation, and decommissioning of the proposed Wollar photovoltaic (PV) solar farm (SF).*
>
> *The objectives of the Wollar SF are to:*
>
> - *Develop a profitable, commercial scale solar electricity generation proposal with on-site capability of energy storage to support the high voltage transmission network.*
> - *Support efforts to mitigate the effect of climate change through the transition to renewable energy.*
> - *Work collaboratively with key stakeholders to ensure all relevant requirements are considered in the location, design, construction and operation of the proposal.*
> - *Provide local and regional employment opportunities and other social benefits during the construction and operation of the facility.*
>
> *The renewable source of energy would:*
>
> - *Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets.*
> - *Provide a clean and renewable energy source to assist in reducing greenhouse gas emissions.*

B.2 DISTRIBUTION OF IMPACTS

The realignment of the access road through the TransGrid lot would excise 1.86 ha from the approved project footprint and adding 2.16 ha to the approved project boundary. This would result in a net change of 0.3 ha.

The additional footprint are would consist of 0.3 ha of White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community (EEC) (PCT).

The subdivision for the onsite substation would not result in any physical impacts. The impacts of the onsite substation were assessed in the project's approved EIS.

B.3 CONSIDERATION OF ENVIRONMENTAL IMPACTS

The proposed access road realignment is outside of the previously assessed project footprint, though within the project boundary. Further assessments in the previously unassessed impact areas have been undertaken.

The following risks were investigated within the EIS (and where relevant, with the Submissions Report and Amendment Report), completed for the approved project. Two of these are considered relevant to the modification and are discussed in detail in this Modification Application.

Table 8-1 EIS impacts

Relevant EIS section	Environmental risk	Relevance to modified layout
7.1	Biodiversity	The realignment of the access road through the TransGrid lot would result in a net additional impact of 0.3 ha of native vegetation. This will affect the consented offset obligation for the project. The proposed subdivision for the onsite substation would not result in any additional physical impacts.
7.2	Aboriginal heritage	The realignment of the access road through the TransGrid lot would result in a net additional impact of 0.3 ha of ground disturbance. Therefore, additional assessment is required in this area. The proposed subdivision for the onsite substation would not result in any additional physical impacts.
7.4	Noise and vibration	The work identified in the modification proposal would involve the same construction process and duration as the approved project. The realigned road would occur at most 100 meters south of the approved road. Given sensitive are all greater than 3 km from the work area, and given the same construction methodology would be used, the proposed modification is expected to have no material additional impacts to noise or vibration. Therefore, no additional mitigation measures are required.
7.3	Visual amenity	The realignment of the access road would result in no material changes to the visual impacts of the approved project. The road would be substantially the same as the approved project; being constructed in the same manner and nearby to the access road identified in the EIS. The proposed subdivision would have no physical impacts. No additional mitigation measures are required.

7.5	Historic heritage	There are no historic heritage sites located in the vicinity of the proposed modification. No change to impacts. No additional mitigation measures are required.
8.1	Traffic, transport and road safety	The proposed modification would have no significant impact on public roads or on traffic types. The increase from 2 to 5 over-dimensional loads represents a very small change in the traffic volumes in the context of the overall project. No changes to approved mitigation strategies are required.
8.2	Soils	The changes to the access road footprint will affect a minor additional area ground disturbance (0.3 ha). The soils that would be affected remain within the same soil landscape unit as the approved project. The impact would occur on relatively flat land. No material change to impacts. No change to approved mitigation strategies.
8.3	Water use and water quality (surface and ground water)	An unnamed tributary of Wollar Creek runs to the North of the Wollar Substation. The proposal modification would realign the access road further south, increasing the distance between the creek and the impact area. No change to impacts. No change to approved mitigation strategies.
8.4	Flooding	The impact areas are not affected by flood. No change to impacts. No change to approved mitigation strategies.
8.5	Land use (including mineral resources)	The relocated access remains within the project boundary and within the TransGrid land tenure. No change to impacts. No change to approved mitigation strategies.
8.6	Resource use and waste generation	No change to impacts. No change to approved mitigation strategies.
8.7	Socio-economic and community	No change to impacts. No change to approved mitigation strategies.
8.8	Climate and air quality	The relocated access will impact a minor additional area of ground disturbance within the same soil landscape unit assessment for the approved project. No noticeable change to impacts. No change to approved mitigation strategies.

8.9	Hazards (including bushfire and EMF)	No impacts.
8.10	Cumulative impacts	The works to construct the relocated access, and traffic during the operational use of the road would be located marginally further from the substation, reducing cumulative impacts in this area. No noticeable change to impacts. No change to approved mitigation strategies.

B.4 CONSIDERATION OF CONSENT CONDITIONS

With reference to the conditions of consent for the project, 25 May 2018, two areas are identified for further consideration.

Table B2. Approval conditions

Consent reference		Can condition be met under the modification
Definitions	The development, as described in the EIS	Is substantially the same.
Definitions	'Development footprint', The area within the project site on which the components of the project will be constructed	Generally, corresponds to mapped 'proposed infrastructure' but this is noted as indicative in the EIS. Development footprint would be updated to allow for the realignment of the access road.
Definitions	'Site', As shown in Appendix 1 and listed in Appendix 2 of the Development Consent	Is located outside the development site, but in close proximity to the approved development site. The same lots would be involved in the development.
Administrative conditions	In meeting the specific environmental performance criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, upgrading or decommissioning of the development.	There is minor additional vegetation removal and soil disturbance that is necessary and can be managed effectively.

Administrative conditions	The Applicant must carry out the development: Generally, in accordance with the EIS; and In accordance with the conditions of this consent. *Note: The general layout of the development is shown in Appendix 1.*	The modified layout is small in comparison to area than stated in the EIS. The areas affected are unlikely to result in material additional impacts.
Schedule 3	The Applicant must ensure that the: (a) development does not generate more than: - 26 AV/B-double vehicle movements a day during construction, upgrading and decommissioning; - 46 medium and/or heavy rigid vehicle movements a day during construction, upgrading and decommissioning; - 2 over-dimensional vehicle movements during construction, upgrading and decommissioning; and - 7 AV/B-Double, medium and/or heavy rigid vehicle movements a day during operations; on the public road network; (b) length of any vehicles (excluding over-dimensional vehicles) used for the development does not exceed 19 metres, unless the Secretary agrees otherwise in writing	The number of over-dimensional vehicle movements during construction, upgrading and decommissioning is increased from 2 to 5.
Schedule 3	All over-dimensional and AV/B-Double vehicles associated with the development must travel to and from the site via: (a) Golden Highway, Ulan Road, Ulan-Wollar Road, Barigan Street, Maitland Street, Wollar Road and Barigan Road; and/or (b) Castlereagh Highway, Ulan Road, Ulan-Wollar Road, Barigan Street, Maitland Street, Wollar Road and Barigan Road; as identified in the figure in Appendix 3.	The proposed modification would not alter site access points, only realign a small section of one access road. No change.
Schedule 3	Biodiversity Vegetation Clearance	This condition needs to be updated based on the footprint of the realigned road.

	The Applicant must not clear any native vegetation or fauna habitat located outside the approved disturbance areas described in the EIS.	
Schedule 3	Biodiversity Retirement of credits Prior to commencing development under this consent, the Applicant must retire biodiversity credits of a number and class specified in Table 1 and Table 2 below, to the satisfaction of BCD, unless the Secretary agrees otherwise in writing. White box grassy woodland in the upper slopes sub-region of the NSW south western slopes bioregion – 469 ecosystem credit.	The condition needs to be updated to account for the ecosystem and species credits associated with the modification application.
Schedule 3	Protection of Heritage Items The Applicant must ensure the development does not cause any direct or indirect impacts on the Aboriginal heritage items identified in Table 1 of Appendix 5 or located outside the approved development footprint. Prior to carrying out any development that could directly or indirectly impact the heritage items identified in Table 2 of Appendix 5, the Applicant must salvage and relocate the item/s that would be impacted to a suitable alternative location, in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010), or its latest version.	The development footprint has expanded but this does not affect impacts materially or the mitigation strategy. One additional Aboriginal heritage item was discovered during the site survey, outside the footprint of either the approved project or the proposed modification. This item would be salvaged as part of the salvage works.
Schedule 3	Soil & water Water pollution The applicant must ensure that the development does not cause any water pollution, as defined under section 120 of the *protection of the environment operations act 1997*.	The modified layout will not impact any waterways. There will be localised soil disturbance during construction and vegetation removal.
Schedule 3	Fire safety study 25. Prior to commencing construction of the battery storage facility, unless the Secretary agrees otherwise in writing, the Applicant must	No implication.

	prepare a Fire Safety Study for the development in consultation with FRNSW and RFS, and to the satisfaction of the Secretary in writing. The study must: (a) be consistent with the: • Department's Hazardous Industry Planning Advisory Paper No. 2 'Fire Safety Study' guideline; and • NSW Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems; and (b) describe the final design of the battery storage facility.	
Schedule 3	29. The Applicant must: (a) minimise the waste generated by the development; (b) classify all waste generated on site in accordance with the EPA's Waste Classification Guidelines 2014 (or its latest version); (c) store and handle all waste on site in accordance with its classification; (d) not receive or dispose of any waste on site; and NSW Government Planning, Industry and Environment 13 (e) remove all waste from the site as soon	No implication.
Schedule 3	Within 18 months of the cessation of operations, unless the Secretary agrees otherwise in writing, the Applicant must rehabilitate the site to the satisfaction of the Secretary in writing. This rehabilitation must comply with the objectives in Table 3.	Additional areas will require management during operation and decommissioning. No implication in terms of ability to meet this condition.

Appendix C **SPECIALIST STUDIES**

C.1 ABORIGINAL CULTURAL HERITAGE ASSESSMENT ADDENDUM

2 July 2020

Bruce Howard
Managing Director
Wollar Solar Development Pty Ltd
PO Box K1053
Haymarket NSW 1240

Bruce.howard@wollarsolarfarm.au

Dear Bruce Howard

Re: 20-179 Wollar Solar Farm Modification Addendum ACHA v2

NGH has prepared this addendum report to detail the results and recommendations of the Aboriginal Cultural Heritage Assessment that has been undertaken for modifications to the detailed design of Wollar Solar Farm (Wollar Solar Farm Modification Addendum ACHA Report). Modifications to the design of the solar farm include the proposed relocation of the main site access route within the Transgrid substation lot as well as the subdivision of the solar farm site to separate the TransGrid assets from the location of this intended access track. As the proposed area for the relocated access route within the Transgrid lot was not assessed during the original ACHA for the solar farm, they have become the subject of this present assessment.

The addendum ACHA report is provided overleaf and should be read in conjunction with the original Wollar Solar Farm ACHA report (NGH 2018) and Wollar Solar Farm Addendum ACHA (2019).

Yours sincerely,

Chelsea Jones and Ali Byrne
Heritage Consultant and Senior Heritage Consultant
0418 117 747 / 0428 747 615
NGH

1. Introduction

NGH was engaged by Wollar Solar Development Pty Ltd (WSD) to complete an Aboriginal Cultural Heritage Assessment (ACHA) to investigate and examine the presence, extent and nature of any Aboriginal heritage sites within the Wollar Solar Farm proposal area as part of an Environmental Impact Assessment (EIS). An ACHA report for the proposal area was prepared and the draft document was sent to the Registered Aboriginal Parties (RAPs) for review and comment before being finalised.

Following the finalisation of the Wollar Solar Farm ACHA (NGH 2018), an area outside the original proposal boundary and extraneous to the Aboriginal cultural heritage assessment was identified for the expansion of the proposed Wollar Solar Farm development footprint in April 2019. This area is referred to in this report as the Eastern Expansion area. The Eastern Expansion area had a development footprint of 2.3 ha which is entirely outside the area assessed during the initial Wollar Solar Farm ACHA. Following investigation of this area, the eastern expansion area has been refined to 0.8 ha.

In August 2019 it was proposed that Barigan Road (an unsealed local road used for accessing the site) would be upgraded due to the increased in heavy vehicles during construction. An alternative access route to the south was also proposed. An additional area was surveyed to cover the areas required for Barigan Road upgrades as well as the alternative access route. An addendum ACHA for Wollar Solar Farm was prepared describing this assessment (NGH 2019).

Most recently the project design has undergone further changes. An amendment to the access route to the solar farm where it traverses the Transgrid substation lot (Figure 1) has been proposed (henceforth referred to as the Proposed Modification). This is outside the area previously assessed and approved for development and as such further assessment was required (Figure 2). Additionally, the area intended for TransGrid to install assets will require subdivision from rest of the solar farm area (though this area was assessed as part of the original assessment). This Proposed Modification will require Aboriginal cultural heritage assessment. No changes to equipment, materials or traffic is anticipated.

It is understood that ground disturbance associated with the new access route and Transgrid lot subdivision has the potential to impact on Aboriginal heritage sites and objects which are protected under the *NSW National Parks and Wildlife Act 1974* (NPW Act).

This addendum report documents the assessment undertaken for the Proposed Modification to investigate the presence of any Aboriginal sites, assess impacts to cultural heritage values, and provide management strategies to mitigate any potential impacts within the additional area. This addendum report is intended to be read in conjunction with the original Wollar Solar Farm ACHA report (NGH 2018) and Wollar Solar Farm Addendum ACHA (2019) as the background analysis, predictive modelling and general discussion detailed therein continues to be relevant to the analysis documented in this addendum and are therefore not repeated.

It is intended that this addendum report will be submitted to the Department of Planning, Industry and Environment in support of a Modification Application (MA) to the existing State Significant Development Consent (#SSD 9254) to ensure the consent provisions may be extended to cover the additional areas and subdivision requirements. Continued Aboriginal consultation, an updated AHIMS search, survey results, coverage and impact assessment are detailed along with recommendations and mitigation strategies to minimise impacts within the Proposed Modification Survey Area (approximately 50m wide).

1.1. Nature of the Proposed Modification

The Proposed Modification to the design of the Wollar Solar Farm Pty Ltd (WSF) includes:

- Relocation of the main site access route, within the TransGrid substation lot.
- Subdivision of land in solar farm site where TransGrid assets will be located

All other solar farm infrastructure proposed remains as described in the Development Consent).

Relocation of the main site access route, within the TransGrid substation lot
TransGrid have advised that they require the project's access road within the Transgrid substation lot to be relocated further away (approximately 60m south) from the existing substation. The relocated access track will

be located toward the southern boundary of the substation lot to ensure sufficient space for future substation expansion by TransGrid,

Subdivision of land in solar farm site where TransGrid assets will be located
In addition to the access modification, a formal subdivision will be required to separate TransGrid assets from the broader solar farm development site. The assets include:

- An onsite 330kV substation containing two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 330kV transmission line onsite.

These areas have been previously assessed by NGH for impacts to Aboriginal cultural heritage as part of the Wollar Solar Farm AHCA and the results of this assessment still apply. The subdivision of the lots for tenure purposes will occur in conjunction with the location of the new access track in the Proposed Modification Survey Area and have been assessed as part of the present assessment.

Proposals classified as State Significant Development or State Significant Infrastructure under the EP&A Act have a different assessment regime. As part of this process, Section 90 harm provisions under the NPW Act are not required, that is, an AHIP is not required to permit impacts to Aboriginal objects. However, the NSW DPIE is required to ensure that Aboriginal heritage is considered in the environmental impact assessment process. The DPIE will consult with internal departments, including BCD (formerly OEH) prior to development consent being approved. The Wollar Solar Farm proposal is a State Significant Development and will therefore be assessed via this pathway, which does not negate the need to carry out an appropriate level of Aboriginal heritage assessment or the need to conduct Aboriginal consultation in line with the requirements outlined by the Aboriginal cultural heritage consultation requirements for proponents 2010 (OEH 2010b). For further information pertaining to the legislative context of this assessment please refer to the Wollar Solar Farm ACHA report.

1.2. Project Personnel

The addendum assessment was undertaken by NGH archaeologists Ali Byrne and Chelsea Jones, including research, Aboriginal community consultation, field survey and report preparation. Shoshanna Grounds of NGH reviewed the report.

Consultation with the Aboriginal community was continuous from the initial project and followed the process outlined in the *Aboriginal cultural heritage consultation requirements for proponents 2010*. A notification of the intended modification was sent to all RAPs on the 26th of March 2020 and resulted in the compilation of this addendum report.

Details regarding the consultation undertaken with reference to this addendum and additional surveys required at the new access rout modification are provided in Appendix A, including a consultation log and records of correspondence. A summary is also provided in Section 2.

This project has ten Aboriginal organisations and one individual recorded as RAPs.

These groups are:

- North West Wiradjuri Company LTD;
- Murong Gialinga Aboriginal & Torres Strait Islander;
- Buudang;
- Wellington Valley Wiradjuri Aboriginal Corporation;
- Gallaggabang Aboriginal Corporation;
- Mudgee LALC;
- Binjang Wellington Wiradjuri Heritage Survey;
- Barraby Cultural Services;
- Yulay Cultural Services; and
- Yurrandaali Cultural Services.

The individual who registered was:

- Paul Brydon

No other party registered their interest, including the entities and individuals recommended by DPIE. The fieldwork for the Proposed Modification Survey Area was arranged with the intention that the four registered parties who participated in the initial survey fieldwork in April 2020 would participate in the fieldwork. Three representatives attended the fieldwork undertaken on Thursday 2 April 2020, as follows:

- Larry Foley (representing Murong Gialinga);
- Melissa Hartwell (representing Wellington Valley Wiradjuri Aboriginal Corporation); and
- James Williams (representing the Mudgee LALC).

The draft Wollar Solar Farm Modification Addendum ACHA was provided to all registered Aboriginal parties on 13 May 2020 for their review and comment. Wellington Valley Wiradjuri Aboriginal Corporation responded on 27 May 2020, indicating that they agreed with the recommendations of the report. No other responses were received.

Documentation of this correspondence is saved in Attachment 1.

1.3. Report format

For the purposes of this addendum, we have prepared the report in line with the following:

- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW;
- Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales; and
- Aboriginal cultural heritage consultation requirements for proponents 2010 (ACHCRP)

The purpose of this addendum ACHA report is to provide an assessment of the Aboriginal cultural values associated with the proposed modification to the Wollar Solar Farm and to assess the cultural and scientific significance of any identified Aboriginal heritage sites within these areas in the context of the larger solar farm assessment. This conforms to the modification letter of intent acceptance provided by the Department of Planning, Industry and Environment on 27/04/2020.

The objectives of the assessment were to:

- Continue Aboriginal consultation as specified in clause 60 (formerly 80c) of the *National Parks and Wildlife Regulation 2009*, using the consultation process outlined in the ACHCRP and in alignment with the DPIE Guideline: *Applying for an Aboriginal Heritage Impact Permit: Guide for Applicants*;
- Undertake an assessment of the archaeological and cultural values of the areas impacted by the modification and any Aboriginal sites therein;
- Assess the cultural and scientific significance of any archaeological material; and
- Provide management recommendations for any objects found.

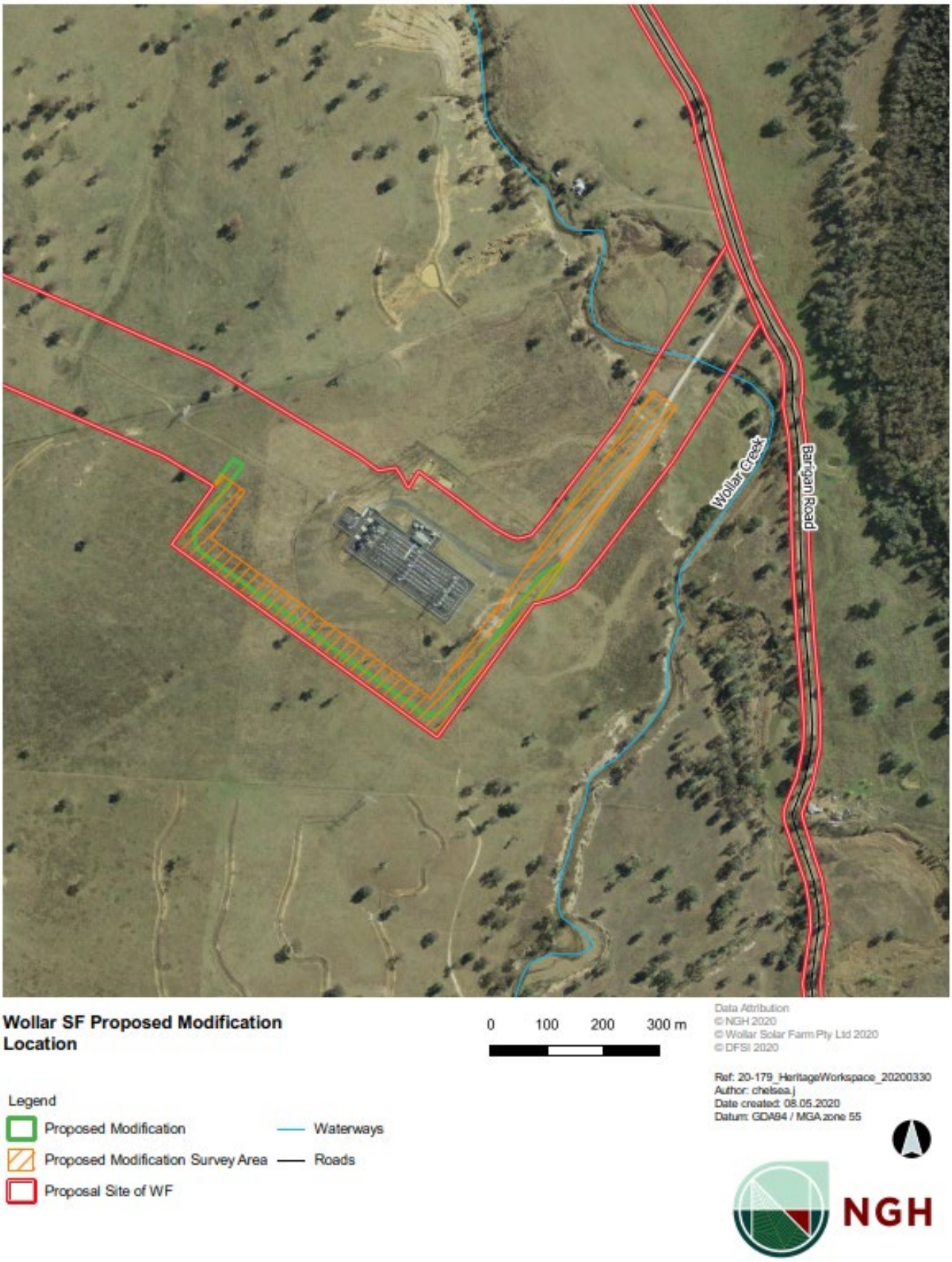


Figure 1 Location of Wollar SF Proposed Modification

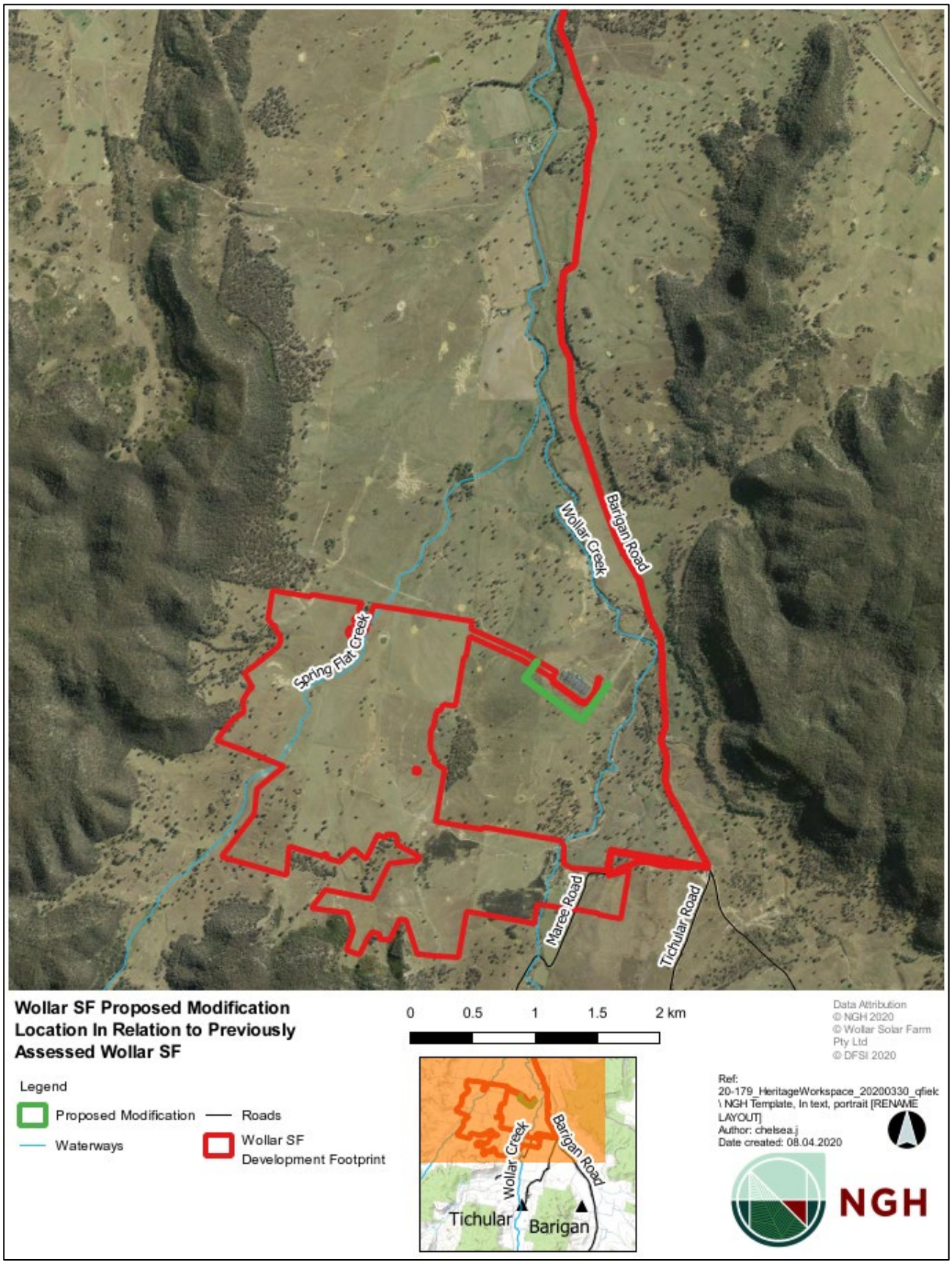


Figure 2 Proposed Modification Location In Relation to Previously Assessed Wollar Solar Farm

2. Review of Aboriginal Archaeological Context

A search of relevant heritage registers for Aboriginal sites and places provides information regarding the presence of previously recorded sites. A register search is not conclusive however, as it requires that an area has been inspected and information about any sites identified provided to the relevant body to add to the register. However, as a starting point, the search will indicate whether any sites are known within or adjacent to the investigation area. The Aboriginal Heritage Information Management System (AHIMS) is maintained by DPIE (formerly OEH) and provides a database of previously recorded Aboriginal heritage sites. A search provides basic information about any sites previously identified within a search area. The results of the search can be considered valid for 12 months.

An extensive search of AHIMS was undertaken for the Wollar Solar Farm ACHA on the 24th of May 2018 which identified a number of previously identified Aboriginal heritage sites. The AHIMS Client Service Number was: 347074. There were 94 Aboriginal sites and no declared Aboriginal Places recorded in the 16 km east-west x 16 km north-south search area which was centred on the proposal area. At the time of the original AHIMS extensive search, two sites with artefacts (Wollar Creek 1/AHIMS #36-3-0335 and Wollar Creek 2/AHIMS #36-3-0336) were located within the Solar Farm proposal area along the proposed access track near the substation. Two additional artefact sites were located in close proximity to the proposal area with AHIMS#36-3-0075 located approximately 30 m south-east of the project area and AHIMS # 36-3-0077 located approximately 90 m east of the project area. In total there was eight recorded open artefact sites within a 2 km buffer of the proposal area. All other sites on AHIMS were over 5 km away from the assessment area. During the field assessment of the Wollar Solar Farm proposal area, as assessed in the original ACHA (NGH 2018), 37 stone artefact sites were recorded within the boundary of the proposed Solar Farm. These archaeological features were recorded as 12 artefact scatters and 25 isolated finds. One grinding groove, one scarred tree, one possible scarred tree and a culturally significant site were also recorded. A site card for each location was submitted to AHIMS for registration with the exception of the possible scarred tree given its ambiguous origin.

Given the approaching expiration of the initial AHIMS search a new search of the database was conducted for the Wollar Solar Farm and the proposed Eastern Expansion Area assessed in this report on the 11th of April 2019. The updated search of the AHIMS database was conducted over an area approximately 7 km east-west x 7 km north-south centred on the proposal area. The recent AHIMS search area was notably smaller than the initial search area. The AHIMS Client Service Number was: 414128. There were 47 Aboriginal sites and no declared Aboriginal Places recorded in the search area. Of the 47 sites 40 of them had been recorded by NGH during the initial survey for the Wollar Solar Farm. The other seven sites had also been identified in the initial search with no other new sites recorded on AHIMS in close proximity to the proposal area beyond those previously noted.

A second additional AHIMS search was completed for the assessment of the proposed Barigan Road upgrade on 21st August 2019, which focussed specifically on the Barigan Road project area; the AHIMS Client Service Number was 443358. This search did not identify any previously unknown or new registered sites within 200 m of the proposed Barigan Road upgrade area. No registered sites have been recorded within the proposed upgrade area, however there are six sites located 200 m or less from the boundary of the upgrade area.

While the initial AHIMS search encompassed the Proposed Modification Survey Area its 2018 search, as this search was undertaken over 12 months previously it is invalid for the purposes of the current project. Therefore, a third AHIMS search was conducted on 30 March 2020 (CS:494348) which focussed on the Proposed Modification Survey Area with a 1km buffer. While no registered sites exist within the proposed new access development footprint, one site is located within the approximate Transgrid area. This sites AHIMS #36-3-0336 as well as AHIMS #36-3-0335 are located almost directly adjacent to the track leading from Barigan Road to the substation and therefore should be considered with regard to possible indirect impacts related to access to the area. The updated AHIMS results in relation to the Proposed Modification Survey Area are shown in Figure 4.

2.1. Previous Archaeological Studies for Wollar Solar Farm

In 2018 NGH undertook the survey for the proposed Wollar Solar Farm, located approximately 7 km south of the town of Wollar in NSW. The ACHA report for the Wollar Solar Farm was undertaken to investigate the presence of any Aboriginal sites and to assess the impacts and management strategies that may mitigate any impact for the proposed development and to address the DPE (now DPIE) issued SEARs relating to Aboriginal heritage for the project which were as follows:

Include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community (SEARs for Wollar Solar Farm 4/05/18).

The Wollar Solar Farm Heritage assessment area was approximately 680 ha and WSD proposed to develop approximately 461 ha. Survey transects were undertaken on foot across the proposal area to achieve maximum coverage. All mature native trees and outcrops within the proposal area were also inspected for evidence of Aboriginal use. Visibility within the proposal site was variable however as a whole the survey of Wollar Solar Farm proposal area had sufficient and effective survey coverage.

During the survey there were a number of stone artefacts found across the proposal site that were recorded as 37 separate site occurrences, including 12 artefact scatters and 25 isolated finds. One grinding groove, one scarred tree, one possible scarred tree and a culturally significant site were also recorded. The sites were identified across a range of landforms including slopes, flats, spurs, hill crests and along creeks/drainage lines. Of the two previously recorded Aboriginal sites within the proposal area, only artefacts from Wollar Creek 2/ AHIMS #36-3-0336 were identified during the ground truthing undertaken as part of the survey. Despite intensive survey around the coordinate location for Wollar Creek 1/AHIMS #36-3-0335 no objects could be identified. Based on the land use history, an appraisal of the landscape, soil, level of disturbance and the results from the field survey, it was concluded that there was negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the proposal area with the exception of the site Wollar SF AFT 11 recorded on the sandy raised western bank of Wollar Creek.

The 2019 Addendum ACHA (NGH 2019) survey included the proposed Eastern Expansion area and the proposed Barigan Road upgrade area. No Aboriginal archaeological sites were located within the proposed Eastern Expansion area for the Wollar Solar Farm the assessment of harm and therefore impact to Aboriginal heritage values for this proposed expansion to the development is nil. Consequently, there are no mitigation methods proposed for the expansion of the Wollar Solar Farm development footprint into the Eastern Expansion area. In the Barigan Road Upgrade Area, a total of nine sites, including four artefact scatters and five isolated finds were identified within the Proposed Barigan Road Upgrade Area. All of these sites will likely be subject to impacts as a result of the proposed upgrade works due to the movement of plant and vehicles within the road reserve and the ground surface disturbance required for the road widening.

The proposed Eastern Expansion of the Wollar Solar Farm development footprint as detailed in the 2019 Addendum ACHA (NGH 2019) has negligible potential to impact Aboriginal objects and was recommended to proceed without any additional archaeological assessment required. Conversely, the Barigan Road Upgrade impacts nine identified Aboriginal archaeological sites. These nine sites were recommended for salvage prior to the commencement of any development works and preparation of a CHMP was recommended to facilitate any further management of any sites identified for the project as well as further archaeological assessment for areas outside the previously assessed areas.

Locations of the sites identified as part of the Eastern Expansion and Barigan Road upgrade assessment as well as currently registered AHIMS sites are shown in Figure 3.

2.2. Archaeological Site Model

Based on the results of the previous archaeological investigations for the Wollar Solar Farm it is possible to provide the following model of site location in relation to the Proposed Modification for the Wollar Solar Farm.

Stone artefact scatters – representing camp sites can occur across the landscape, usually in association with some form of resource or landscape unit such as spur and ridge crests and creek lines. Wollar Creek is less than 300m east of the Proposed Modification and therefore there is moderate to high potential for artefact scatters to be present.

Scarred Trees – these require the presence of mature trees and are likely to be concentrated along major waterways and around swamp areas. There are patches of remnant vegetation across Proposed Modification, therefore, it is possible that this feature could occur.

Isolated Artefacts – are present across the entire landscape, in varying densities. As Aboriginal people traversed the entire landscape for thousands of years, such finds can occur anywhere and indicate the presence of isolated activity, dropped or discarded artefacts from hunting or gathering expeditions or the ephemeral presence of short-term camps.

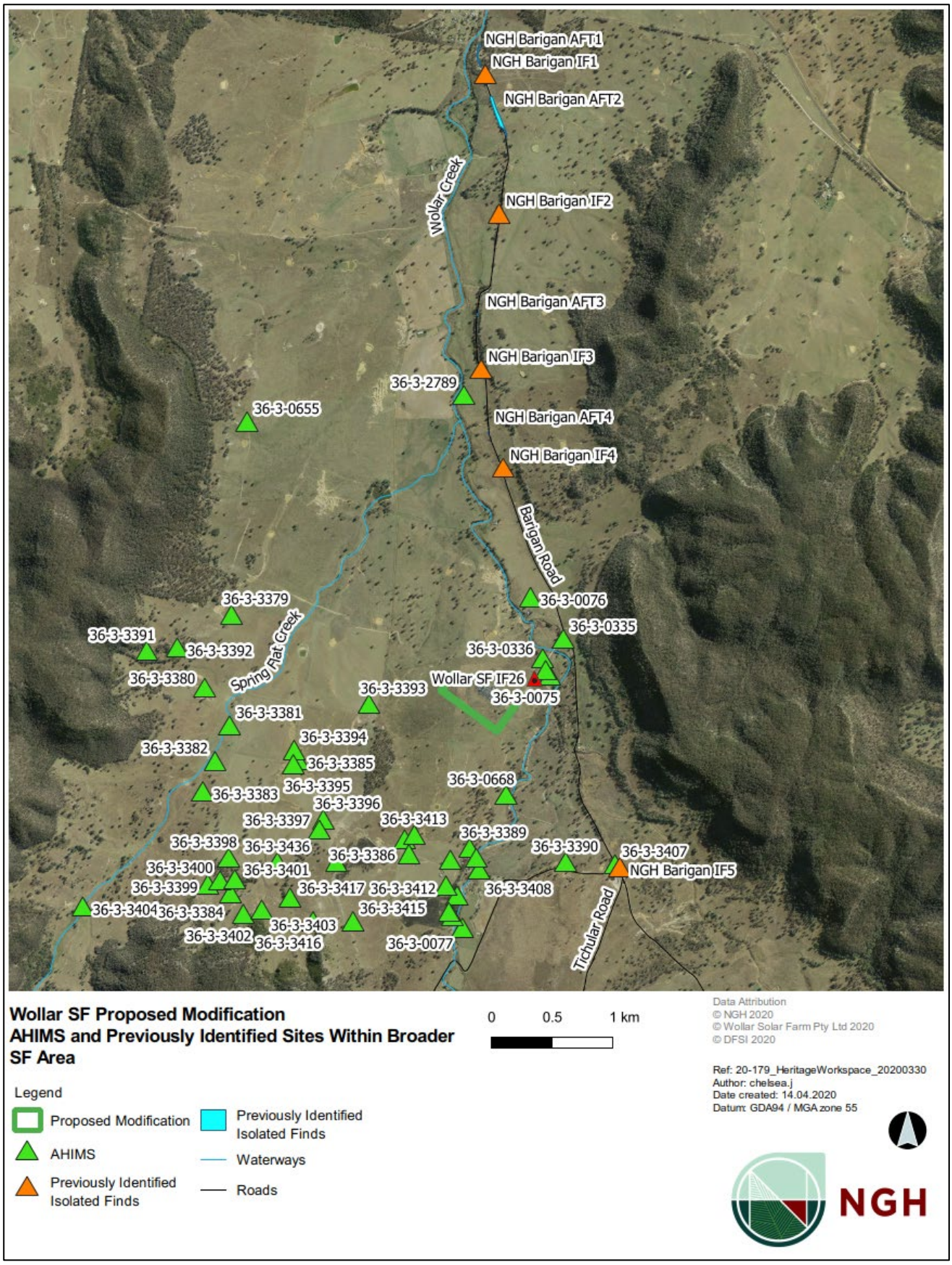


Figure 3 AHIMS and Previously Identified Sites Within Broader Solar Farm Area

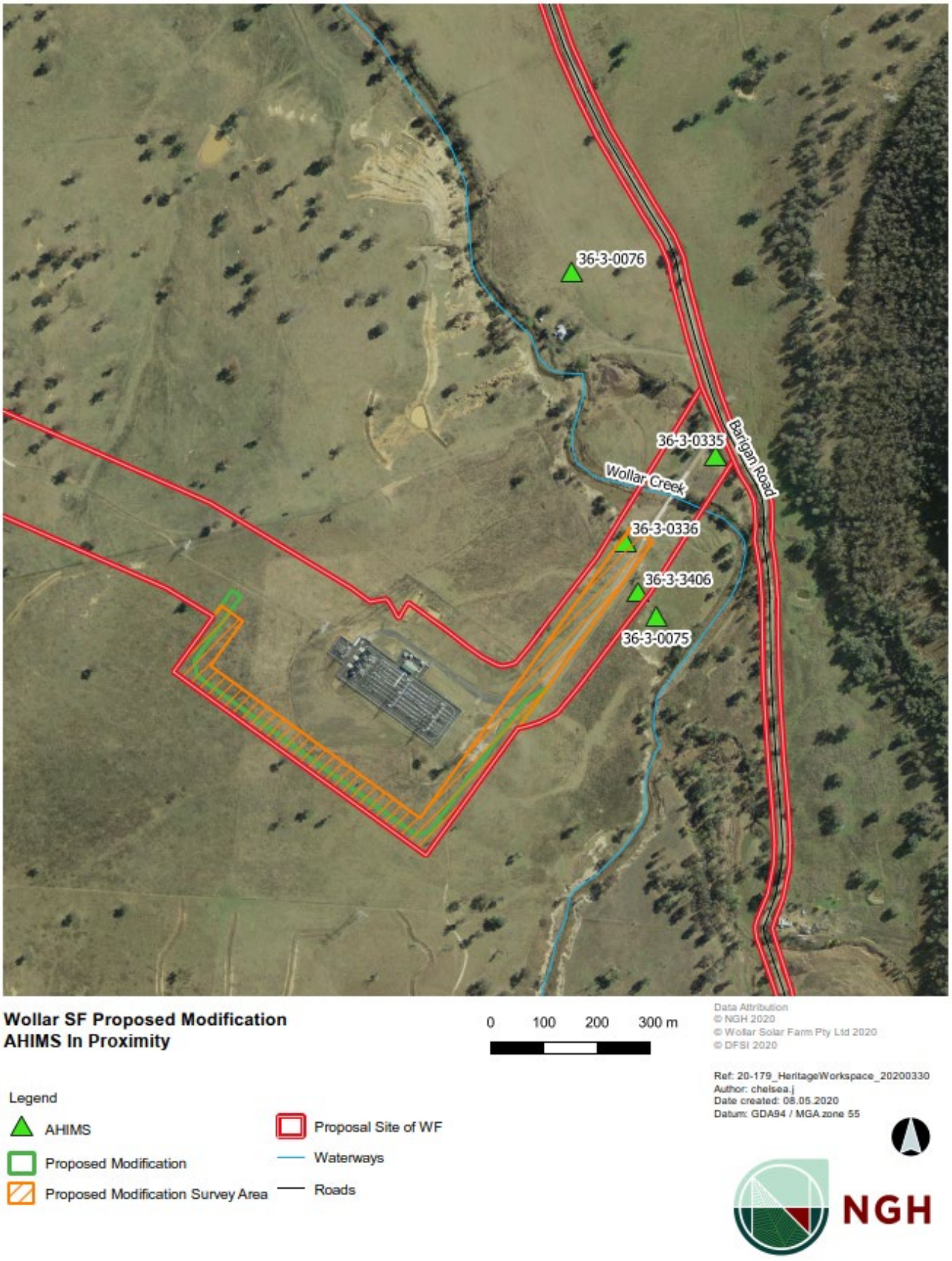


Figure 4 AHIMS In Proximity to Proposed Modification

3. Archaeological Investigation Results

3.1. Survey Strategy

The survey strategy was to cover as much of the ground surface as possible related to the Proposed Modification alignment. Being adjacent to existing substation and encompassing part of the existing track, the actual ground to be impacted by the construction of the Proposed Modification works is considered to be within an area previously disturbed. However, consideration for the nearby registered AHIMS and lack of survey previously within this particular area is necessary to ascertain any potential heritage constraints that may be directly impacted by the alignment of new access route construction or indirectly through works associated and vehicle movement to access said new access route alignment.

The strategy therefore was to walk a transect to cover the Proposed Modification alignment to achieve maximum coverage by the Proposed Modification Survey Area and allow some flexibility for the final access track design in the modification. Because the Proposed Modification Survey Area comprises cleared paddocks previously used for grazing livestock, as well as an existing powerline easement and part of an access track, transects were spaced evenly with the survey team spaced approximately 10 metres apart, walking in parallel lines. The survey team comprised four people, allowing for coverage of most of the 50-metre-wide Proposed Modification Survey Area. There were few large trees present within or near the project area, but where present, these were inspected for cultural modification. No cultural scarring was identified on any trees during the survey.

NGH believes that the survey strategy was comprehensive and the most effective way to identify the presence of Aboriginal heritage sites. Discussions were held in the field between the archaeologist and Aboriginal community representatives to ensure all were satisfied and agreed with the spacing and methodology.

During the original survey undertaken for the Wollar Solar Farm, two landforms were identified which formed the project area:

- Steep hills and sandstone escarpments with cliffs, rock outcrop and long debris slopes; and
- Broad open valleys and floodplain with creeks and drainage lines.

The modification area falls wholly within the ‘Broad open valleys and floodplain with creeks and drainage lines’ landform.

The survey was undertaken on Thursday 2 April 2020. Notes were made about visibility, photos taken, and any possible Aboriginal features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

3.2. Survey Coverage

The modification area comprises a cleared paddock, adjacent to the existing substation and partially within an existing powerline easement. An access track also forms part of the modification area. The landform units are primarily floodplain and low gentle slopes, with the confluence of Barigan and Wollar Creeks approximately 250 metres to the south east of the modification area. The majority of the modification area contained very dense knee-high pasture grasses, with the occasional exposure caused by land modification and water runoff.

The survey transect was undertaken on foot and traversed the proposal area. Visibility within the proposal area was variable however as a whole it generally had poor visibility averaging 5% overall. The effective visibility in the paddocks ranged from 95% in exposures and on the track, to less than 2% in areas with a dense grass cover, which formed most of the modification area. Between the survey participants, over the course of the field survey, approximately 5,800 metres of transects were walked across the proposal area. Soils within the modification area comprised clayey silt, which, where exposed, appeared to be heavily eroded. A number of locations which exhibited significant modification as a result of earthworks for drainage purposes, were observed throughout the modification area.

Table 1 below shows the calculations of effective survey coverage and Figure 5 to Figure 8 show examples of the transects and landform units within the proposal area. Allowing for an effective view width of 5 m for each

person and given the variability in the ground visibility across the proposal site overall the survey effectively examined 17.43% of the proposal area. It is considered that the survey of the modification area had sufficient and effective survey coverage.

The discovery of one Aboriginal site indicates that the survey technique was effective enough to identify the presence of Aboriginal occupation in the area. Therefore, the results identified are considered a true reflection of the nature of the Aboriginal archaeological record present within the proposal area, despite the limited visibility.

Table 1 Survey Coverage

Landform	Number of Survey Transects	Exposure Type	Project area (ha)	Surveyed area (length m *width m)	Survey area (m^2)	Average visibility (%)	Effective coverage (area * visibility) m^2	Project area surveyed (ha)	Percentage of Project area effectively surveyed	Archaeological Result
Broad open valleys and floodplain with creeks and drainage lines	**4**	**Bare ground, gate entrances, fence lines, vehicle tracks, cattle tracks, creek banks, modified drainage lines**	**6.655**	**5800 x 40**	**232,000**	**5%**	**11,600**	**1.16**	**17.43%**	**1 x isolated find 1 x previously recorded AHIMS site**

Figure 5 Low visibility within grassed areas, view west

Figure 6 Exposures with high visibility, view north

3.3. Survey Results

PREVIOUSLY RECORDED SITES IN THE MODIFICATION AREA

One previously registered AHIMS site with artefacts, AHIMS 36-3-0336 Wollar Creek 2, is located alongside the access track near the substation which is outside of the proposed modification area.

AHIMS site # 36-3-0336 referred to as Wollar Creek 2 was recorded in 2005 as an artefact scatter with quartz, volcanic and fine-grained siliceous artefacts eroding out of an expose on the south-western bank of Wollar Creek. During the original surveys undertaken for the Wollar Solar Farm development in 2018, this site was ground truthed and a total of three artefacts were identified eroding out of the south-western bank of Wollar Creek within 20-30 m of the GPS coordinates for the original AHIMS site. The artefacts were located in an exposure on the creek bank between a fence and the substation access track. The artefacts recorded during the current assessment were manufactured from quartz (n=2; 66.7%) and tuff (n=1;33.3%) and typologies included flakes (n=2; 66.7%) and a core (n=1; 33.3%).

During the current survey, these artefacts could not be identified as a result of the dense grasses which have subsequently grown in the location following substantial rainfall. Comparative images below show the current visibility at the site.

Figure 7 Image from 2018 during original survey, view north from within Wollar Creek bed

Figure 8 Image taken during current survey, view north from above Wollar Creek

FIELD SURVEY RESULTS

Despite the variable visibility during the survey, there was one stone artefact identified though this was actually in an area surveyed which was outside of the modification area (Figure 9 - Figure 11). This isolated find comprised a pink/cream coloured silcrete distal fragment, which was located on the northern edge of the access road, 150 metres to the south west of AHIMS 36-3-0336. The artefact was located on top of imported gravels used for the access road, and appeared to have suffered some damage, possibly as a result of vehicle movement.

No other Aboriginal objects were identified during the completion of the survey. No areas of archaeological potential were identified, due to the previous modifications and eroded natures of the soils.

Figure 9 Distal fragment of pink silcrete

Figure 10 Looking north west towards location of isolated find, Wollar SF IF26.

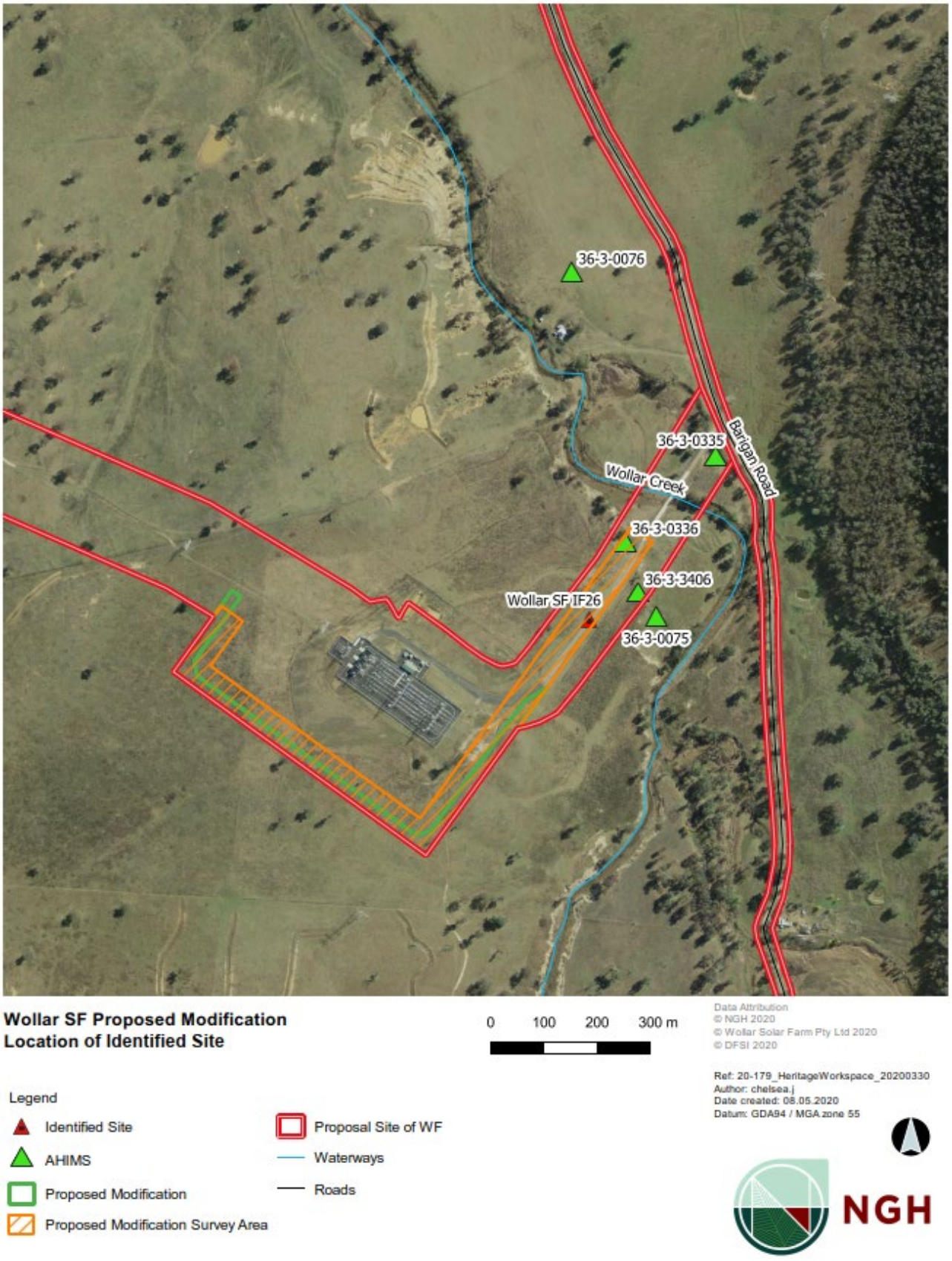


Figure 11 Location of Identified Site - Wollar SF IF26

3.4. Consideration of Subsurface Potential

Extrapolating from the results of this survey it is possible that additional stone artefacts could occur within the proposed development footprint. However, consideration must also be given to the level of disturbance of any such sites. Based on the land use history of the proposal site, and an appraisal of the results from this field survey and the results of the previous assessments undertaken for the Wollar Solar Farm area, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the Proposed Modification Survey Area as assessed in this report.

4. Discussion

The results of previous archaeological surveys in the Wollar region, including the surveys undertaken for the original Wollar Solar Farm project area, show that there are sites and artefacts present across the landscape. The predictions based on the modelling for the proposal site were that stone artefacts were the most likely manifestation of Aboriginal occupation of the area. It was noted that while Aboriginal sites may be expected throughout all landscapes the most archaeologically sensitive areas occur in proximity to water. The survey results for the current assessment are in keeping with the original findings of the Wollar Solar Farm ACHA, with an isolated find identified within 200 metres of Wollar Creek.

Beyond this, it is difficult to draw any meaningful conclusions from the single isolated find recovered from the survey which was outside of the proposed modification area. The silcrete material composition of the artefact recovered is a minority lithological material of those previously identified as part of the Wollar Solar Farm surveys which indicates that this material was not as readily available in comparison to other raw materials within the immediate area. Based on the condition of the area surveyed being highly disturbed, subsurface potential is considered negligible owing to the disturbed nature of the area.

The result of the survey of the Proposed Modification Survey Area does not negate the need for further survey to occur in any other areas of proposed activity for the Wollar Solar Farm that extend beyond the areas assessed in this report, the Eastern Expansion area addendum ACHA and the original Wollar Solar Farm ACHA.

5. Cultural Heritage Values and Statement of Significance

The assessment of the significance of Aboriginal archaeological sites is currently undertaken largely with reference to criteria outlined in the ICOMOS Burra Charter (Marquis-Kyle & Walker 1994). Criteria used for assessment are:

- Social or Cultural Value: In the context of an Aboriginal heritage assessment, this value refers to the significance placed on a site or place by the local Aboriginal community – either in a contemporary or traditional setting.
- Scientific Value: Scientific value is the term employed to describe the potential of a site or place to answer research questions. In making an assessment of Scientific Value issues such as representativeness, rarity and integrity are addressed. All archaeological places possess a degree of scientific value in that they contribute to understanding the distribution of evidence of past activities of people in the landscape. In the case of flaked stone artefact scatters, larger sites or those with more complex assemblages are more likely to be able to address questions about past economy and technology, giving them greater significance than smaller, less complex sites. Sites with stratified and potentially in situ sub-surface deposits, such as those found within rock shelters or depositional open environments, could address questions about the sequence and timing of past Aboriginal activity, and will be more significant than disturbed or deflated sites. Groups or complexes of sites that can be related to each other spatially or through time are generally of higher value than single sites.
- Aesthetic Value: Aesthetic values include those related to sensory perception and are not commonly identified as a principal value contributing to management priorities for Aboriginal archaeological sites, except for art sites.
- Historic Value: Historic value refers to a site or place's ability to contribute information on an important historic event, phase or person.
- Other Values: The Burra Charter makes allowance for the incorporation of other values into an assessment where such values are not covered by those listed above. Such values might include Educational Value.

All sites or places have some degree of value, but of course, some have more than others. In addition, where a site is deemed to be significant, it may be so on different levels or contexts ranging from local to regional to national, or in very rare cases, international. Further, sites may either be assessed individually, or where they occur in association with other sites the value of the complex should be considered.

The assessments below are provided with direct reference to the significance assessment in the original Wollar Solar Farm ACHA and addendum Wollar Solar Farm ACHA (NGH 2018, NGH 2019).

SOCIAL OR CULTURAL VALUE

While the true cultural and social value of Aboriginal sites can only be determined by local Aboriginal people, as a general concept, all sites hold cultural value to the local Aboriginal community. Cultural significance can be determined only by the local Aboriginal community.

With the exception of an isolated find which was recorded during the survey for the Proposed Modification Survey Area, no other Aboriginal objects were identified during the completion of the survey. No areas of archaeological potential were identified, due to the previous modifications and eroded nature of the soils present. No known cultural sites or places of value within or in close proximity to the Proposed Modification have been identified during the consultation process for the project beyond the existing identified artefactual material.

All identified sites within proximity to the Proposed Modification Survey Area hold cultural value to the local Aboriginal community. This includes stone artefacts identified during this survey and those previously registered, which should be collected before any damage or development occurs. Furthermore, placement of collected artefacts in a location which will be safe in the long term was noted as an important aspect of the impact mitigation process.

SCIENTIFIC (ARCHAEOLOGICAL) VALUE

The research potential pf the site identified within the Proposed Modification Survey Area is considered to be low., in the context of sites identified during the Wollar Solar Farm ACHA. While the presence of the sites can be used to assist in the development of site modelling for the local landscape, their scientific value for further research is limited.

While the artefact identified is intrinsically valuable for its base technical information and expansion of data sets, its lack of temporal context and the absence of information about local resources makes further conclusions about land and resource use difficult. Scientific value for further research is also low due there being only a single artefact as well as the disturbed nature of the landscape and the subsequent movement of objects as a result of the construction and maintenance of the road.

AESTHETIC VALUE

There are no intrinsic aesthetic values associated with the archaeological sites recorded within the Proposed Modification Survey Area, apart from the possible aesthetic value associated with the setting of Wollar Creek. However, this has been altered as a result of the construction and maintenance of Barigan Road and the track leading toward the substation which detracts significantly from this aesthetic setting.

HISTORIC VALUE

No historical values are associated with the archaeological sites identified within the Proposed Modification Survey Area.

OTHER VALUES

There are no other known heritage values associated with the Proposed Modification Survey Area.

6. Proposed Activity

The Proposed Modification will include:

- Relocation of the main site access route, within the TransGrid substation lot.
- Subdivision of the solar farm site to separate it from TransGrid assets at the point of the Proposed Modification Survey Area.

These works will include ground disturbance as well as the movement of vehicles and plant along the road during the construction works.

7. Assessment of Harm

A single isolated find was identified outside the Proposed Modification Area, however this was located along the access track leading to the proposed works (within the Proposed Modification Survey Area and within the overall wind farm footprint). This site will likely be subjected to impacts as a result of the proposed upgrade works due to the movement of plant and vehicles within the road reserve and the ground surface disturbance required for the road widening. Table 2 provides a summary of the impacts.

Table 2 Assessment of Harm - Proposed Modiifcation Impacts on Heritage Sites

AHIMS ID	Site Name	Type of Harm	Degree of Harm	Consequence of Harm
TBC	**Wollar Solar Farm IF26**	**Indirect**	**Complete**	**Total loss of value**

Although, outside the Proposed Modification Survey Area the impacts are considered to the Aboriginal object as the movement of plant and vehicles and ground surface disturbance for the widening of roads may result in the removal, breakage or displacement of the artefacts. While the assessment of harm for the Proposed Modification Survey Area is high as a standalone project, in context of the original Wollar Solar Farm ACHA, the assessment of harm overall is assessed to be moderate (refer to NGH 2018:53).

8. Impacts To Values

The values which will be impacted by the proposed modification are any social and cultural values attributed to the artefacts by the local Aboriginal community. The extent to which the loss of the sites would impact on the community is only something that can be assessed by the local Aboriginal community.

The impact to scientific values for this proposal is summarised in Table 3. The identified stone artefact site was recorded outside the Proposed Modification area but within the existing access track corridor and therefore will be indirectly impacted. The access track which is already in use for the substation, will be used for the development and modification, and is therefore at risk of impact from all relevant works and must be collected. This collection may be undertaken as part of the broader solar collection works. Furthermore, it is argued that there is likely to be a large number of similar site types, with greater intactness and integrity, present within the local area and therefore the impact to the overall archaeological record is assessed to be low. The stone artefacts have little research value apart from what has already been gained from the information obtained during the present assessment. This information relates more to the presence of the artefacts in relation to building more comprehensive Aboriginal site modelling for this area and the broader region, which has largely now been realised by the recording of multiple sites related to this project.

Table 3 Impacts to Values Assessment Table

AHIMS ID	Site Name	Site Integrity	Scientific Significance	Recommendation
TBC	**Wollar Solar Farm IF26**	**Poor – modified landform as a result of road construction and maintenance**	**Low**	**Salvage objects prior to commencement of proposed road upgrade works**

9. Avoiding or Mitigating Harm

9.1. Consideration of ESD Principles

Consideration of the principles of Ecologically Sustainable (ESD) and the use of the precautionary principle was undertaken when assessing the harm to sites and potential for mitigating impacts to the sites recorded within the Proposed Modification Survey Area as part of the wider Wollar Solar Farm proposal area. The main consideration was the cumulative effect of the proposed impact to the sites and the wider archaeological record. The precautionary principle in relation to Aboriginal heritage implies that development proposals should be carefully evaluated to identify potential impacts and assess the risk of potential consequences.

In broad terms, the archaeological material located during this investigation is similar to what has been found previously within the Wollar region. Currently there is no clear regional synthesis of the nature, number, extent and content for archaeological sites within the Mid-Western Regional LGA. Nevertheless, given the size of the geographical area, it is certain that there would be similar artefacts present within the region. The result of this addendum to the Wollar Solar Farm ACHA has confirmed the proposed model of site location and site distribution, where sites could be expected to occur across the landscape and in particular in proximity to a water source, even in disturbed areas.

The implications for ESD principles are that in fact more sites are likely to be present in the region than previously thought, which reduces the individual value of the particular sites within/nearby the proposed upgrade area, particularly with reference to the condition in which the isolated find nearby the Proposed Modification Survey Area had been found. Better representations of artefact sites are likely to be present elsewhere within the local area. It must be recognised that large parts of the region have been heavily cleared, mined, farmed, and developed through the construction and maintenance of roads and residential structures and therefore other sites are likely to also have been disturbed. However, it is also likely that more intact sites are present. The conclusion that similar sites exist reduces the representative values of the sites within the proposed upgrade area.

It should be noted that the isolated find identified along the access route towards the east of the Proposed Modification Survey Area will likely be subject to impacts as a result of the upgrade, within the wider Wollar Solar Farm development, there are a number of sites around which the design of the proposal has been amended to ensure that impacts do not occur. While the proposed modification does not directly impact this site, use of the track to access the Proposed Modification Area will indirectly harm the site Therefore, this artefact should be included in the CHMP for the development and collected as part of those works.

The archaeological value of the sites within the upgrade area has been assessed to be low and therefore the proposed impacts to the sites would not adversely affect the archaeological record for the local area or region significantly. The principle of intergenerational equity requires the present generation to ensure that the sites and diversity of the archaeological record is maintained or enhanced for the benefit of future generations. This assessment concludes that the diversity of the archaeological record will not be compromised by the proposed upgrade of the road. The overall cumulative impact on the archaeological record for the region is likely to be minimal, assuming a density of artefact sites remain across the wider region.

9.2. Consideration of Harm

Due to the location of the existing access route to the substation, avoidance of impacts to the site located during this assessment is unfeasible, not to mention that this area is already developed. This site is located wholly within the access track and therefore has likely been disturbed as a result of construction and maintenance of the road previously. In situations such as these mitigation can take the form of minimising harm, through direct management measures applied to Aboriginal archaeological sites. Detailed recording of this site can contribute to measures to mitigate harm. Avoidance of this site as a mitigation measure is not feasible in this instance, however surface collection salvage would be considered by the Registered Aboriginal Parties on site as an appropriate mitigation measure.

As there are four registered AHIMS sites within proximity to the Proposed Modification Survey Area, temporary high visibility fencing along the shoulders of the road corridor is recommended to be erected to ensure the protection of the sites during the development works and to mitigate further disturbance outside the Proposed Modification Survey Area and existing access corridor..

Owing to the negligible subsurface potential no further mitigation would be required. Salvage in the form of surface collection should be undertaken by a qualified archaeologist and with representatives from the registered Aboriginal parties prior to the commencement of any proposed upgrade works. The artefacts should be collected and moved to a safe area within the Wollar Solar Farm project area that will not be subject to any ground disturbance in the long term as per the recommendations for the artefact sites identified in the original Wollar Solar Farm ACHA (NGH 2018). It is noted that during the completion of the original assessment, the registered Aboriginal parties had requested the opportunity to perform a smoking ceremony to cleanse the salvaged artefacts and the reburial location.

10.Conclusions and Recommendations

The Proposed Modification area, as detailed in this addendum report, will indirectly impact any one isolated find was found outside of the Proposed Modification area nearby the access track to the modification area and will therefore be indirectly harmed and provisions for its collection must be included in the broader CHMP for the solar farm. To effectively mitigate harm to this site and prevent harm to the other four sites registered in the vicinity, during the works intended for the Proposed Modification Survey Area and the broader Wollar Solar Farm development, Wollar Solar Development Pty Ltd should adhere to the recommendations below. The recommendations are based on the following information and considerations:

- Results of the archaeological survey;
- Consideration of results from the original Wollar Solar Farm survey and Eastern Expansion Area survey;
- Results of consultation with the registered Aboriginal parties;
- Appraisal of the proposed development, and
- Legislative context for the development proposal.

It is recommended that:

1. The artefact identified at Wollar Solar Farm IF26 must be salvaged prior to the proposed work commencing and moved to a safe area within the Wollar Solar Farm development footprint, along with the artefacts referenced in Recommendation 4 of the Wollar Solar Farm ACHA and Recommendation 4 of the Wollar Solar Farm ACHA addendum (NGH 2018, NGH 2019).
2. The surface collection and relocation of the artefacts must be undertaken by a suitably qualified archaeologist and representatives of the registered Aboriginal parties. The salvage should be consistent with Requirement 26 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. A new site card must be completed once the artefacts are moved to record their new location on the AHIMS database.
3. As there are four registered AHIMS sites within proximity to the Proposed Modification temporary high visibility fencing along the shoulders of the road corridor is recommended to be erected to ensure the protection of the sites during the development works and to mitigate further disturbance outside the Proposed Modification Survey Area and existing access corridor.

4. With reference to the Wollar Solar Farm ACHA (NGH 2018) the Aboriginal community requests that a Cultural Smoking Ceremony be accommodated to cleanse the salvaged artefacts and the reburial location.
5. WSD should prepare a Cultural Heritage Management Plan (CHMP) which includes an unexpected finds procedure to encompass the management required as per the recommendations of this present report, the original Wollar Solar Farm ACHA report (NGH 2018) and Wollar Solar Farm Addendum ACHA (2019). Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties and be incorporated into the overall management plan for the solar farm.
6. In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.
7. Further archaeological assessment would be required if the proposal activity extends beyond the Proposed Modification Survey Area as documented in this addendum report and the Heritage study area as detailed in the original Wollar Solar Farm ACHA and Wollar Solar Farm addendum ACHA (NGH 2018, NGH 2019). This would include consultation with the registered Aboriginal parties and may include further field survey.

11. References

NGH Environmental (2018), *Wollar Solar Farm Aboriginal Cultural Heritage Assessment Report*, report prepared for Wollar Solar Development Pty Ltd.

NGH (2019), *Addendum Aboriginal Cultural Heritage Assessment Eastern Expansion Area and Barigan Road Upgrade Wollar Solar Farm*, report prepared for Wollar Solar Development Pty Ltd.

OEH 2010a, *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.*

OEH 2010b, *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*

OEH 2011, *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW.*

Attachment 1 – Consultation Documentation

From: WVWAC Contact Officer
To: Ali Byrne
Cc: Chelsea Jones
Subject: RE: 20-179 Notification of Wollar Solar Farm Modification
Date: Wednesday, 27 May 2020 11:01:54 AM
Attachments: B6864B4A9B0645AF95761FA8E32176DB.png

Hi Ali,

Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) would like to thank you for your invitation to provide a response for This Aboriginal Cultural Heritage issue relevant to obligations to protect our Heritage within our Traditional Lands. Wellington Valley Wiradjuri represent the fourteen traditional families with identified apical ancestry pre European occupation with our known Traditional Lands. We know our culture, country and continue with our association with our traditional lands (Ngurangbang).

WVWAC object to any other non-traditional aboriginal organizations or people taking part in site surveys, consultation and assessments within our defined Traditional Lands. These non-traditional people and groups are outsiders under Traditional Lore and have no right to advise on or to be present during consultation or site visits as they do not possess the specific traditional knowledge in relation to these lands or sites. These participants may be indigenous and may live locally within the region however, this still does not give them the right to disregard Traditional Lore and values.

Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) have through consultation with other Traditional Elders and Community with cultural knowledge have the following comments and or recommendations:

- WVWAC agree to the recommendations made as per the 20-179 Wollar Solar Farm Modification Addendum ACHAR.

WVWAC look forward to further participating in the above project, sharing our knowledge of county and to ensure our Heritage is protected. We trust our response meets your requirements. Please contact WVWAC Directors should you require our assistance to address any Aboriginal issues to support your future plans.

Regards,

Bradley R. Bliss J.P.
WVWAC CEO and Contact Officer
Gallanggabang Aboriginal Corporation Director
Senior Aboriginal Cultural Heritage Field Officer
Senior Aboriginal Cultural Mentor and Educator
Mobile: 0427321016

From: Ali Byrne
Sent: Wednesday, 13 May 2020 10:23 PM
To: Ali Byrne
Cc: Chelsea Jones
Subject: 20-179 Notification of Wollar Solar Farm Modification

Good evening,

Further to the below, please find attached the addendum report pertaining to this modification.

Please provide your comments no later than Thursday 11 June 2020. If you have any questions, please do not hesitate to contact us.

Kind regards,
Ali

ALEXANDRA BYRNE
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Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

C.2 BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT UPDATE

Wollar Solar

Biodiversity Development Assessment Report

WOLLAR SOLAR FARM

MAY 2020

ngh environmental

Document Verification

Project Title: Wollar Solar Farm

Project Number: 18-012

Project File Name: 20-179 Wollar SF v3

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Final v1.1	13/12/18	Gillian Young (Accredited BAM Assessor), Zoe Quaas, Mitch Palmer (Accredited BAM Assessor), Deb Frazer.	Dave Maynard (preliminary draft) (Accredited BAM Assessor) Brooke Marshall (Accredited BAM Assessor)	Brooke Marshall
Final v1.2	14/02/19	Brooke Marshall (Accredited BAM Assessor)	Minor changes	Brooke Marshall
Final v1.3	15/03/19	Gillian Young (Accredited BAM Assessor)	Minor changes	Brooke Marshall
Final v1.4	04/06/19	Mitch Palmer (Accredited BAM Assessor)	Brooke Marshall	Brooke Marshall
Final v2	11/10/19	Michelle Patrick Gillian Young (Accredited BAM Assessor)	Brooke Marshall (Accredited BAM Assessor) Dave Maynard (adjustment of impact areas in calculator) (Accredited BAM Assessor)	Brooke Marshall (Accredited BAM Assessor)
Final v2	18/10/19	Gillian Young (Accredited BAM Assessor)	Minor changes	Brooke Marshall
Final v3	20/05/20	Gillian Young (Accredited BAM Assessor)	Brooke Marshall (Accredited BAM Assessor)	Brooke Marshall (Accredited BAM Assessor)

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spring hill qld 4000 (t 07 3129 7633)

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

BAM	Biodiversity Assessment Methodology
BC Act	Biodiversity Conservation Act 2016 (NSW)
BCD	Biodiversity Conservation Division, formerly OEH (NSW)
BDAR	Biodiversity Development Assessment Report
BGW	Box Gum Woodland
BOM	Australian Bureau of Meteorology
BOAMS	Biodiversity Offsets and Agreement Management System
CEEC	Critically Endangered Ecological Community (CW listing)
DBH	Diameter at Breast Height
DNG	Derived Native Grassland
DPE	(NSW) Department of Planning and Environment
EEC	Endangered Ecological Community (NSW listing)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FM Act	*Fisheries Management Act 1994* (NSW)
GHG	Greenhouse Gases
ha	hectares
HBT	Hollow-bearing Tree
km	kilometres
LRET	Large-scale renewable energy target
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (*c.f.*)
NSW	New South Wales
REAP	Regional Environmental Action Plan (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water, now BCD
PV	Photovoltaic
SSD	State Significant Development
SEARS	Secretary's Environmental Assessment Requirements
SAII	Serious and Irreversible Impact
SEPP	State Environmental Planning Policy (NSW)
sp/spp	Species/multiple species
TEC	Threatened Ecological Community (can refer to either CW or NSW listing)

EXECUTIVE SUMMARY

The proposed Wollar Solar Farm is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP). This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the proposed Wollar Solar Farm (the proposal) according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) and supplementary SEARs issued for the proposal. NGH Environmental has prepared this report on behalf of the proponent, Wollar Solar Development Pty Ltd.

The proposed Wollar Solar Farm involves the construction, operation and decommissioning of a ground-mounted PV solar array. The subject land is approximately 878 ha and would consist of associated infrastructure occupying around half the area. Approximately 290MW (AC) of renewable energy would be generated and supplied directly to the national electricity grid.

Consideration has been given to avoid and minimise impacts to native vegetation where possible. Site design options have been assessed against key environmental, social and economic criteria. Identifying the final development footprint (463 ha) has been iterative, informed by site surveys and specialist assessments. Mitigation and management measures will be put in place to adequately address direct and indirect impacts associated with the proposal.

Biodiversity impacts have been assessed through comprehensive survey, mapping and assessment completed in accordance with the BAM. Regarding onsite surveys, three targeted survey programs were undertaken to address candidate species. The three candidate species confirmed on site were:

- Large-eared Pied Bat (*Chalinolobolus dwyeri*),
- Large Bentwinged-bat (*Miniopterus orianae oceanensis*) and
- Eastern Cave Bat (*Vespadelus troughtoni*).

Although detected onsite, it was concluded after extensive inspection of rocky scarp habitat that no specialised breeding/roosting/refuge habitat was present inside the development footprint, as such no species credits would be generated for these species.

The Version 2 BDAR provided an updated assessment for site access and road upgrades. This included BAM assessment of native vegetation fringing the Barigan Road, where it is proposed that widening will be required for providing access for large construction machinery to the site. There are two access points to the Wollar Solar farm site from Barigan Road. This can either be through the northern access track around the existing Transgrid substation or further south, where Barigan Rd intersects with Maree Road and provides an alternative southern access for construction (option 2).

This Version 3 BDAR replaces the previous version 2 BDAR. Updates include;

- Relocation of the main site access outside of the previously assessed development site, resulting in a slight increase (0.32ha) of native vegetation impact. This change has triggered the need for a Modification Application, which this BDAR supports.
- Clarification of the offset obligation for the four stages of construction. Stage 1 (road upgrades) will proceed in advance of Stages 2 and 3 (site access and solar farm development). Stage 4 (an alternative southern access, referred to above) may never be constructed.
- Recalculation of species credit polygons along Barigan Road (stages 1 & 4), to more accurately reflect trees that would be removed versus trees that would be retained but indirectly impacted, deleting overlaps that previously overestimated credits.

All areas and credits in Version 3 now reflect these changes.

The new development footprint is now 463 ha. Of this area, 367 ha comprises native vegetation requiring BAM assessment with impacts to:

- 24.92 ha of structural woodland and forest
- 343.24 ha of derived grasslands and cultivated low condition areas
- 5 paddock trees (assessed under BAM).

It is noted that:

- 343.24 ha of vegetation meets the NSW criteria for Endangered Ecological Communities, most (92%) in degraded condition that does not generate offsets.
- 229.9ha of vegetation that meets the Commonwealth criteria for Critically Endangered Ecological Communities, most (89%) in degraded condition.

The impact areas above include sixty-four hollow-bearing trees (HBTs) that would need to be removed inside the Wollar property and the new Barigan Road access route.

Most of the development footprint (55%) will be used to mount solar panels above the ground. The impacts of shading and diversion of rainfall runoff from the panels themselves on groundcover beneath them is largely unknown. For the purpose of this BDAR report, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial peripheral areas are likely to be unimpacted and it is likely that several perennial native species will persist underneath the solar arrays. Certainly, only a minor proportion of the seed bank will be impacted, given the limited excavation proposed. This is therefore a 'worst case' conservative approach. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact such as the results of ground cover monitoring beneath the solar array.

As such, the NSW credit requirement for the 'worst case' impact has been generated as:

- 723 ecosystem credits (5 of these credits generated by paddock tree removal)
- 350 species credits

All species credits are generated by 'assumed presence' of timbered habitat inside the new expanded footprint and also some of the development site for possible disturbances to hollow bearing trees within the Barigan road reserve required for access upgrades, not by targeted surveys. In the absence of targeted surveys in this area, presence has been assumed for and credits generated for:

- Austfeld's Wattle
- Bush Stone-curlew
- Gang-gang Cockatoo
- Large-eared Pied Bat
- *Commersonia procumbens*
- Large-leafed Monotaxis
- Barking Owl
- Powerful Owl
- Squirrel Glider
- Brush-tailed Phascogale
- Koala
- Masked Owl

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme (BOS).

The project is subject to a Commonwealth 'streamlined assessment[1]', to capture MNES, as well as NSW matters. Regarding MNES, potential impacts on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community are considered likely to be significant and warrant offsets. No other Commonwealth entity was assessed to have potential for a significant impact by the project.

A Wollar Solar Farm offset strategy will be developed to satisfy Commonwealth requirements. At this time, offset investigations are outlined to demonstrate that:

- Securing in perpetuity physical offsets within the subject land are likely to be feasible.
- Similar vegetation occurs in the locality and could also be considered, if required, for physical offsets.

Payment options may also be considered, such as making payments into the NSW Biodiversity Conservation Fund using the offset payments calculator or funding a biodiversity action.

[1] This is not related to the NSW Biodiversity Offset Scheme streamlined assessment, rather it represents concurrent Commonwealth and state assessment of all relevant MNES.

1 INTRODUCTION

The proposed Wollar Solar Farm is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP). This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the proposed Wollar Solar Farm (the proposal) according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal. NGH Environmental has prepared this report on behalf of the proponent, Wollar Solar Development Pty Ltd.

The following terms are used in this document, as required for a BDAR:

Subject land – all lots that would be impacted by the proposal.

Development site – The broader area of land that may be affected by the proposal and to which the BAM is applied. For the purposes of conducting this BDAR, the development site extends 200m out from the development footprint where legal access to land could be obtained. This is mapped on Figure 1-1.

Development footprint – The area of land that is directly impacted on by the proposal. Including, solar array design, perimeter fence, access roads, transmission line footprint and temporary areas used to store construction materials etc. This is mapped on Figure 1-2.

Buffer area – Land extending 1500m out from the development site used to assess native vegetation extent and other landscape features. This is mapped on Figure 3-1.

1.1 THE PROPOSAL

The proposed Wollar Solar Farm involves the construction, operation and decommissioning of a ground-mounted PV solar array. The subject land is approximately 900 ha and would consist of associated infrastructure occupying around half the area (463 ha). Approximately 290MW (AC) of renewable energy would be generated and supplied directly to the national electricity grid. This would provide enough clean, renewable energy for about 104,926 average NSW homes while displacing approximately 515,564 metric tons of carbon dioxide annually.

Key development and infrastructure components would include:

- Approximately 922,432 PV solar panels mounted on either fixed or tracking systems, both of which are considered feasible:
  - Fixed-tilted structures in a north orientation at an angle of 32 degrees or
  - East-west horizontal tracking systems.
- Approximately 58 PCU composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33kV AC energy.
- Steel mounting frames with driven or screwed pile foundations.
- An onsite 330kV substation containing two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 330kV transmission line onsite.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, indoor 33kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- Internal access tracks for construction and maintenance activities.
- Space for a future energy storage facility with a capacity of up to 30MWh and comprising of lithium ion batteries with inverters.

- Perimeter security fencing up to 2.3m high.
- Native vegetation planting to provide visual screening for specific receivers, if any are required.
- Access upgrades – this is the only project change from the BDAR presented in the EIS and is detailed below for clarity.

Access upgrades

The EIS proposed two access options; a Northern Access) and a Southern Access. The Northern Access was assessed for use by all vehicles, including heavy and oversized vehicles during construction and operation. The Southern Access Option 1 was assessed for use during construction and operation, with vehicle use limited to light vehicles only.

An alternative access, termed the Southern Access Option 2, is now proposed that would be constructed if Northern Access cannot be used for site access. If required, Southern Access Option 2 would allow heavy vehicle construction access via Barigan Road and the (Maree Road) road reserve. Southern Access Option 2 would only be used if Option 1 could not be used. Approximately 1.8 km of heavy vehicle access for the Northern access would not be developed in this case.

The inclusion of this alternative access option would increase the development footprint by up to 2 ha, to a total of approximately 463 hectares. These changes are required to provide an additional southern access for construction (option 2). All options are assessed in this BDAR as a conservative approach.

The construction phase of the proposal would take about 12 – 18 months and is anticipated to be operational for 30 years. When the solar farm is no longer viable, all above ground infrastructure, except for the onsite substation, would be removed. Any cabling more than 500mm underground may be left in place as it would not impact future agricultural activities following rehabilitation of the site.

An Environmental Impact Statement (EIS) inclusive of this BDAR was prepared (NGH Environmental, 2019a) on behalf of the proponent and was submitted to NSW Department of Planning and Environment (DPE) which was placed on public exhibition from 10 April 2019 to 7 May 2019. Following submissions resulting for the public exhibition period and from relevant public authorities, and although the proposal remains generally as detailed in the EIS, a change regarding vehicle access has been made (widening of Barigan Road and addition of Open 2, as set out above. Both options are assessed as a 'worst case' assessment approach.

Staging

The project is likely to proceed in four distinct stages of construction. Stage 1 (road upgrades) will proceed in advance of Stages 2 and 3 (site access and solar farm development). Stage 4 (the alternative southern access, referred to above) may never be constructed.

The Version 3 BDAR now shows the offset obligation for the project in terms of these stages.

1.2 THE SUBJECT LAND

1.2.1 Site location

The Wollar Solar Farm proposal is within the Mid-Western Regional Local Government Area (LGA). Mudgee is the closest regional centre to Wollar, located approximately 38km south west of the subject land.

Figure 1-1 shows the development site.

Owners of the subject land are outlined in Table 1-1.

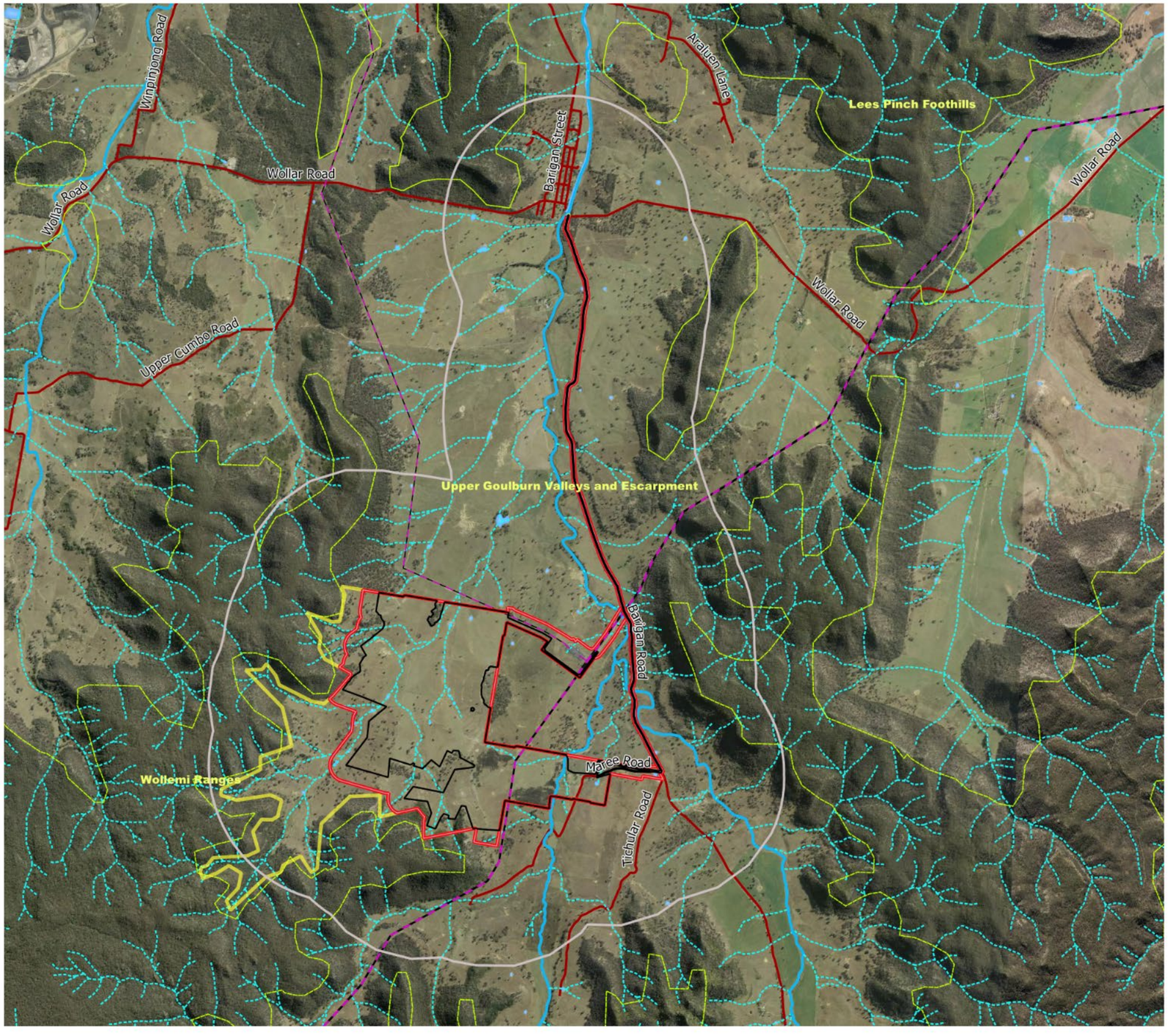


fig 1-1 Development Site/Subject land

Legend
- Mitchell Landscapes
- Development site 1500 m buffer
- Development site
- Subject land
- Development footprint
- Transmission line
- Roads

Waterway
- Perennial
- Non perennial
- Farm dam/other water body

LGA: Mid-Western Regional
CMA: Hunter Central Rivers
IBRA Bioregion: Sydney Basin (SB)
IBRA Subregion: Kerrabee (SB01) and Wollemi (SB04)

0 1,000 2,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ fig 1-1 Development Site/Subject land
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

Figure 1-1. Development Site/Subject Land

Table 1-1 Lots associated with potential development of the proposed Wollar Solar Farm

Lots and DP	Owner
Lots 1, 22 - 25, 27, 30, 45, 49-51, 60-63, 69-80, 84, 92, 105-107, 119 and 152-154 of DP 755430 and Lot 1 DP650653	Currently owned by one private landowner
Lots 46 and 84 of DP755430 and Lots 10 and 11 DP1090027	Peabody Australia Pty Ltd.
Lots 1, 2, 4, 6, 8 & 10 DP1090027	TransGrid
Lot 7303 DP1139558	Crown Land
Lot 80 DP755430 and Lot 11 DP1090027	Peabody Australia Pty Ltd.
Road corridor	
Lot 7006, DP1024130	-
Lot 6011, DP1116440	-
Lots 29, 30, 31, 32, 35, 40, 41, 65, 87, 131, 136 DP755455	-
Lots 31, 41 DP755430	-
Lots 6, 7, 9, 11, 34, 7001, DP1090027	-

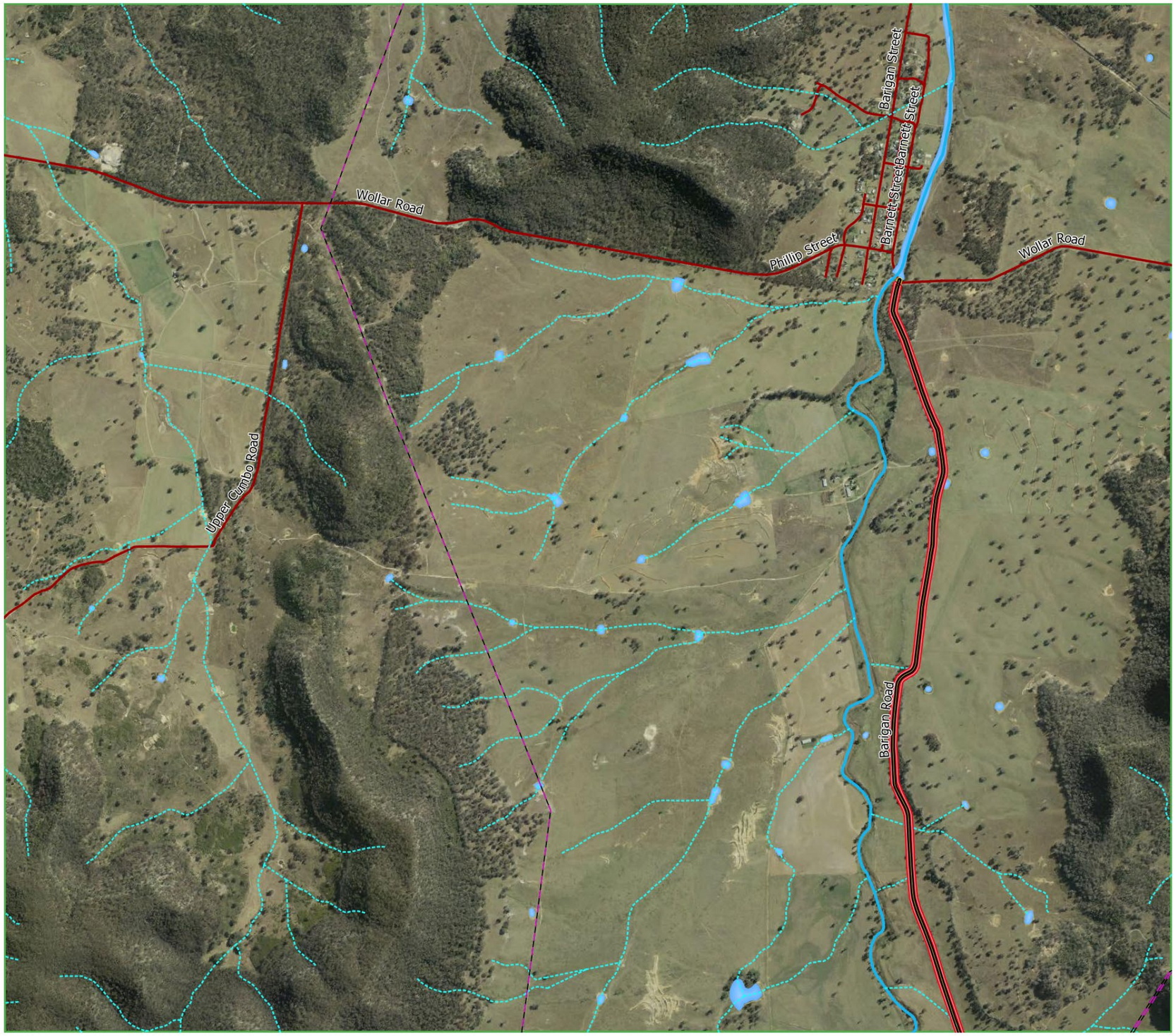
1.2.2 Site description

The Wollar Solar Farm proposal is located on the western side of Barigan Road, approximately 7km south of Wollar Village. The proposal would be located on a property of about 878 ha of freehold land. The development site comprises mostly paddocks within flatter land or foot slopes, which have been cleared for agricultural purposes, and an existing TransGrid 330kV transmission line that crosses the subject land in the north eastern corner.

Key features of the development site include:

- Woodlands and hollow bearing trees of high conservation value.
- Areas of woodland and derived native grassland with high diversity in the groundcover stratum which are classified as Critically Endangered under the EPBC.
- Highly disturbed native vegetation that lacks native understory and forb diversity due to grazing practices (Not critically endangered).
- Fifteen dams.
- Two ephemeral watercourses and approximately eight other tributaries.
- Rocky outcrops

The proposed solar farm would connect to the existing TransGrid 330kV transmission line located to the north eastern corner of the development site. Refer to Figure 1-2 below.

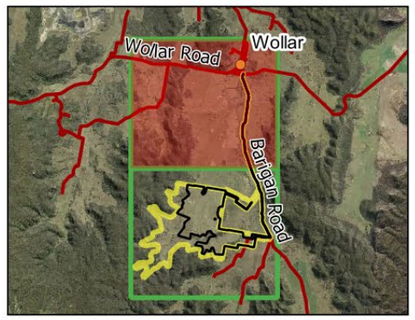


Legend

- Subject Land
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 1-2 Subject land and infrastructure layout
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

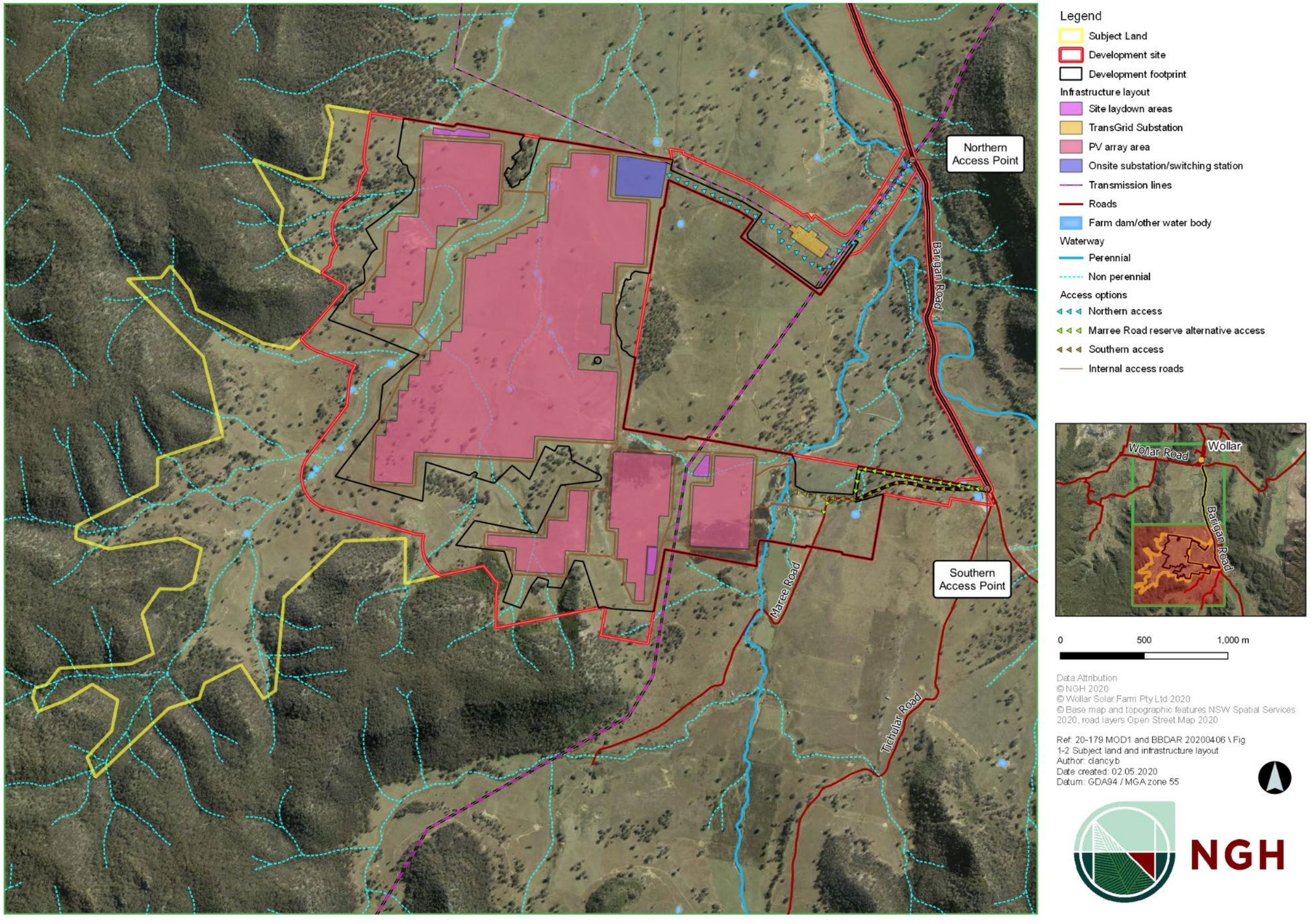


Figure 1-2 Subject land (Barigan Road impacts were added in Version 2 BDAR; shown over 2 maps)

1.3 STUDY AIMS

This BDAR has been prepared by NGH Environmental on behalf of Wollar Solar Development Pty Ltd.

The aim of this BDAR is to address the requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act), as required in the Secretary's Environmental Assessment Requirements (SEARs) and summarised below.

Secretary's Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues: • **Biodiversity** – including an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW).	**Sections 7.1**

No additional or specific threatened species, populations or communities were specified in the SEARs or by the NSW Office of Environment and Heritage (OEH) for consideration.

This BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Provided in Appendix B.

1.4 SOURCES OF INFORMATION USED IN THIS ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by Green Switch.
- Australian Government's Species Profiles and Threats (SPRAT) database http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- NSW OEH's Threatened Species Profiles http://www.environment.nsw.gov.au/threatenedspeciesapp/
- DPI profiles of threatened species, population, and ecological communities
  Commonwealth Department of Environment and Energy Protected Matters Search Tool Accessed online at http://environment.gov.au/epbc/protected-matters-search-tool
- Clean Energy Council of Australia website accessed online at https://www.cleanenergycouncil.org.au/technologies/geothermal.html
- Wind power Engineering and Development website accessed online at https://www.windpowerengineering.com/projects/guidelines-selecting-sites/
- Australia's IBRA Bioregions and sub-bioregions. Accessed http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- Lumsden L.F & Micaela J.L (2015). National Recover Plan for Southern Bent-wing Bat. Dept of Land, Water and Planning, Melbourne.
- NSW Government SEED Mapping
- Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Method.

- NSW OEH's Biodiversity Assessment Method (BAM) calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx).
- NSW Biodiversity Values Map

  https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap
- NSW OEH's BioNet threatened biodiversity database

  Accessed online via login at http://www.bionet.nsw.gov.au/.
- NSW OEH Threatened Species Profiles

  http://www.environment.nsw.gov.au/threatenedSpeciesApp/ and

  www.environment.nsw.gov.au/AtlasApp/UI_Modules/
- OEH BioNet Vegetation Classification Database (OEH 2017)

  Accessed online via login at http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx
- OEH VIS Mapping
- Mitchell, P. 2002 Descriptions for NSW Mitchell Landscapes version 2, NSW National Parks and Wildlife Service, Hurstville.
- NSW Planning portal online https://www.planningportal.nsw.gov.au/find-a-property

1.5 CONSULTATION

Table 1-2 Consultation with relevant departments.

Date	Contact	Reason	Outcome
24/09/18	Shannon Simpson, OEH Ecosystem Assessment Project Officer	To determine areas of mapped 'important areas' for the Swift Parrot and Regent Honeyeater within the solar farm.	'Important areas' for the Swift Parrot do not occur near to the site. The development footprint was refined to ensure no identified 'important areas' for the Regent Honeyeater would be impacted.
16/04/20	David Geering (BCD)	J. Blomfield for B. Marshall (NGH) seeking advice on how NGH should assess the impacts of the Modification (relocated access).	NGH advised BCD that modification to the Wollar Solar Farm was required to relocate the track to give Trangrid more room to expand their substation in future if they need to. Estimated impacts were predicted to be about 0.3 ha more impact. The vegetation zone is the same and no species credits are relevant to this new area or to this zone. No additional plots are required for this zone. A response was received directly from Department of Planning, Infrastructure and Environment (M. Patterson, 24 April) that the existing BDAR and its credit calculations could be updated to reflect the modifications, but only if the vegetation zone remained the same, no species credits are relevant to this zone and no additional plots were required due to the increase in impact area.

Date	Contact	Reason	Outcome
11/05/20	David Geering, BCD	G.Young (NGH) called BCD about updated 'important areas' mapping for Regent Honeyeater, not assessed under BDAR Ver. 2	BCD confirmed that updates to important areas did not need re-assessment for already approved areas. No newly mapped areas are relevant to the additional 0.32 ha of impact assessed in te Version 3 BDAR. BCD noted they would investigate a mapping anomaly within the approved stage 2 area (around TransGrid Substation).
18/05/20	David Geering (BCD)	G.Young (NGH) follow up on important areas mapping for Regent Honeyeater.	BCD advised that vegetation mapping (Yellow Box - Blakelys Red Gum Grassy Woodland) was used to update Regent Honeyeater important areas and confirmed it was an old mapping error and recommended NGH explain the error in the BDAR. No SAII necessary for Regent Honeyeater required.
26/05/20		B. Marshall (NGH) email update on status of the V3 BDAR and its contents.	NGH advised the V3 BDAR was a few days way and key changes to V2 would include: • Relocated section of access, requiring about 0.3 ha of additional impact and generating about small number of additional ecosystem credits. No impact on species credits. • Recalculation of threatened species polygons due to overlaps that over estimated impacts on Barrigan Road • Inclusion of staging breakdown.

2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGIONS

Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features, and flora and fauna communities. The development site is located within the NSW Sydney Basin Bioregion, in the Kerrabee subregion. The bioregion is characterised by warm summers and no dry season. The geology is characteristic of the Sydney-Bowen Basin, comprised of Carboniferous and Triassic marine volcanic sediments, creating a landscape of elevated plateaued sandstone for the most part of the basin, and sandstone and conglomerate cliff lines of Permian sediments to the south and west.

The dominant IBRA subregion impacted by the proposal is the Kerrabee subregion. This was entered into the BAM Calculator for the proposal.

2.2 NSW LANDSCAPE REGIONS AND AREA

The development site is in the Upper Goulburn Valleys and Escarpment Landscape. This landscape as described by Mitchell, 2002 is distinguished by steep hills and escarpments with rock outcrops on a mix of quartz sandstone, lithic sandstone and conglomerate and shale, making up harsh texture-contrast soils. Woodland in this area generally consists of grey box (*Eucalyptus moluccana*), forest red gum (*Eucalyptus tereticornis*), white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*).

Upper Goulburn Valleys and Escarpment Landscape was entered into the BAM Calculator for the proposal.

2.3 NATIVE VEGETATION

As determined by GIS mapping from aerial imagery, approximately 2,728 ha of native vegetation comprises 55% of the 4,951 ha buffer area 1,500m around the proposal site, including 2,264 ha of woody vegetation and 464 ha of derived grasslands.

The native vegetation in the landscape surrounding the development is considered to be predominantly grassy woodland on the Wollar Valley flats (Figure 2-1) comprising White Box (*Eucalyptus albens*), Blakely's Red gum (*Eucalyptus blakelyi*), Rough-barked Apple (*Angophora floribunda*), Grey Box (*Eucalyptus moluccana*) and Yellow Box (*Eucalyptus melliodora*). Black Cyprus (*Callitris endlicheri*) as well as White Box (*Eucalyptus albens*) dominate the foot slopes and steeper hilly terrain. Areas containing derived native grasslands inside the development footprint were considered Grassy Woodland – Derived Grasslands and included in the native vegetation assessment.

Figure 2-1 Example of native vegetation found within the Development Site

2.4 CLEARED AREAS

Cleared areas in the development site is primarily land where there is evidence of past ploughing/cultivation and where infrastructure is located (i.e. the substation and farm buildings). These areas provide limited foraging habitat for native species. Grass and weed seeds would provide some food for cockatoos and rodents which in turn would provide foraging habitat for raptors. Introduced species such as foxes and rabbits also occur. Around 87 ha (14%) of cleared areas exists within the development site with photographic examples illustrated within Figure 2-2 Example of cleared areas within the development site below. Cleared areas also include farmhouses, sheds and the substation.

Figure 2-2 Example of cleared areas within the development site

2.5 RIVER AND STREAMS

Spring Flat Creek (Figure 2-3) traverses the middle of the development site in a south-west to north-east direction and discharges into Wollar Creek approximately 2.5km north of the development site. This creek is also a fourth order stream under the Strahler stream classification system (Strahler, 1952). There are eight unnamed tributaries of Spring Flat Creek which traverse throughout the development site. The development site also contains fifteen farm dams; four to the south west, nine to the centre and two to the south east. According to Mid-Western Regional Council online mapping, the development site is not subject to flooding or groundwater vulnerability.

Wollar Creek (Figure 2-4) dissects the western portion of the development site. This creek is a fourth order stream under the Strahler stream classification system (Strahler, 1952).

Figure 2-3 Left: Spring Flat Creek south west of the development site leading into a dam; Right: Spring Flat Creek within north of portion of the development site

Figure 2-4 Left: Wollar Creek directly south of property access track creek crossing, Right; Wollar creek running underneath access track creek crossing to electricity substation.

2.6 WETLANDS

No wetlands occur in or adjacent to the development site. The nearest important wetland listed under the EPBC Act is the Hunter estuary wetlands, which is 150 – 200 km upstream of the locality.

A search of the 1:25000 topographic map reveals no wetlands in or adjacent to the development site.

2.7 CONNECTIVITY FEATURES

There are no significant connectivity features within the development site.

Small patches of treed Box Gum Woodland directly south of the development site provide some minor connectivity value, mainly for highly mobile species such as birds. Tree canopy connectivity is broken by open paddocks devoid of trees, which are mainly used for grazing and cultivation.

The connectivity of native grasslands is more significant for the site. The Wollar Valley has a patchy distribution of both exotic and native pastures. The proposed solar farm is not expected to disrupt connectivity of native grasslands when consideration is given the large area of native grasslands surrounding the development site that exist within Wollar Valley (~8000ha). Also, native groundcover will not be specifically targeted for removal underneath the solar panel arrays.

Spring Flat Creek, although a fourth order watercourse, is largely ephemeral and did not contain much tree cover. There was no observed ponded water at the time of inspection in May 2018. The creek appears to have a wide flat area for distribution of water where much of it would lie underground. The designated 40 metre buffer zone either side of the bank was largely devoid of trees and shrubs and is considered highly degraded (see Figure 2-3).

2.8 AREAS OF GEOLOGICAL SIGNIFICANCE

There are no karsts, caves, crevices or cliffs or other areas of geological significance within the development site. These features do occur in the surrounding vegetated ridgelines but will not be directly or indirectly impacted. There is a distinct band of Narrabeen Sandstone outcropping along the 70-80m contour line south and west of the development site as can be seen in Figure 2-5 below.

Figure 2-5 Sandstone outcropping found adjoining the development site to the south and west.

2.9 AREAS OF OUTSTANDING BIODIVERSITY VALUE

Two areas of Outstanding Biodiversity Value occur within the development site (NSW Biodiversity Values Map); Spring Flat Creek in the centre of the site and Wollar Creek to the south-east (Figure 2-6). The development layout avoids placement of solar panels inside the 40m buffer on either side of Spring Flat Creek. There will be up to two waterway crossings to cross the creek, however. No impacts are required for the use of an existing crossing over Wollar Creek.

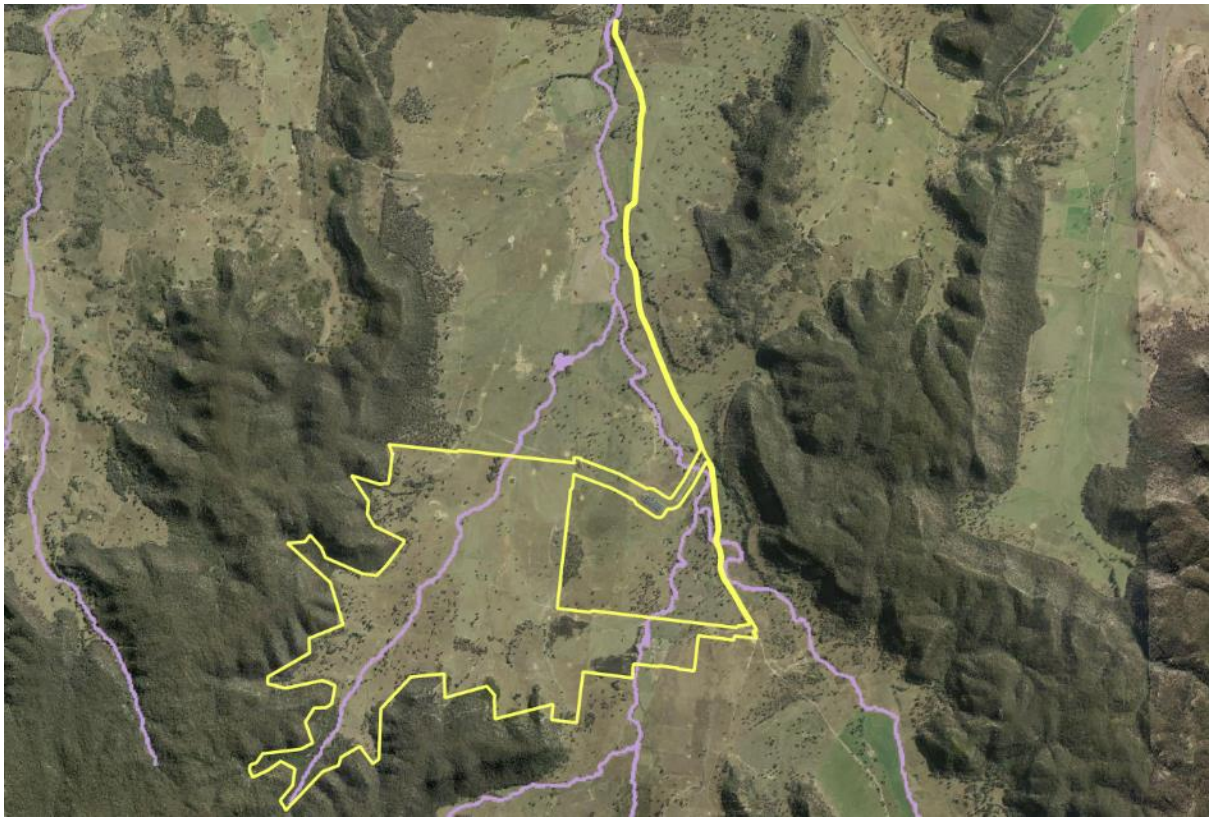


Figure 2-6 Map of biodiversity values (pink) sourced from NSW Government GIS data showing Spring Flat Creek as having biodiversity value, with the proposal site shown in yellow.

For Spring Flat Creek, erosion and waterway protection would be ensured by designing waterway crossings in accordance with the following:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (Fairfull & Witheridge, 2003).*
- *Policy and Guidelines for Fish Friendly Waterway Crossings (NSW DPI, 2003).*
- *Guidelines for Watercourse Crossings on Waterfront Land (NSW DPI, 2012).*

2.10 SITE CONTEXT COMPONENTS

Method applied

The proposal conforms to the definition of a *site-based development* under the Biodiversity Assessment Methodology. The site-based development assessment methodology has been used in this BAM assessment.

Percent Native Vegetation Cover

The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 74% (See Figure 3-1). This was entered into the BAM calculator for the proposal.

Percent Native Vegetation was calculated by estimating the presence of any native vegetation based on aerial imagery within the 1500m buffer. Unless verified by visual inspection, areas containing grasslands inside the 1500 m buffer were assumed to be non-native grasslands because of existing farming operations in the surrounding landscape and because it could not be verified by site survey. The landscape surrounding the Wollar property contained similar land management practises and it was therefore assumed that groundcover was primarily dominated by native species.

3 NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT

Approximately 552 ha (86%) of native vegetation occurs within the development site in two main condition states being remnant Box Gum Woodland and forest and derived native grassland (of varying conservation value).

The remaining 88 ha (14%) of the development site either contains non-native vegetation or infrastructure (such as Wollar substation, ploughed paddocks with no trees, farmhouses and farm sheds). For areas not containing infrastructure, exotic species such as Lucerne (*Medicago sativa*), Rye Grass (*Lolium perenne*), Wild Oats (*Avena fatua*) and Barley Grass (*Hordeum leporinum*) were observed growing in cultivated paddocks. Other areas were observed to contain freshly ploughed country that did not contain any groundcover (May and August 2018). These areas do not contain native vegetation or provide any threatened species habitat and are not assessed further.

Five paddock trees occur throughout the development site (see Table 3-4 Zones 4 & 7). These trees were assessed using the Paddock Trees module because the vegetation met the following definition:

I. In terms of the groundcover, there was less than 50% cover of indigenous species, and
II. greater than 10% of the area was covered with vegetation (whether dead or alive), and
III. the assessment was made at the time of year suitable for groundcover assessment (Spring), and
IV. foliage cover for the tree growth form group was less than 25% of the benchmark for tree cover for the most likely PCT (See Zone 4 & 7 of Table 3-4).

3.2 PLANT COMMUNITY TYPES (PCTS)

3.2.1 Methods to assess PCTs

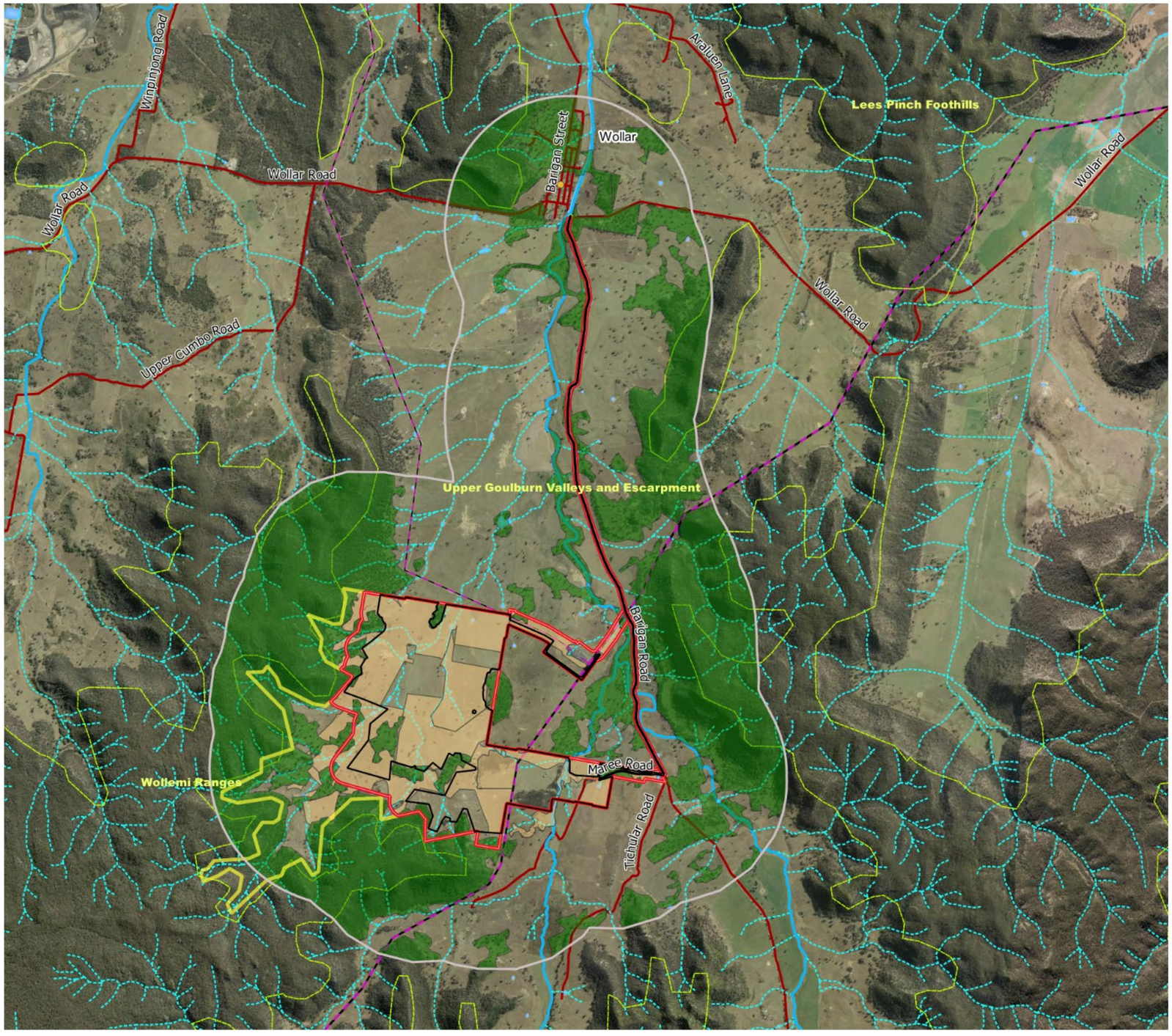
Review of existing information

A search was undertaken of OEH Vegetation Information System (VIS) database and NSW SEED mapping to access existing vegetation mapping information within the development footprint. One relevant vegetation map was found covering the Development site.

- *SEED Mapping – Sharing and Enabling Environmental Data (2017)*.
    - Central Tablelands Vegetation [API. VIS_ID 4163]

Existing vegetation mapping is largely absent in covering the Wollar Valley. Therefore, PCT classification primarily relied on;

- Species noted during survey in May and August 2018,
- Landscape setting and whether the vegetation was found on a valley floor, foot slope or steeper hilly terrain,
- Geology and observation of soils onsite.



Legend

- Native vegetation within 1500m of development site
- Native vegetation (non-woody/grassland)
- Native vegetation (woody/treed)
- Mitchell Landscapes
- Development footprint
- Development site
- Subject land
- Development site 1500 m buffer
- Existing transmission lines
- Roads
- Waterway
- Perennial
- Non perennial
- Farm dam/other water body

LGA: Mid-Western Regional
CMA: Hunter Central Rivers
IBRA Bioregion: Sydney Basin (SB)
IBRA Subregion: Kerrabee (SB01) and Wollemi (SB04)

0 1,000 2,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 3-1 Native vegetation extent within the development site
Author: clancyb
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

Figure 3-1 Native vegetation extent within the development site

Floristic survey

A preliminary environmental assessment involving field work was conducted within the Wollar property on the 6th and 7th of February 2018. The site was surveyed by a senior ecologist accredited under the BAM. The inspection involved identifying biodiversity constraints and vegetation mapping within the subject land. PCTs were determined based on the presence of diagnostic species via a rapid assessment and recording of dominant species within each stratum. No floristic plots were undertaken.

Following the initial site inspection, the client requested additional areas for assessment outside of the original survey area. A desktop assessment was carried out and compared to adjacent areas surveyed to stratify the vegetation within new areas based on landscape morphology such as topography and aspect.

A second survey was conducted from the 22nd to the 24th May 2018 by two ecologists accredited under the BAM and one graduate ecologist. The field work involved carrying out final stratification of vegetation onsite to adequately inspect areas not inspected from the initial site inspection. Collection of vegetation integrity plot data commenced. Six vegetation integrity plots, of 20m by 50m were established in homogenous vegetation zones. Data was collected on the composition, structure and function of the vegetation. The methodology conducted was consistent with the methodology presented in the BAM 2017 by persons trained in the BAM.

The number of plots undertaken did not meet the minimum number of plots required by the BAM. Therefore, further surveys were conducted onsite in October 2018 to complete the density of plot survey required for each validated vegetation zone inside the development footprint. A total of thirty-two plots were collected to adequately survey for all eight validated vegetation zones onsite.

For version 2 BDAR, additional areas for vegetation zones were added into the development site and development footprint to cover off vegetation within the proposed and alternative access which included Barigan Road. A field inspection in September 2019 was conducted to inspect vegetation along Barigan Rd and to collect data on threatened species habitat, which included survey for hollow bearing trees. The additional vegetation zone areas did not trigger the need for further BAM plots. As such, no addition BAM plots were added for any vegetation zones and no updated floristic data entered into the BAM calculations. Only changes in BAM C were updates to vegetation zone areas.

For this version 3 BDAR modification, there has been a relocation of the access track further south of the Transgrid substation. The impact is slightly more (0.32ha) but has been verified through an additional site inspection in April 2020 to be Vegetation Zone 1. This increase in area does not require additional BAM Plots but was inspected to verify vegetation zones and threatened species habitat inside the additional areas of the development footprint and site. The VI plot data presented in Appendix A.1.1 of this report remains unchanged to the previous Version 2 BDAR.

3.2.2 PCTs identified on the development site

Three PCTs were identified within the development site:

- White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion, White Box - Grey Gum - Kurrajong grassy woodland on northern Capertee Valley, Sydney Basin Bioregion (PCT 1303)
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (PCT 281), and
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes (PCT 1610).

A description of each PCT follows in Table 3-1 to Table 3-3. See Figure 3-2 for mapping of PCTs within the development site.

Table 3-1 Description of PCT 1303 within the development site

PCT name White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	Western Slopes Grassy Woodlands	
Vegetation type	**PCT ID**	1303
	Common Community Name	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion
Approximate extent within the development site	Overall, 317 ha of PCT 1303 (inc. paddock trees). There are four broad condition states; 1) 55.19 ha of 1303_Box Gum Woodland (Zone 1) 2) 133.27 ha of 1303_Derived Native Grassland (Zone 2) 3) 116.01 ha of 1303_Cultivated Low Condition (Zone 3) 4) 12.81 ha of 1303_Exotic (1 paddock tree) (Zone 4)	
Species relied upon for PCT identification	***Species name***	
	Eucalyptus moluccana (observed outside plot)	
	Eucalyptus albens (present within two plots)	
	Bursaria spinosa (observed outside plot)	
	Brachychiton populneus subsp. populneus (present within one plot)	
	Austrostipa scabra (present in three plots)	
Justification of evidence used to identify the PCT	This Box Gum Woodland occurs on lower slopes of the Wollar Valley and is generally associated with a north westerly aspect. It has been subjected to past disturbances caused by land clearing and farming practises. *Eucalyptus albens* was dominant over the landscape with lesser dominant *E. moluccana*. Groundcover species diversity was high with the most prevalent groundcover species being *Bothriochloa macra*. This PCT, although not known to occur in Kerrabee Subregion is the best PCT match based on site observations, plot data, landscape setting and soils. PCT 1303 occurs within Capertee Valley which occurs on Narrabeen Sandstone geology of which Wollar Valley has very similar traits. A shortlist of other PCTs revealed; PCT 483 - This PCT contains the best floristic match however, landscape position and distribution of Wollar Valley did not match with descriptions for this PCT. Wollar Valley does not contain black earths or chocolate soils derived from Basalt. Wollar Valley contains sandy alluvium derived from Narabeen Sandstone geology which is more closely related to PCT 1303 (similar landscape to Capertee Valley). PCT 496	

PCT name White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	
	- Equal floristic matches but weak distribution. PCT 266 - *Eucalyptus moluccana* absent in the upper stratum which was observed to be associated within the zone (although not captured in plots).
TEC Status	This vegetation forms part of the listed EEC: White Box Yellow Box Blakely's Red Gum Woodland listed under the BC Act.
Estimate of percent cleared	90%
Examples	 VI Plot 1

PCT name White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	
	 VI Plot 4

Table 3-2 Description of PCT 281 inside the development site.

PCT name: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion		
Vegetation formation	**Grassy Woodlands**	
Vegetation class	Coastal Valley Grassy Woodlands	
Vegetation type	**PCT ID**	281
	Common Community Name	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
Approximate extent within the development site	Overall, 225.51 ha of PCT 281 (inc. paddock tree areas). There are three broad condition states; 1) 50.77 ha of 281_Box Gum Woodland (Zone 5) 2) 143.14 ha of 281_Derived Native Grassland (Zone 6) 3) 31.60 ha of 281_Exotic (4 Paddock trees) (Zone 7)	
Species relied upon for	***Species name***	

PCT name: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	
PCT identification	*Eucalyptus blakelyi* (2 plots)
	Eucalyptus albens (one plot)
	Angophora floribunda (outside plot)
	Eucalyptus melliodora (outside plot)
	Microlaena stipoides (2 plots)
	Bothriochloa macra (one plot)
Justification of evidence used to identify the PCT	This Box Gum Woodland occurs on the Wollar Valley and is generally associated with Spring Flat Creek. It has been subjected to past disturbances caused by land clearing and farming practises. *Angophora floribunda* was dominant over the landscape with equal numbers of *Eucalyptus blakelyi* and lesser dominant *Eucalyptus melliodora*. Groundcover species diversity was high with the most prevalent groundcover species being *Microlaena stipoides* and *Bothriochloa macra*. This PCT is known to occur in Kerrabee Subregion and was the best PCT match based on site observations and comparison to plot data. A shortlist of other PCTs revealed; PCT 618 - *White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley* - Strong floristic match but *Eucalyptus blakelyi* was not present in the upper stratum. PCT 85 - *River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion* - Strong floristic match but PCT not found inside Kerrabee subregion. PCT 266 - White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion - Strong floristic match but no *Angophora floribunda*, the key dominant species in the upper stratum for this vegetation zone.
TEC Status	This vegetation forms part of the listed EEC: White Box Yellow Box Blakely's Red Gum Woodland.
Estimate of percent cleared	94%

PCT name: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	
Examples	 VI Plot 2  VI Plot 5

Table 3-3 Description of PCT 1610 in the development site

PCT name White Box - Black Cypress Pine shrubby woodland of the Western Slopes

PCT name White Box - Black Cypress Pine shrubby woodland of the Western Slopes		
Vegetation formation	**Dry Sclerophyll Forest**	
Vegetation class	Western Slopes Dry Sclerophyll Forests	
Vegetation type	**PCT ID**	1610
	Common Community Name	White Box - Black Cypress Pine shrubby woodland of the Western Slopes
Approximate extent within the development site	Overall, 53.76 ha of PCT 1610. There were two broad condition states within the development site; 1) 12.17 ha of 1610_Forested (Zone 8) 2) 41.59 ha of 1610_Degraded (Zone 9)	
Species relied upon for PCT identification	***Species name***	
	Eucalyptus albens (observed outside plot)	
	Callitris endlicheri (observed outside plot)	
	Calotis lappulacea (inside one plot)	
	Vittadinia cuneata (inside one plot)	
	Cassinia arcuata	
Justification of evidence used to identify the PCT	This PCT occurs on the steeper foothills of the Wollar Valley above a distinct sandstone escarpment. The lower parts of this PCT have been subjected to past land clearing and farming practises. *Eucalyptus albens* was the dominant tree with disturbed areas being dominated by thick regeneration of *Callitris endlicheri* and *Acacia ixiophylla*. Groundcover species diversity was high with the prevalence of *Calotis lappulacea*, *Vittadinia cuneata* and *Bothricholoa macra*, *Themeda australis* and Austro*stipa sp*. This PCT is known to occur in Kerrabee Subregion and was the best PCT match based on site observations during field survey. A shortlist of other PCTs revealed; • PCT 281 - *Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* -The upper stratum species did not contain *Callitris endlicheri* which was a dominant species within disturbed parts of this vegetation zone. • PCT 412 - *White Box - Black Cypress Pine shrubby hill woodland in the east Pilliga - Mendooran - Gulgong regions, mainly Brigalow Belt South Bioregion.*	

PCT name White Box - Black Cypress Pine shrubby woodland of the Western Slopes	
	- Incorrect distribution of this PCT. It was not found within Sydney Basin Bioregion. • PCT 434 - W*hite Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion* - PCT not distributed within Kerrabee Subregion.
TEC Status	Not associated with a TEC.
Estimate of percent cleared	40%
Examples	 PCT 1610_Forest

PCT name White Box - Black Cypress Pine shrubby woodland of the Western Slopes	
	 PCT 1610_Degraded

3.3 VEGETATION INTEGRITY ASSESSMENT

3.3.1 Vegetation zones and survey effort

The random meander, overview inspection and detailed floristic plots have been used to assist in the delineation of vegetation zones. Three PCTs were identified in the development site. Each of the PCTs were further stratified into additional zones on the basis of their condition or other environmental variables. All three PCTs were further stratified and this was on the basis of presence/absence of trees and noticeable differences in groundcover composition, especially the abundance of native species. All vegetation zones including photos of each are shown in Table 3-1 to Table 3-3 and mapped in Figure 3-2.

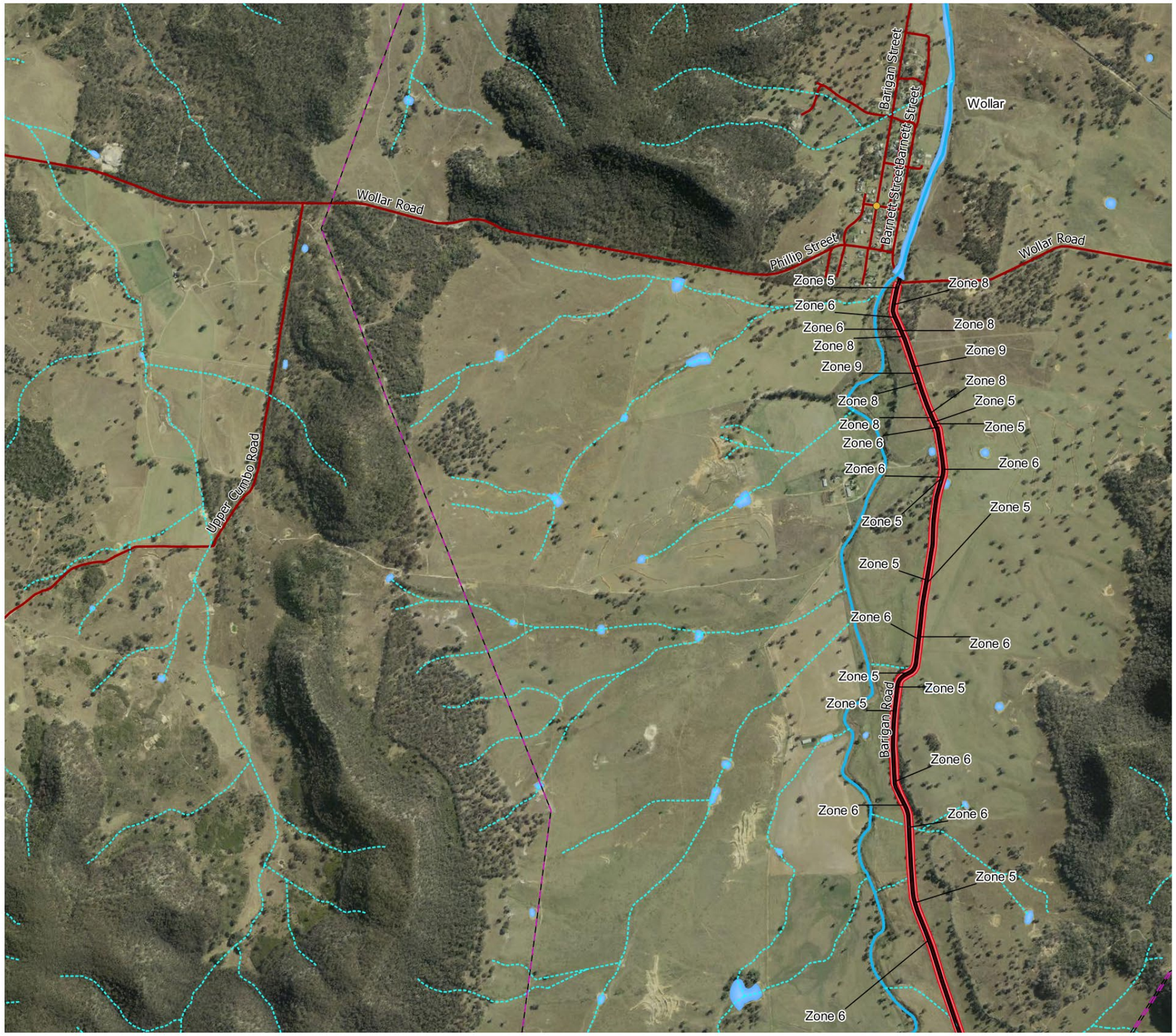
The number of plots undertaken meets the minimum number of plots required by the BAM for vegetation zones 1-7. A total of thirty-two plots were collected to adequately survey for all nine validated vegetation zones onsite.

Representative plots were undertaken within 'exotic/paddock tree' areas to confirm that the vegetation integrity score was less than 15 and did not require offsetting.

3.3.2 Paddock trees

Five paddock trees occur inside the development site within 'Exotic groundcover' within Zone 4 & 7 (see Table 3-4 below). Tree species included White Box (*Eucalyptus albens*) which was assigned to PCT 1303. Remaining species included Rough-barked Apple (*Angophora floribunda*), Blakley's Red Gum (*Eucalyptus blakelyi*) and Yellow-box (*E. melliodora*) which were assigned to PCT 281. As none of the paddock trees had hollows, most of the threatened candidate species identified by the BAM Calculator are not considered to utilise these trees. The only exception would be the Little Eagle where there is evidence of these birds utilising paddock trees as potential nesting areas. Where targeted fauna surveys were required for the BAM Calculations, paddock trees were also included in surveys for inspection of raptor nests. More details are included under Section 4 and 5.

All paddock trees were mapped in the field using a handheld GIS Tablet. Trees were identified to genus and species. The Diameter at Breast Height (DBH) of the tree was assessed and assigned a paddock tree class relevant to the large tree benchmark. The Large tree benchmark for PCTs 1303 and 281 is 50cm DBH. The trees were visually assessed from the ground to determine whether any hollows were present. The paddock trees occurring in the development site are shown within zones 4 and 7 in Table 3-4 below.



Legend

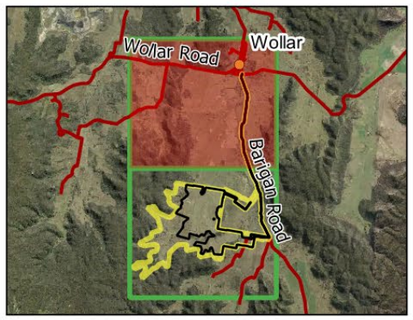
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial

Vegetation zones

- Zone 5: PCT 281: BGW
- Zone 6: PCT281: Derived
- Zone 8: PCT1610: Forest
- Zone 9:'PCT1610: Degraded



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 3-2 Vegetation zones
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

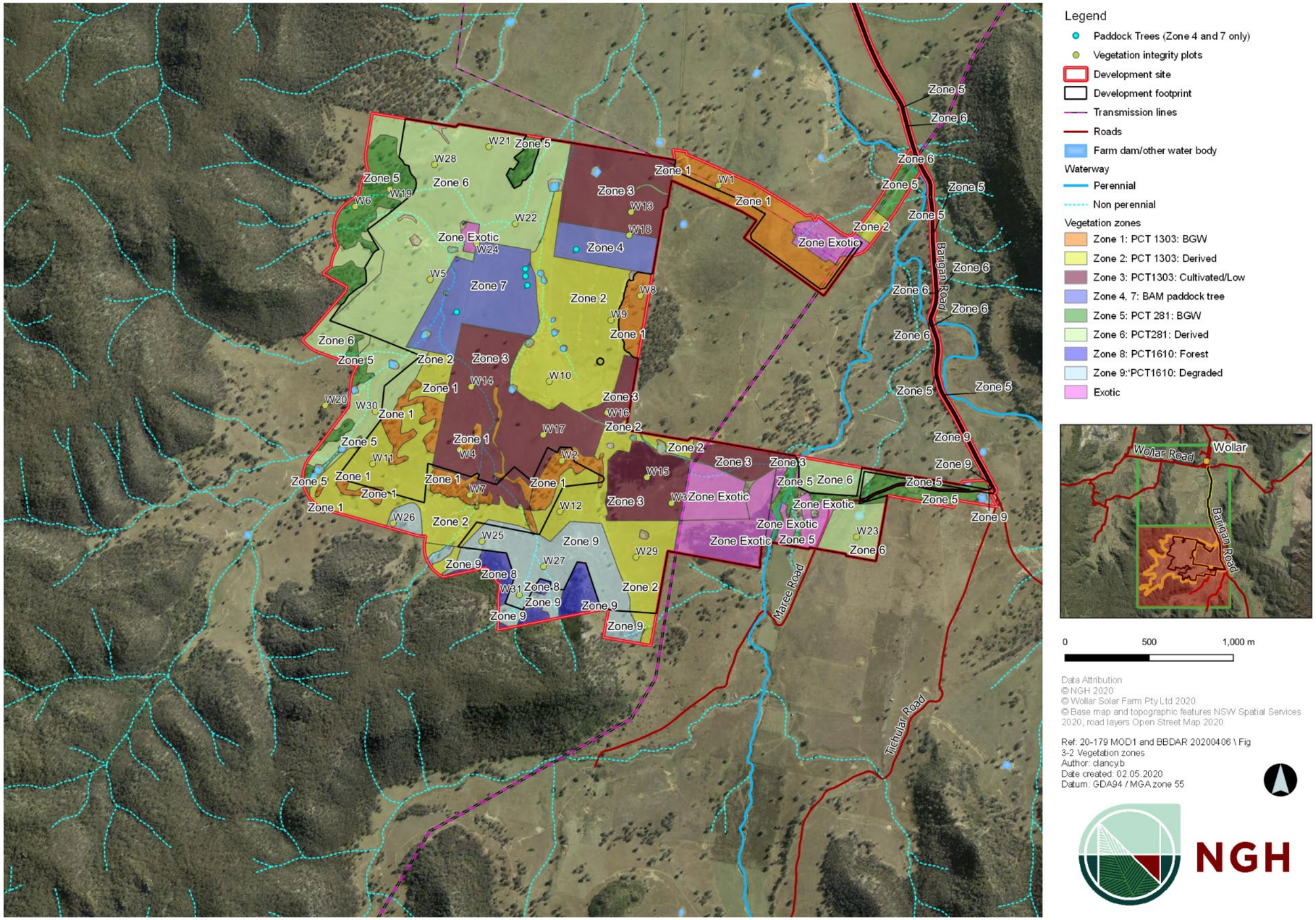


Figure 3-2 Vegetation zones, PCTs and representative Vegetation Integrity plots for development site (shown over 2 maps)

Table 3-4 Vegetation zones within the development footprint (impact area)

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)	Patch size (ha)	Examples
1	1303	**Box Gum Woodland** PCT containing tree cover (although sparse in some sections) and with diverse mix of native and exotic groundcovers. Considered to be in moderate condition. This woodland is a TEC under EPBC and BC Act.	16.82	3 plots required (4 plots collected on site includes W1, W2, W7, W8)	101	
2	1303	**Derived Native Grassland** PCT lacking most trees and with a mix of native and exotic groundcovers. Considered to be in moderate to low condition. This zone is still classified as a TEC under the EPBC and BC Act.	102.30	6 plots required (6 collected including W4, W9, W10, W11, W12, W29)	101	

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)	Patch size (ha)	Examples
3	1303	**Cultivated Low Condition** This vegetation zone has been cultivated in the past and Red Grass (*Bothriochloa macra*) now colonises this zone. High threat weed Saffron (Carthamus lanatus) also dominated this area. This zone is degraded in diversity but still classified as TEC under the BC Act, because it achieves a vegetation integrity score greater than 15.	110.70	6 Plots required (6 collected including plots W3, W13, W14, W15, W16, W17).	101	
4	1303	**Exotic Ground Cover – 1 Paddock tree** This zone comprised of 1 mature non-hollow bearing White Box tree (Eucalyptus albens) existing within cultivated land containing exotic groundcover (photos illustrates the paddock tree). The overall canopy cover for this vegetation zone was less than 25% of the lower benchmark for PCT 1303. This tree was classified as class 3. This vegetation zone is not classified as TEC. This paddock tree is classified as a class 3 tree and assessed accordingly with use of the paddock tree tool. The trees are not seen to provide habitat for any species credit species generated within BAM assessment.	12.81	One Plot (W18) carried out to confirm groundcover species composition dominated by exotics (>80%) and lack of native groundcover.	NA	

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)	Patch size (ha)	Examples
5	281	**Box Gum Woodland** PCT containing tree cover of Rough-barked Apple (*Angophora floribunda*) (although sparse in some sections) and with diverse mix of native and exotic groundcovers. Considered to be in moderate condition. This woodland is a TEC under EPBC and BC Act.	7.99	3 Plots required. (3 collected including W6, W19 and W20)	101	
6	281	**Derived Native Grassland** PCT lacking most trees and with a mix of native and exotic groundcovers. Considered to be in moderate to low condition. This zone is still classified as a TEC under EBPC and BC Act.	102.80	6 Plots required. (6 collected including W5, W21, W22, W23, W28 and W30)	101	

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)	Patch size (ha)	Examples
7	281	**Exotic Groundcover – 4 paddock trees** This zone comprised of 4 mature non-hollow bearing paddock trees (2 x Eucalyptus melliodora, 1 x E. blakelyi, 1 x Angophora floribunda) existing within cultivated land containing exotic groundcover. The overall canopy cover for this vegetation zone was less than 25% of the lower benchmark for PCT 281. These paddock trees are classified as class 3 trees and assessed accordingly with use of the paddock tree tool. The trees are not seen to provide habitat for any species credit species generated within BAM assessment. Photo illustrates the two Yellow-Box gums assessed as paddock trees.	31.64	One Plot (W24) carried out to confirm groundcover species composition dominated by exotics (>80%) and lack of native groundcover.	NA	
8	1610	**Good** This vegetation zone is not a TEC under EPBC or BC Act. This zone is within the recently upgraded development footprint alongside Barigan Rd only but not the Wollar property itself.	0.14	NA	NA	

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)	Patch size (ha)	Examples
9	1610	**Degraded** PCT subjected to past clearing and is now is regenerating thickly with Black Cyprus Pine (*Callitris endlicheri*) and Sticky-leaved Wattle (*Acacia ixiophylla*). This vegetation zone is not a TEC under EPBC or BC Act.	27.1	4 collected including W25, W27, W31 and W32.	101	

Table 3-5 Paddock trees within the development site

ID	Easting	Northing	Species	Common Name	DBH (cm)	DBH above benchmark (50cm)	Paddock Tree Class	Hollows Present	Impacted by proposal	Vegetation Zone/PCT
1	776316	6410068	*E. albens*	White Box	82	Yes	3	no	Yes	4/1303
2	776042	6409984	*E. blakelyi*	Blakely's Red Gum	72	Yes	3	no	Yes	7/281
3	776015	6400957	*E. melliodora*	Yellow Box	70	Yes	3	no	Yes	7/281
4	776024	6409856	*E. melliodora*	Yellow Box	95	Yes	3	no	Yes	7/281
5	775585	6409691	*A. floribunda*	Rough-barked Apple	76	Yes	3	no	Yes	7/281

3.3.3 Vegetation integrity assessment results

The results of the plot field data can be found in Appendix A.

The plot data from the vegetation integrity survey plots were entered into the BAM calculator. The results of the vegetation integrity assessment are provided in Table 3-5.

Table 3-6 Data used in BAM Calculator for this BDAR assessment based on current development proposal

Vegetation Zone	Plot collected during May 18	Plots collected during Oct 18	Number of plots required by BAM	Approach taken BAM calculator (BAM C)
Veg zone 1 1303_BoxGumWL	2	2	3	4 plots entered.
Veg zone 2 1303_DerivedNativeGL	1	5	6	All plots entered into BAM C
Veg Zone 3 1303_Cultivated Low	1	5	6	All plots entered into BAM C
Veg Zone 4 1303 Exotic (Paddock trees)	0	1	NA	Paddock tree data entered into BAM C. One plot confirmed exotic groundcover
Veg Zone 5 281 BoxGumWL	1	2	3	All plots entered into BAM C
Veg Zone 6 281 DerivedNativeGL	1	5	6	All plots entered into BAM C
Veg Zone 7 281 Exotic (paddock trees)	0	1	NA	Paddock tree data entered into BAM C. One plot confirmed exotic groundcover
Veg Zone 8 1610 Forest	0	1	1	Plot entered into BAM C
Veg Zone 9 1610 Degraded	0	4	4	All plots entered into BAM C

Field plot data collected in May 2018 can be found in Appendix A.1.2 and representative photos of each plot are shown in Appendix A.1.1. Data from the vegetation integrity survey plots (where collected onsite) was entered into the BAM calculator. Sources of data used for the BAM calculator can be seen in table 3-6 above. The results of the vegetation integrity assessment are provided in Table 3-7 below.

Table 3-7 Table of current vegetation integrity scores for each vegetation zone within the development site.

Zone ID	Composition score	Structure score	Function score	Vegetation Integrity Score
Veg zone 1 1303_BoxGumWL	68.3	87.7	30.6	56.8
Veg zone 2 1303_DerivedNativeGL	59	38.3	0.4	9.4
Veg Zone 3 1303_Cultivated Low	39.4	15.3	2.5	11.4
Veg Zone 4	NA	NA	NA	NA

Zone ID	Composition score	Structure score	Function score	Vegetation Integrity Score
1303 Exotic (Paddock trees)				
Veg Zone 5 281 BoxGumWL	64.9	50.1	65.1	59.6
Veg Zone 6 281 DerivedNativeGL	58.7	27.1	1.1	11.9
Veg Zone 7 281 Exotic (paddock trees)	NA	NA	NA	NA
Veg Zone 8 1610 Forest	49.3	23.1	17.2	27
Veg Zone 9 16010 Degraded	35.7	4.7	0.1	2.3

4 THREATENED SPECIES

4.1 ECOSYSTEM CREDIT SPECIES

The following ecosystem credit species were returned by the calculator as being associated with the PCTs present on the development site.

Table 4-1 Ecosystem Credit Species assessed.

Ecosystem credit species	Vegetation type(s)	NSW Status	National Status
Anthochaera phrygia Regent Honeyeater (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Critically Endangered	Critically Endangered
Artamus cyanopterus Dusky Woodswallow	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Callocaphalon fibbriatum Gang-gang Cockatoo (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Chthonicola sagittata Speckled Warbler	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Circus assimilis Spotted Harrier	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed

Ecosystem credit species	Vegetation type(s)	NSW Status	National Status
Climacteris picumnus victoriae Brown Treecreeper	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Daphoenositta chrysoptera Varied Sittella	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Dasyurus maculatus Spotted-tailed Quoll	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Endangered
Falsistrellus tasmaniensis Eastern False Pipistrelle	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	Vulnerable	Not Listed
Glossopsitta pusilla Little Lorikeet	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Vulnerable
Grantiella picta Painted Honeyeater	1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Vulnerable

Ecosystem credit species	Vegetation type(s)	NSW Status	National Status
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Hieraaetus morphnoides Little Eagle (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Lathamus discolor Swift Parrot (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Endangered	Critically Endangered
Lophoictinia isura Square-tailed Kite (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Melanodryas cucullata cucullata Hooded Robin	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Melithreptus gularis gularis Black-chinned Honeyeater	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed

Ecosystem credit species	Vegetation type(s)	NSW Status	National Status
Miniopterus orianae oceanensis Large Bent-wing Bat (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Micronomus norfolkensis Eastern Coastal Freetail-bat	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	Vulnerable	Not Listed
Neophema pulchella Turquoise Parrot	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Ninox connivens Barking Owl (Foraging)	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion 1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Vulnerable	Not Listed
Ninox strenua Powerful Owl (Foraging)	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Petroica boodang Scarlet Robin	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Petroica phoenicea Flame Robin	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and	Vulnerable	Not Listed

Ecosystem credit species	Vegetation type(s)	NSW Status	National Status
	Brigalow Belt South Bioregion		
Phascolarctos cinereus Koala (Foraging)	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Pomatostomus temporalis temporalis Grey-crowned Babbler	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Stagonopleura guttata Diamond Firetail	1303 -White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Tyto novaehollandiae Masked Owl (Foraging)	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Varanus rosenbergi Rosenberg's Goanna	281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed

4.1.1 Species excluded from the assessment

Only one ecosystem credit species was partially excluded from the assessment. This was Painted Honeyeater (*Grantiella picta*). This was due to there being less than five mistletoes per hectare within all vegetation zones

with exception for PCT 1610_Good. This was based on the observation of some mistletoes within White Box Trees within PCT 1610_Good (Veg zone 8)

All other ecosystem credit species were included in the BAM assessment.

4.2 SPECIES CREDIT SPECIES

4.2.1 Candidate species to be assessed

The BAM Calculator predicted the following species credit species to occur at the development site as can be seen in Table 4-2 below.

Table 4-2 Candidate species credit species requiring assessment

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
FAUNA							
Anthochaera phrygia **Regent Honeyeater (Breeding)**	Mapped Important areas (OEH)	High	Critically Endangered	Critically Endangered	Outside mapped important areas (OEH)	Included	Parts of the solar farm site contained preliminary 'important mapped areas' mapping.
Aprasia parapulchella **Pink-tailed Legless Lizard**	Rocky areas or within 50 m of rocky area	High	Vulnerable	Vulnerable	Optimal habitat within the development site	Included	Survey required and undertaken
Burhinus grallarius **Bush Stone-curlew**	Fallen/standing dead timber including logs	High	Endangered	Not Listed	Distinct lack of fallen timber resources inside the development site.	Included (partial)	No suitable habitat in solar farm site due to the absence of preferred timber resources Assumed present in timbered PCTs for Barigan Road
Callocephalon fimbriatum **Gang-gang Cockatoo (Breeding)**	Living or dead tree with hollows greater than 10 cm diameter and greater than 9 m above ground.	High	Vulnerable	Not Listed	Suitable Hollow-bearing Trees (HBTs) present within development site	Included	Survey required and undertaken
Chalinolobus dwyeri **Large-eared Pied Bat**	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	Very High	Vulnerable	Not Listed	No suitable habitat in development site however suitable habitat is located within surrounding sandstone ridgelines	Included	Survey required and undertaken

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
Haliaeetus leucogaster **White-bellied Sea-Eagle (Breeding)**	Living or dead trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines (BioNet).	High	Vulnerable	Not Listed	Large trees exist near large dams along Spring Creek Flat.	Included	Survey required and undertaken
Hieraaetus morphnoides **Little Eagle**	Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	High	Vulnerable	Not Listed	Woodland and paddock trees present inside the development site.	Included	Survey required and undertaken
Lathamus discolor **Swift Parrot**	Mapped Important areas (OEH)	Moderate	Endangered	Critically Endangered	Outside mapped important areas (OEH)	Excluded	Outside mapped important area (OEH)
Lophoictinia isura **Square-tailed Kite (Breeding)**	Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	High	Vulnerable	Not listed	Large waterbody within 1 km of development site	Included	Survey required and undertaken
Miniopterus orianae oceanensis **Large Bent-wing-bat (Breeding)**	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Very High	Vulnerable	Not listed	Potential habitat within areas containing rocky outcrops, farm sheds, road culverts.	Included	Survey required and undertaken
Ninox connivens **Barking Owl (Breeding)**	Hollow-bearing trees. Woodland and open forest, including fragmented remnants and partly cleared farmland. Known in subregion.	High	Vulnerable	Not listed	Suitable HBTs present within development site	Included	Survey required and undertaken
Ninox strenua **Powerful Owl (Breeding)**	Large mature trees likely to contain large hollows.	High	Vulnerable	Not listed	Suitable HBTs present within development site	Included	Survey required and undertaken

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
Petaurus norfolcensis **Squirrel Glider**	Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart).	High	Vulnerable	Not listed	Suitable HBTs present within development site	Included	Survey required and undertaken
Petrogale penicillata **Brush-tailed Rock-wallaby**	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	High	Endangered	Vulnerable	Distinct lack of suitable rocky outcrop within the development site. More suitable habitat on the north facing southern ridgeline outside of the development site	Excluded	No suitable habitat to be impacted.
Phascogale tapoatafa **Brush-tailed Phascogale**	Hollows with entrances 2.5 - 4 cm wide	High	Vulnerable	Not listed	Suitable HBTs present in development site	Included	Survey required and undertaken
Phascolarctos cinereus **Koala (Breeding)**	Areas identified via survey as important habitat based on density of Koalas and quality of habitat.	High	Vulnerable	Vulnerable	Survey required to identify	Included	Survey required and undertaken
Pteropus poliocephalus **Grey-headed Flying-fox (Breeding)**	Breeding camps. Breeding camps will need to be identified by survey	High	Vulnerable	Vulnerable	Suitable vegetation and riparian areas for camps not within development site	Excluded	No suitable habitat to be impacted.

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
Tyto novaehollandiae **Masked Owl**	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	High	Vulnerable	Not Listed	Suitable HBTs present within development footprint (Barigan Rd)	Included	Survey undertaken for solar farm site. Limited large hollow habitat inside Barigan Rd, accounted for in BAM C.
Vespadelus troughtoni **Eastern Cave Bat**	A cave roosting species found in dry forest or woodland, near cliffs and rocky overhangs	Very High	Vulnerable	Not Listed	Potential habitat within areas containing rocky outcrops, farm sheds, road culverts.	Included	Survey undertaken for solar farm site. No rocky habitat inside Barigan Rd and therefore assumed absent.
FLORA							
Acacia ausfeldii **Ausfeld's Wattle**	Associated species include *Eucalyptus albens, E. blakelyi and Callitris* spp. Although killed by fire, the seedbank will be stimulated.	Moderate	Vulnerable	Not listed	PCTs 1303, 281 & 1610 known habitat for this species. *E. albens* present within Development site.	Included	Survey undertaken for solar farm site. Assumed present inside timbered zones for Barigan Road.

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
Commersonia procumbens	Often found as a pioneer species of disturbed sandy habitats. It has been recorded colonising disturbed areas such as roadsides, the edges of quarries and gravel stockpiles and a recently cleared easement under power lines. Associated species include E. *dealbata, E. sideroxylon, E. albens, Calytrix tetragona, Callitris spp.*	Moderate	Vulnerable	Vulnerable	PCT 1610 known habitat for this species. *E. albens* present within Development site	Included	Survey undertaken for solar farm site. Assumed present inside timbered zones for Barigan Road.
Eucalyptus cannonii **Capertee Stringybark**	Capertee Stringybark has a broad altitudinal range, from around 450m to 1,050m. Within this range, the species appears to tolerate most situations except the valley floors.	Moderate	Vulnerable	Not listed	Entire development footprint is located on valley floor <450m in elevation. Inappropriate habitat for this species.	Excluded	No suitable habitat to be impacted.
Prostanthera cyrptandriodes subsp. cryptandroides **Wollemi Mint-bush**	Associated with rocky ridgelines on sandstone in a range of vegetation	Moderate	Vulnerable	Vulnerable	PCT 1303 known habitat for this species. Rocky outcrop sites exist within PCT 1610 & 1303.	Included	Survey undertaken for solar farm site. Assumed absent due to lack of rocky habitat for Barigan Road.

Species Credit Species	Habitat components	Sensitivity to gain class	NSW Listing status	National listing status	Presence of habitat onsite	Include/exclude from assessment	Action undertaken
Monotaxis macrophylla **Large-leafed Monotaxis**	Grows on rocky ridges and hillsides. The distribution is related to the occurrence of fire.		Endangered	Not listed	Timbered habitat in PCT 1303, 281 & 1610	Included	Survey undertaken for solar farm site. Assumed present inside timbered zones for Barigan Road.

4.2.2 Exclusions based on habitat features

Under Section 6.4.1.17 of the BAM, a species credit species can be considered unlikely to occur on a development site (or within specific vegetation zones) if following field assessment, it is determined that the habitat is substantially degraded such that the species is unlikely to utilise the development site (or specific vegetation zones). These species are identified in Table 4-3 along with justification regarding the habitats present.

Table 4-3 Species credit species excluded based on habitat

Species Credit Species	Zones excluded	Reason for exclusion
Eucalyptus cannonii	All zones	The development footprint is located on valley floor <450m in elevation and therefore considered unlikely to occur. No further assessment required
Lathamus discolor **Swift Parrot** ***Petrogale penicillata*** **Brush-tailed Rock-wallaby** ***Pteropus poliocephalus*** **Grey-headed Flying-fox (Breeding)**	All zones	These zones are excluded, as there is no suitable habitat that occurs within the impacted native vegetation zones. The species are unlikely to utilise these zones on a regular basis for breeding due to a lack of relevant critical habitat required for that species i.e. large rocky escarpments. Habitat assessment of the likelihood of a breeding camp for the Grey-headed Flying Fox was undertaken and considered unlikely due to the presence of fragmented vegetation within the development site and the lack of good condition riparian vegetation. Additionally, surveys undertaken in May, August and October did not locate any evidence of individuals or camps within the development site. Consultation with OEH confirmed that there are no 'important mapped areas' for Swift Parrot within the development site. Site surveys confirmed that vegetation located within the development site is unlikely to be utilised by Swift parrots during migration with better more suitable habitat located in the broader locality.
Burhinus grallarius **Bush Stone-curlew *(partial)***	Zones 1, 2, 3, 4, 6, 7, 9	There is no suitable timbered habitat within these vegetation zones. Bush Stone-curlew is unlikely to utilise these zones on a regular basis for breeding due to a lack of fallen timber. Timbered PCTs (Zones 5 & 8) alongside Barigan Road still included and assumed for presence for Bush Stone Curlew.

4.2.3 Candidate species requiring confirmation of presence or absence

The species listed in Table 4-4 are those that are considered to have habitats present at the development site and where targeted surveys are required within suitable habitat. Targeted survey inside the solar farm site was undertaken for Koala and all Owls onsite and commenced in May 2018. Targeted surveys in August and October 2018 were also undertaken for all potential threatened flora species, as well as diurnal and nocturnal fauna where the timing of survey was appropriate. The results of the targeted survey are summarised in Table 4-4. There have been some recent changes to data in the BAM calculator which has altered acceptable survey times for certain candidates. Where this has occurred, footnotes have been added to Table 4-4 to flag those species with recently updated survey times.

Habitat for Barigan road reserve was unable to be targeted for survey before submission of this BDAR. Therefore the assumption of suitable habitat/presence was entered into the calculator where habitat was identified. This included wooded habitat inside the development footprint for PCT 281 (all of Zone 5 inside Barigan Rd) and PCT 1610 (All of Zone 8 inside Barigan Rd).

Hollow bearing tree dependent species polygons:

Species polygons for hollow bearing trees were calculated in accordance with instructions in the threatened species database (where available) for each candidate species. For the Barking Owl, Masked Owl and Powerful Owl, each suitable hollow tree had a 100m buffer applied (where the vegetation zone was relevant). The same buffer of 100m was applied around trees suitable for the Gang-gang Cockatoo. The Brush-tailed Phascogale is known to prefer tree hollows that have small entrance holes (van der Ree et. al. 2015). As such, hollow-bearing trees with large hollows were excluded as breeding habitat for this species. For Brush-tailed Phascogale, a 15m buffer was applied around hollow-bearing trees with small and medium sized hollows. The smaller buffer was applied because Phascogales are known to utilise paddock trees which are surrounded by heavily disturbed habitat (i.e. cultivated land, BioNet, 2019) but in terms of breeding, have a preference for areas with a high density of large (>80cm DBH) hollow-bearing trees (van der Ree et. al., 2015). Brush-tailed Phascogales are also known to have a large foraging range, with females an average of 5 ha and males up to 100 ha (van der Ree et. al., 2001). As such, the trees within the development footprint are considered likely to provide 'stepping stone' habitat as opposed to preferred breeding habitat and a 15m buffer has been applied to account for the actual impacts on the potential breeding habitat for this species.

As the hollow bearing tree buffers extend further than the direct impact footprint, different rules were applied in calculating the species polygons. Depending on whether the tree was to be removed or was adjacent to the impact area and would be retained, the following areas were calculated and represent the species polygons that generate species credits:

1) where the tree would be removed, each species polygon buffer was clipped to the development site; representing the loss of all habitat associated with the tree.

2) where the tree was adjacent to the impact footprint (but would be retained), only the area of the polygon that overlapped the impact footprint was used; representing lopping or disturbance from noise and vibration during works.

Notes:

- Due to point 1), the areas of some species polygon buffers exceeded the maximum areas of vegetation zones within the development footprint. Where this occurred, the maximum vegetation zone for the development footprint was used to calculate the species polygon.
- As one tree's buffer may overlap an adjacent tree buffer (ie for trees less than 100m or 15 metres apart) where this represented the same species, the polygon was merged so species polygon areas were not duplicated. This meant a reduction in species polygon areas by approximately 50% from the BDAR Ver 2 calculations and has corrected a previous over-estimation.

Details of the survey methodologies and results are provided for each species below. Targeted survey locations are mapped on Figure 4.1. Species polygons have been defined for the species present on the site as mapped on Figure 4.1.

Table 4-4 Summary of species credit species surveyed at the development site.

Species Credit Species	Biodiversity risk weighting	Survey Period[2]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone in BAM C)
FLORA					
Acacia ausfeldii **Ausfeld's Wattle**	2	Aug - Oct	Surveyed on solar farm site August 2018	No	0 ha Not recorded on solar farm site. Assumed presence for Barigan Rd for PCT 281 Zone 5 (1.06ha) and PCT 1610 Zone 8 (0.14ha)
Commersonia procumbens	2	Jan – May Aug to Dec	Surveyed on solar farm site August 2018	No	0 ha Not recorded on solar farm site. Assumed presence in Barigan Rd for PCT 1610 Zone 8 (0.14ha) & Zone 9 (0.21ha)
Monotaxis macrophylla **Large-leafed Monotaxis**	2	Aug - Feb	Surveyed on solar farm site August 2018	No	0 ha Not recorded on solar farm site. Assumed presence in Barigan Rd Reserve for PCT 281 Zone 5 (1.06ha) and PCT 1610 Zone 8 (0.14ha)
Prostanthera cyrptandriodes subsp. cryptandroides **Wollemi Mint-bush**	2	Anytime	Surveyed on solar farm site [3]August 2018	No	0 ha Not recorded on solar farm site. No suitable habitat in Barigan Rd Reserve.
FAUNA					
Anthochaera phrygia **Regent Honeyeater**	3	Anytime	Important mapped habitat areas surveyed May, August & October 2018	Not recorded during survey. Mapped important habitat occurs survey indicated non-optimal	0 ha Not recorded during survey. Unable to confirm 'important mapping' inside Barigan road and assumed not present in BAM C.

[2] As prescribed in the BAM calculator.

[3] August was an acceptable survey time for this species at the time of survey. Recently changed with BAM C update.

Species Credit Species	Biodiversity risk weighting	Survey Period[2]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone in BAM C)
				habitat	
Burhinus grallarius **Bush Stone-curlew**	2	Anytime	Assumed to occur (Only inside Barigan Road, timbered PCTs)	Not surveyed	PCT 281 Zone 5 (1.06ha) PCT 1610 Zone 8 (0.14ha)
Aprasia parapulchella **Pink-tailed Legless Lizard**	2	Sept-Nov	Surveyed October 2018	Not recorded during survey. Suitable habitat has been avoided.	0 ha Not recorded during survey on solar farm site. No suitable habitat in Barigan Rd Reserve.
Callocephalon fimbriatum **Gang-gang Cockatoo (breeding)**	2	Oct-Jan	Surveyed October 2018 Assumed to occur (Barigan Road only). 100m buffer applied.	No	Not recorded during survey on solar farm site. Assumed present where med/large HBTs exist in Barigan Rd reserve for PCT 281 Zone 5 (2.03ha), PCT 281 Zone 6 (0.73ha) PCT 1610 Zone 8 (0.12ha), PCT 1610 Zone 9 (0.19ha).
Chalinolobus dwyeri **Large-eared Pied Bat**	3	Nov-Jan	Surveyed [4] October 2018 for solar farm site. Assumed present in wooded PCTs for Barigan Road only	Yes	Not recorded on solar farm site. Recorded during survey however no impacts to optimal breeding and or foraging habitat) Barigan Road assumed presence for PCT 281 Zone 5 (1.06), PCT 1610 Zone 8 (0.14ha)
Haliaeetus leucogaster **White-bellied Sea-Eagle**	2	July-Dec	Surveyed August, September and October 2018/19	No	0 ha Not recorded during survey. No stick nests observed along Barigan Rd.
Hieraaetus morphnoides **Little Eagle**	1.5	Aug-Oct	Surveyed August, September and October	No	0 ha Not recorded during survey. No stick nests observed along Barigan

[4] October was an acceptable survey time for this species at the time of survey. Recently changed with BAM C update.

Species Credit Species	Biodiversity risk weighting	Survey Period[2]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone in BAM C)
			2018/19		Rd.
Lophoictinia isura **Square-tailed Kite (Breeding)**	1.5	Sept-Jan	Surveyed September, October 2018/19	No	0 ha Not recorded during survey. No stick nests observed along Barigan Rd.
Miniopterus orianae oceanensis **Large Bent-wing Bat (Breeding)**	3	Dec-Feb	[5] Surveyed October 2018	Probable, therefore assumed present. (Anabat recording)	0 ha Recorded during survey but there are no impacts to breeding habitat. No breeding habitat alongside Barigan Rd.
Ninox connivens **Barking Owl (Breeding)**	2	May-Dec	Surveyed May & August and October 2018. Assumed present where large hollow trees inside Barigan Rd reserve for relevant PCTs	No	Not recorded on solar farm site. Assumed present in Barigan Rd Reserve where suitable large HBTs for PCT 281 Zone 5 (0.52ha), PCT 281 Zone 6 (0.01ha) and PCT 1610 Zone 9 (0.08ha)
Ninox strenua **Powerful Owl (Breeding)**	2	May-Aug	Surveyed May & Aug 2018. Assumed present where large hollow trees inside Barigan Rd reserve for relevant PCTs. 100m buffer applied.	No	Not recorded on solar farm site. Assumed present in Barigan Rd Reserve where suitable large HBTs for PCT 281 Zone 5 (0.52ha) and PCT 281 Zone 6 (0.01ha)
Petaurus norfolcensis **Squirrel Glider**	2	Anytime	Surveyed August and October 2018. Assumed present where small/medium hollow trees inside Barigan Rd reserve	No	Not recorded on solar farm site. Assumed present in Barigan Rd Reserve within timbered habitat for PCT 281 Zone 5 (1.06), PCT 1610 Zone 8 (0.14ha)
Phascogale tapoatafa **Brush-tailed**	2	Anytime	Surveyed August and October 2018	No	Not recorded on solar farm site. Assumed present in

[5] October was an acceptable survey time for this species at the time of survey. Recently changed with BAM C update.

Species Credit Species	Biodiversity risk weighting	Survey Period[2]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone in BAM C)
Phascogale			Assumed present where small/medium hollow trees inside Barigan Rd reserve. (15m canopy diameter applied)		Barigan Rd Reserve where suitable small/med HBTs found inside PCT 281 Zone 5 (0.38ha) and PCT 281 Zone 6 (0.18ha) and PCT 1610 Zone 8 (0.06), PCT 1610 Zone 9 (0.08ha)
Phascolarctos cinereus **Koala (Breeding)**	2	Anytime	Surveyed May 2018. Assumed present in timbered PCT 281/1610 Barigan Rd Reserve	No	Not recorded on solar farm site. Assumed present in Barigan Rd Reserve for PCT 281 Zone 5 (1.06 ha) and PCT 1610 Zone 8 (0.14ha)
Tyto novaehollandiae **Masked Owl (Breeding)**	2	May-Aug	Surveyed May & Aug 2018. Assumed present where large hollow trees inside Barigan Rd reserve for relevant PCTs. 100m buffer applied.	No	0 ha Not recorded on solar farm site. Assumed present in Barigan Rd Reserve where suitable HBTs exist for PCT 281 Zone 5 (0.52ha) and 281 Zone 6 (0.01ha)
Vespadelus troughtoni **Eastern Cave Bat**	3	Nov-Jan	Surveyed [6]October 2018	Possible, therefore assumed present. (Anabat recording)	0 ha Recorded during survey but there are no impacts to breeding habitat. No suitable breeding habitat inside Barigan Rd and therefore assumed absent.

4.3 THREATENED SPECIES SURVEY

General and targeted biodiversity surveys was undertaken to target NSW listed candidate species and Commonwealth listed species nominated in the Supplementary SEARs (Appendix B). surveys were undertaken in three survey sessions:

- 22nd-24th May 2018

[6] October was an acceptable survey time for this species at the time of survey. Recently changed by BAM C update.

- 27th-29th August 2018
- 22nd-26th October 2018
- 2-4th September 2019

Methods and effort are provided below. Weather conditions recorded for these dates from the Bureau of Meteorology (BOM) at the Mudgee Weather Station are as follows:

Table 4-5 Weather Conditions onsite during targeted surveys

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Rainfall (mm)	Max Wind Gust (km/h)
22nd May 2018	19	6.1	0	37 (3.16pm)
23rd May 2018	21	3	0	24 (11.19am)
24th May 2018	23.3	1.0	0	22 (7.01pm)
27th August 2018	17.2	2.8	9.8	31 (2.47pm)
28th August 2018	14.7	1.6	0	24 (3.47pm)
29th August 2018	15.2	-2.8	0	35 (3.58pm)
22nd October 2018	25.8	14.5	0	24 (7.42pm)
23rd October 2018	29.2	11.4	0	37 (11.23pm)
24th October 2018	8.8	28	0	31 (12.57pm)
25th October 2018	27.3	14.1	0	30 (2.25pm)
26th October 2018	27.6	6.6	0	46 (11.57am)
2 September 2019	24.0	3.1	0	41 (10:53am)
3 September 2019	26.9	2.6	0	43 (14:48pm)
4 September 2019	28.8	5.2	0	54 (12:55pm)

Diurnal Woodland Birds (Regent Honeyeater, Swift Parrot, Gang-gang Cockatoo, White-bellied Sea Eagle, Little Eagle, Square-tailed Kite)

SURVEY EFFORT

May 2018

A woodland bird census consisting of a five (5) transect and five (5) 20 minute point opportunistic surveys were completed on the mornings and evenings of the 22-24 May for a total of seven (7) hours. Five one kilometre transect surveys targeting swift parrot as well as general avifauna were walked over one hour, as well as one 20 minute point opportunistic survey at the centre of each transect. Remnant trees were surveyed for evidence of stick nests used by raptors. Weather conditions recorded at Mudgee weather station included minimum temperature 1.0°C, maximum temperature 23.3°C, and 0 mm of rainfall.

August 2018

Three (3) 20 minute two (2) ha diurnal bird surveys were completed on the mornings of the 28th and 29th August over a total one hour survey time. Targeted hollow-bearing tree surveys as well as surveys for large stick nests were carried out for evidence of suitable breeding habitat. All paddock trees within the development footprint were surveyed for the presence of hollows. The number, size and height of hollows were recorded for each tree along with any evidence of use. Hollows were categorised as small (< 10 cm), medium (10 – 20 cm), and large (> 20 cm).

October 2018

Six (6) 20 minute two (2) ha diurnal bird surveys as well as area searches and call playback were completed within mapped regent honeyeater habitat and undertaken early mornings between the 23rd-26th October. Additionally, any suitable Eucalypt species in flower within the development site were also observed for a period for 20 mins to monitor avifauna activity. Targeted hollow-bearing tree surveys and opportunistic surveys were also undertaken for evidence Gang-gang cockatoo within the development site.

September 2019

All trees inside the Barigan Road reserve part of the development footprint were inspected for evidence of large stick nests. A hollow bearing tree inventory was also carried out inside Barigan road reserve with size class range of hollows classified into small (< 10 cm), medium (10 – 20 cm), and large (> 20 cm) categories.

SURVEY RESULTS

None of the targeted candidate diurnal avifauna species or evidence of breeding (i.e. large stick nests for raptors) were observed during the surveys.

No regent honeyeater or swift parrots were observed during the targeted surveys. Approximately 0.34ha of regent honeyeater mapped important habitat is predicted to occur within the development site. Generally, habitat within the development site is fragmented and consisted of isolated individuals or small remnant clumps without a consistent shrub layer or complex structure. Therefore, fragmented habitat throughout the majority of the development site is dominated by more common and disturbance tolerant native and exotic species as well as aggressive native species such as noisy miners and noisy friarbirds. Vegetation throughout the site is recovering from a recent bushfire with large amounts or epicormic growth and very little evidence of flowering. However, the vegetation on the lower slopes that occur on the boundaries of the development site and subject land contain more complex structure and contain a high abundance of common and threatened woodland avifauna. Sporadic *E. melliodora* were observed to be flower at the far southern end of the development site, however limited avifauna species were observed utilising these blossoming individuals. Vulnerable listed Grey-crowned Babbler, Speckled Warbler, Diamond Firetail were detected directly south of the development footprint within vegetation equivalent of PCT 1610 forest (Zone 8). Dusky Wood swallow and Brown Treecreeper were also detected within PCT 1610 forest/disturbed (Zone 8 and 9). Refer to Appendix A.1.3 for a complete list of species observed.

Hollow bearing trees inspected during targeted surveys did had no evidence of use by any threatened flora. More common species such as galahs and red rump parrots were observed utilising hollow bearing trees within the development footprint.

The development would impact five (5) paddock trees inside the Wollar property and fifty-six (56) trees inside Barigan road reserve that contain suitable hollows that may be utilised for various threatened species. In accordance with the BAM, paddock trees assessed under the streamlined paddock tree assessment are not considered as species credit polygons.

Nocturnal Birds (Barking Owl, Masked Owl & Powerful Owl)

SURVEY EFFORT

May 2018

Three (3) separate targeted species surveys were completed on the nights between 22nd - 24th May for a total of 4 hours. Call playback with a megaphone was used from the vehicle along remnant vegetation, followed by a period of listening for responses and spotlighting.

August 2018

An additional four separate sites were surveyed above on the nights of the 27th-28th August 2018 for a total of three (3) hours. Spotlighting in addition to call playback with a megaphone and Bluetooth speakers were used from the vehicle and whilst walking through patches of remnant vegetation and isolated paddock trees, followed by a period of listening for responses in accordance with OEH threatened species guidelines.

SURVEY RESULTS

During the May survey, no threatened birds were seen or heard during the survey. One Southern Boobook, (*Ninox novaeseelandiae)* and Barn Owl (*Tyto alba)* were seen in open farmland in the north of the development footprint. During August survey, no threatened birds were seen or heard during the survey. One Barn Owl (*Tyto alba*), Tawny Frogmouth (*Podargus strigoides*) and Owlet Nightjar (*Aegotheles cristatus*) were observed during spotlighting.

Microbats (Eastern Cave Bat, Large Bent-winged Bat, Large-eared Pied Bat)

SURVEY EFFORT

October 2018

A targeted Anabat survey was completed for the nights of 22nd – 25th October. One (1) Anabat Swift unit was placed at two locations within the development site and surrounding areas for two separate nights at each location (Figure 4-1). The Anabat was placed outside of the development site within suitable habitat for cave dwelling microbats including sandstones caves and overhangs approximately 400m from the development site on the 22nd – 23rd October. The Anabat was relocated to within management zone 1 in the central eastern boundary of the development site on the 24th – 25th October. Recordings produced were filtered and analysed by NGH Environmental ecologists.

SURVEY RESULTS

Numerous microbats' species were identified from the Anabat recordings, including the Large-eared Pied Bat and potentially the Eastern Cave Bat and Large Bent-winged Bat. Definite calls from the Large-eared Pied Bat were recorded whilst calls from at the Large Bent-winged Bat and Eastern Cave Bat were deemed as probable and possible respectively when compared to reference calls. Difficulties in differentiating calls from other sympatric species such as Little Forest Bat (*Vespadelus vulturnus*) resulted in lower confidence in identification for the Easter Cave Bat. It therefore has been assumed as present within the subject land.

Nocturnal Mammals (Squirrel Glider, Brush-tailed Phascogale, Koala)

SURVEY EFFORT

May 2018

Targeted spotlighting surveys were undertaken at night during the 22nd - 24th May over four (4) separate areas (Figure 4.1) for approximately one hour each night (30 mins per area). A 100-watt spotlight was used in both vehicle-based and foot surveys within remnant woodland patches and isolated paddock trees prior to nocturnal owl call playback surveys. Seven separate scat surveys were completed for Koalas on the 23rd and 24th May 2018, with mature feed trees searched for signs of Koalas for approximately 8 person hours.

August 2018

An additional four surveys were undertaken via spotlighting from a vehicle and on foot on the 30th and 31st August for approximately two hours each night. A 100-watt spotlight was used in both vehicle-based and foot

surveys within remnant woodland patches and isolated paddock trees prior to nocturnal owl call playback surveys.

SURVEY RESULTS

None of the targeted arboreal mammals were detected during spotlighting in May or August. No Koalas were observed, or their evidence of use were recorded during the surveys. Multiple wombats (*Vombatus ursinus*), Eastern Grey Kangaroos (*Macropus giganteus*), Wallaroos (*Macropus robustus*), and Red-necked Wallabies (*Macropus rufogriseus*) were detected during the August survey and were generally confined to the southern sites (see Appendix A.1.3).

Reptiles (Pink-tailed Legless Lizard)

SURVEY EFFORT

Areas of rocky outcrop were assessed and surveyed by two ecologists on the 24th and 25th October 2018 for approximately 30 minutes at each site within and surrounding the development site. This included traversing the rocky outcrop area and randomly turning and inspecting loose rocks and partially embedded rock that occurred before being placed back into their original position. Where practicable, between 100-150 rocks were turned and inspected at each surveyed area.

SURVEY RESULTS

The vast majority of the rocky outcrops consist of embedded rock and occasional loose rock within paddocks containing improved pastures species with little or no native grasses or forb presence. These was considered non-optimal habitat for the Pink-tailed Legless Lizard. One identified area development site contains optimal habitat (Figure 4.1) with an abundance of partially embedded rock and loose rock surrounded by high cover of native grasses occur within the development site however has been largely avoided. A further two areas are considered to contain potential habitat based on the availability of rock outcrop, however, has a low abundance of native grass and subject to consistent disturbance. Of the areas surveyed, one common species, Two-clawed worm-skink (*Anomalopus leuckartii*), was observed. Small areas of rock outcrop were observed within remnant woodland areas and surveyed accordingly. No threatened species were observed during the survey and in addition of avoiding and minimise better quality habitat within the development site, it is considered that this species would not be impacted.

Threatened flora (*Acacia ausfeldii, Monotaxis macrophylla, Commersonia procumbens, Prostanthera cryptandroides)*

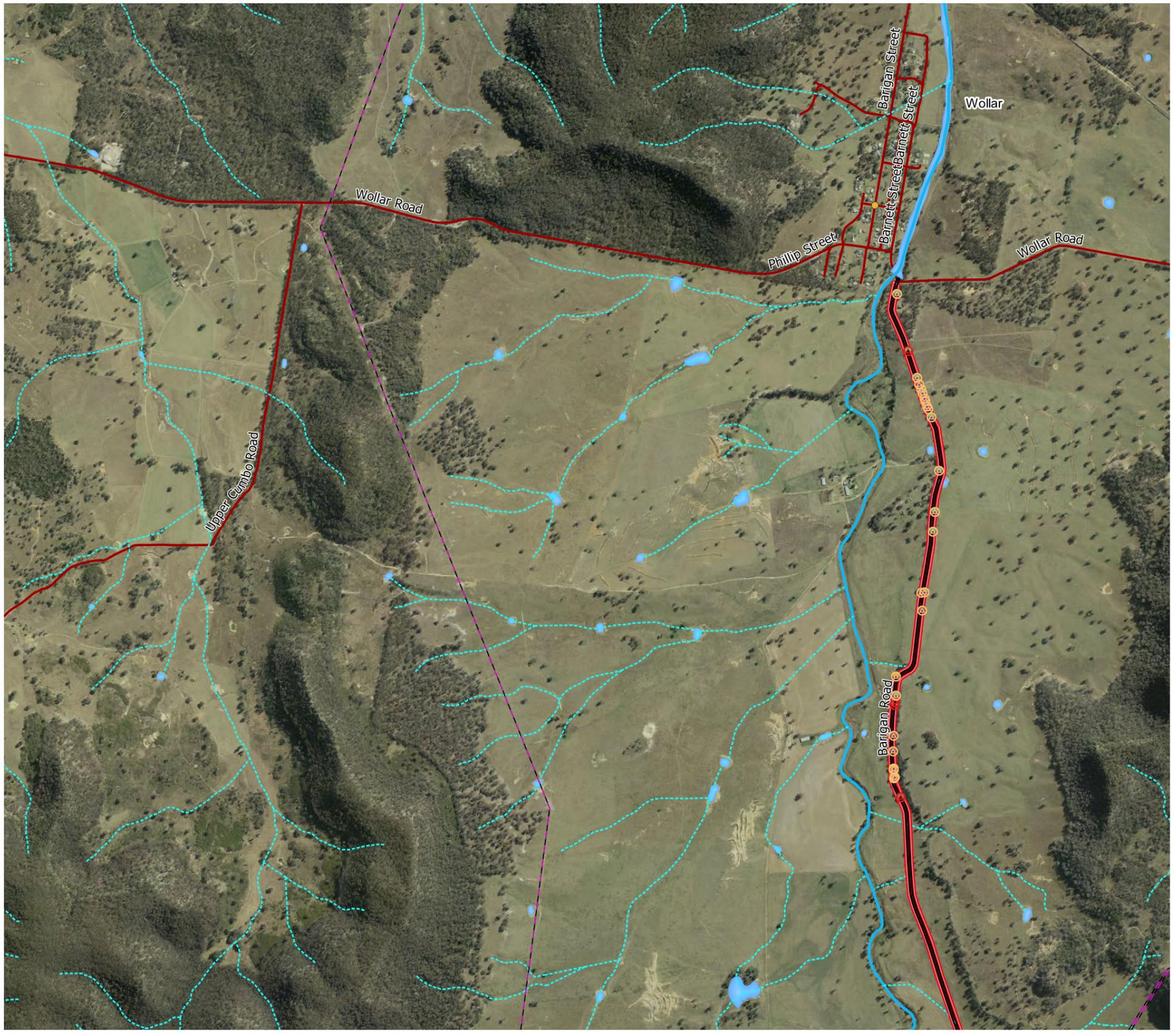
SURVEY EFFORT

Suitable habitat for these species occurs in the small remnant patches of moderate to good condition vegetation associated with PCT 1303, PCT 281 and PCT 1610 (vegetation zones 1, 2, 5 and 8). Areas of vegetation within the development site that had been recently burnt and recovering following the 2017 bushfire were also surveyed. Areas of suitable habitat within the development site were surveyed using the parallel field traverse survey technique were practicable in conjunction with random meander where vegetation became more degraded and less optimal during suitable survey periods in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016).

SURVEY RESULTS

No threatened flora were detected within the survey area. Although not required to be surveyed based on PCTs present and on distribution limitations, a potential observation of *Swainsona sericea*, listed as vulnerable within the BC Act, was observed and sent to the National Herbarium of New South Wales for confirmation. It was confirmed on the 13th November that species identified was *S. behriana*, an uncommon observation of the region, and not *S. sericea*.

Considering the extensive survey effort undertaken in suitable habitat during flowering season, targeted threatened flora species are not considered to occur within the development site.



Legend

Fauna survey sites
- Anabat
- Camera
- Diurnal bird survey
- Koala SAT
- Nocturnal

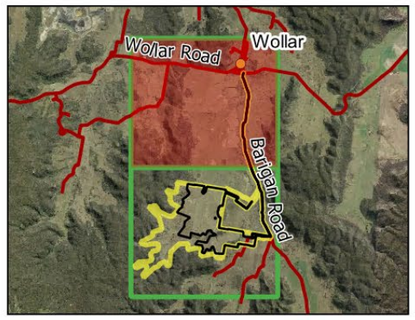
Fauna survey areas
- Callpayback location
- Spotlight locations
- Swift Parrot transect

Aprasia habitat
- Potential Habitat
- Suitable Habitat

Habitat trees
- Not cleared by development
- To be cleared

- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway
- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 3-2 Threatened fauna targeted survey
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

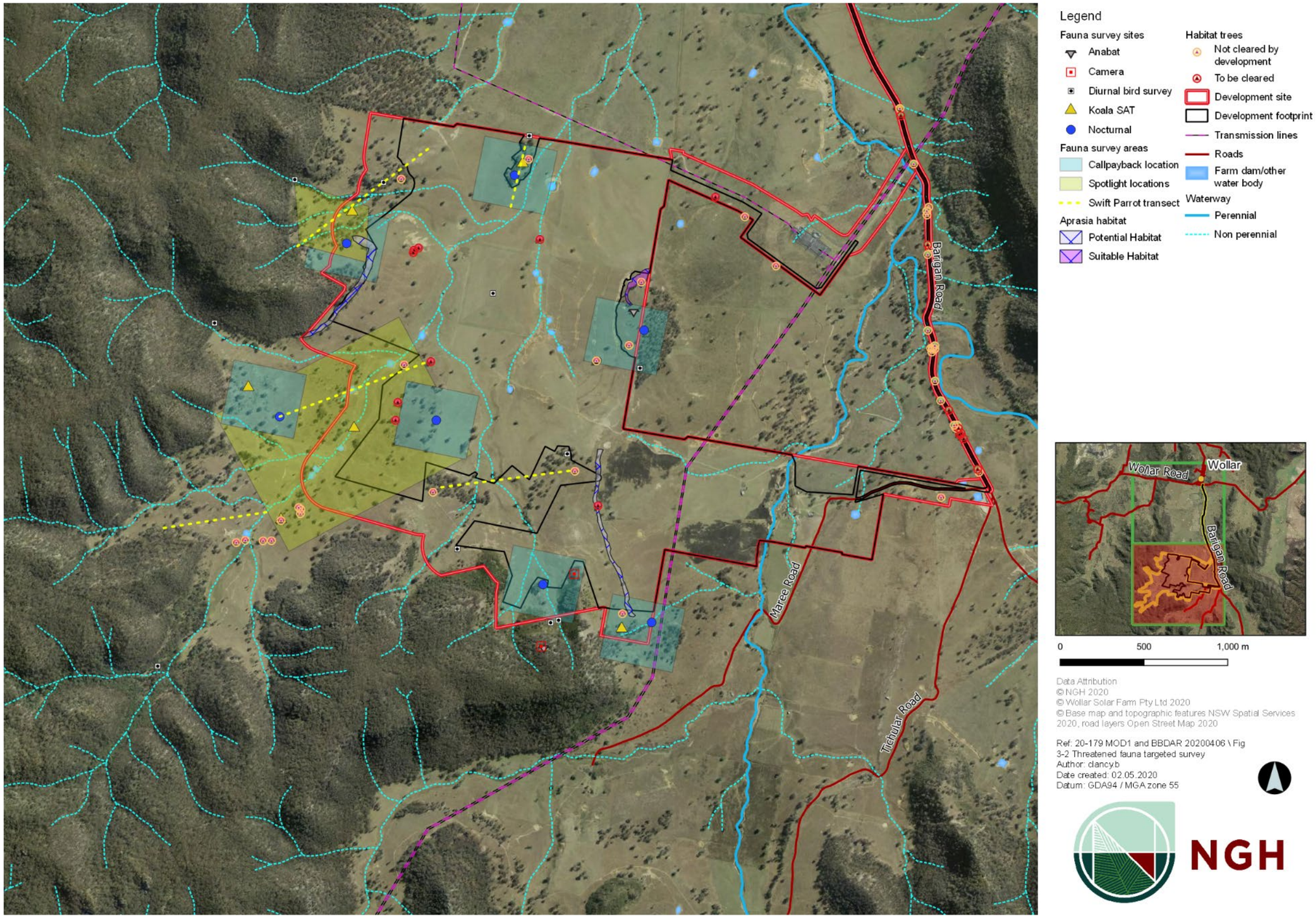


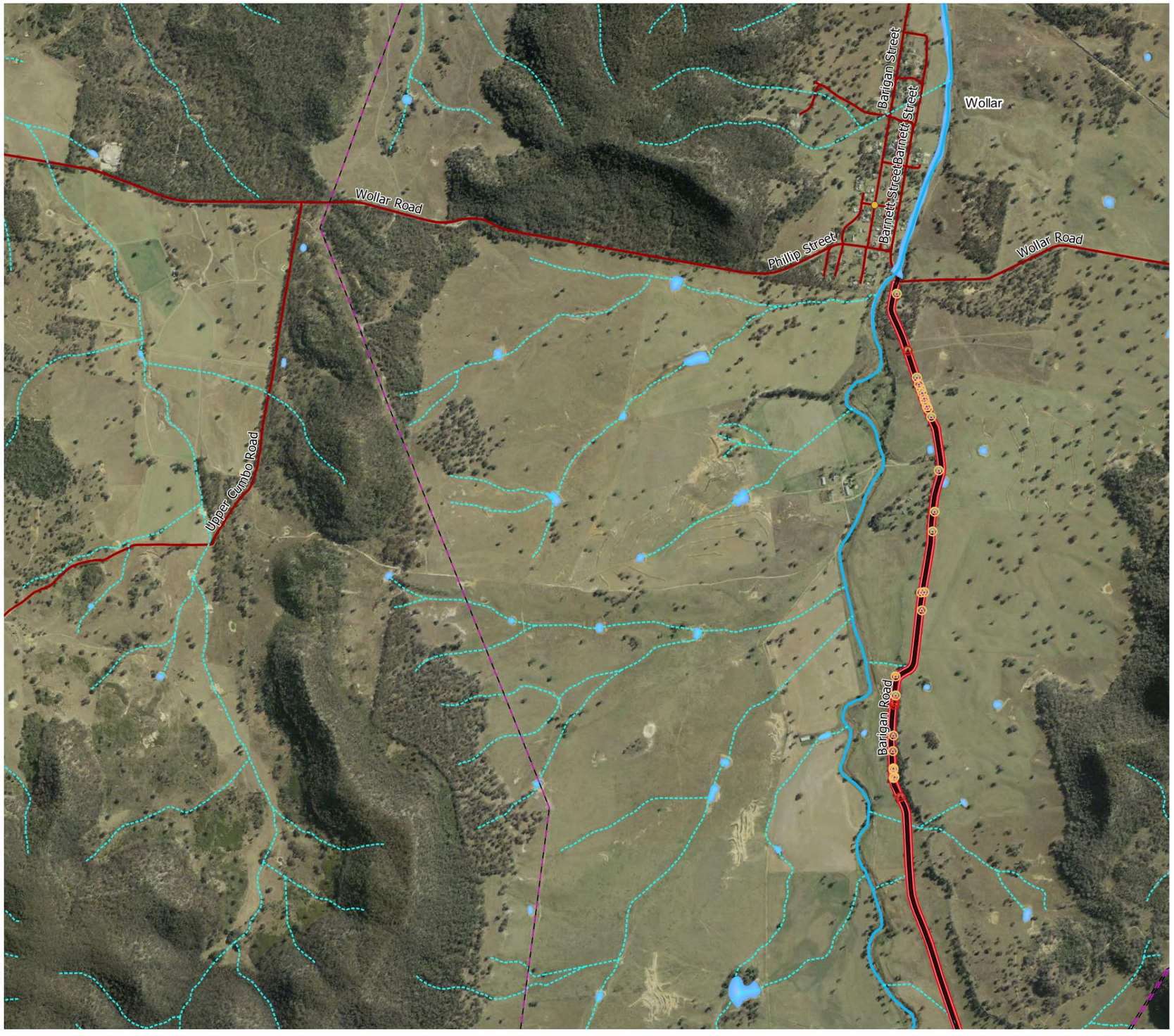
Figure 4-1 Threatened fauna targeted survey locations (shown over 2 maps)

4.4 ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS

4.4.1 Occurrences of karst, caves, crevices and cliffs

There are several occurrences of largely embedded linear rock outcrop that contain shallow crevices within the development site as illustrated on Figure 4-2 below and Figure 4-3. Rocky outcrops may provide candidate species habitat for Pink-tailed Legless Lizard, Large-eared Pied Bat, Eastern Bent-wing Bat and Eastern Cave Bat and therefore targeted surveys for these species were undertaken in these areas. Vegetated sandstone ridgelines surrounding the development site contain suitable roosting habitat such as caves, crevices and overhangs for the Microchiroptera bats mentioned above. Although outside of the development site and would not be impacted, ridgelines at the southern end of the subject land were surveyed via with remote camera and Anabat ultrasonic detectors for baseline data.

There are no known biological processes onsite that are known to preserve these features in their current state, other than the site being largely undisturbed farming land.

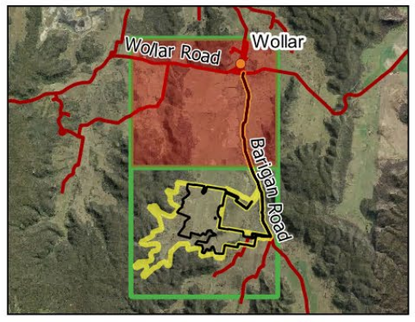


Legend

- Rocky outcrops
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 4-2 Rocky outcrops
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

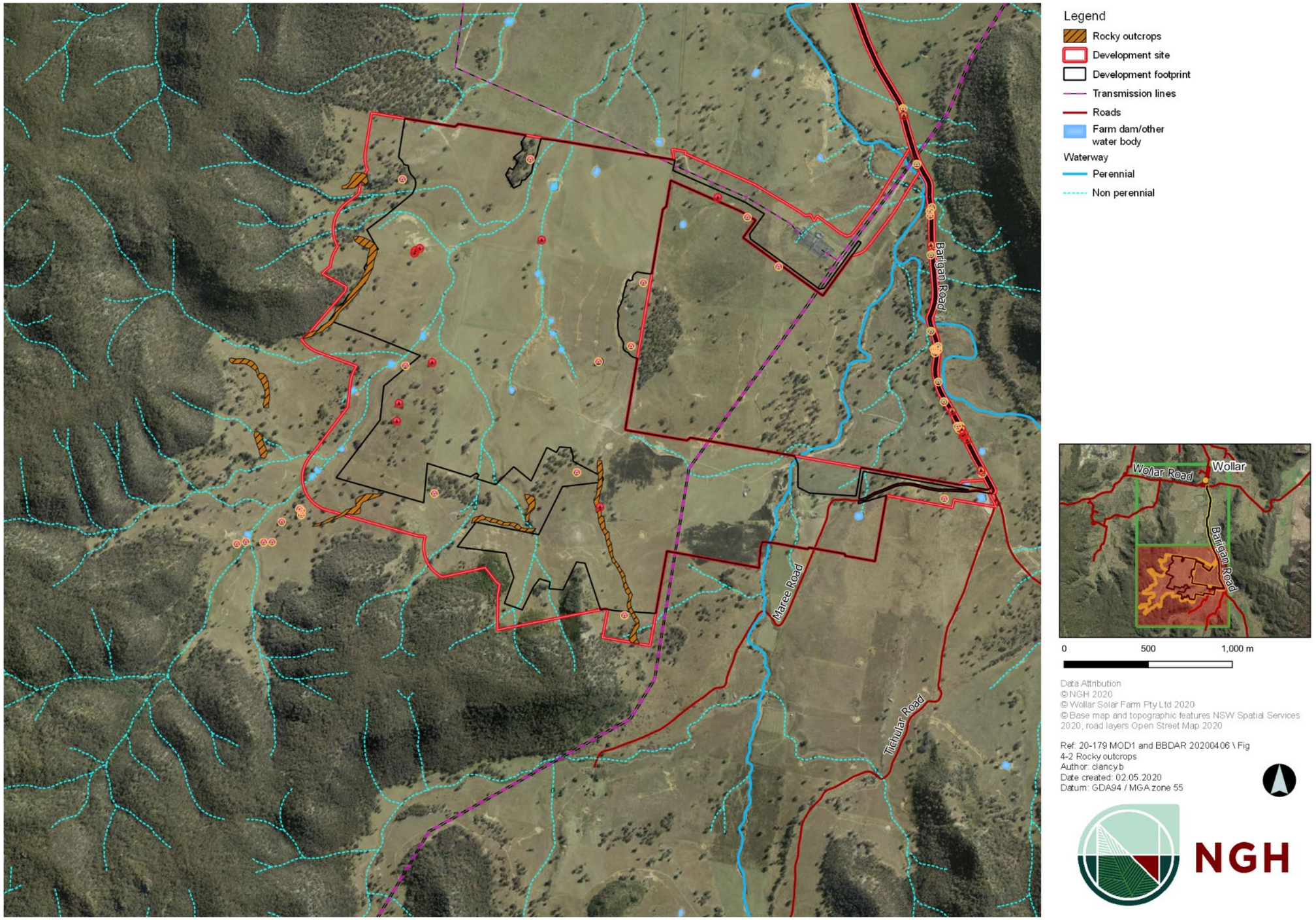


Figure 4-2 Rocky crevice habitat present within and close to the Development footprint

Figure 4-3 Examples of rocky crevices found within the development site.

4.4.2 Occurrences of rock

There are several distinct bands of Narrabeen Sandstone outcropping along the 70-80m contour line south and west of the development site as can be seen in Figure 4-4. In total, there are five separate areas consisting of rocky outcrops/crevices that required targeted survey for the following candidate species;

- Pink-tailed Legless Lizard (*Aprasia parapulchella*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*)
- Eastern Cave Bat (*Vespadelus troughtoni*)
- *Monotaxis macrophylla*
- Wollemi Mint Bush (*Prostanthera cryptandroides)*


Figure 4-4 Examples of rocky outcrops within the development site.

4.4.3 Occurrences of human made structures and non-native vegetation

There is one large agricultural building within the development footprint used to store farm machinery and one small tin shed within some stockyards located within the centre of the property. There is also one culvert within Wollar Creek on the substation access track near the intersection of Barigan Road (Figure 4-4 below). No evidence of use by Microchiroptera bats was observed during the field surveys. The culvert (Figure 4-) is unlikely to provide suitable roosting habitat for Large Bent-winged-bat because the culvert is quite short in length and exposed to the outdoor elements. The existing tunnel is not likely to allow any build-up of heat or humidity thus not providing ideal maternity habitat for the Eastern Bent-wing Bat (BioNet).

Figure 4-4 Small Culvert under access road to substation which is unlikely to provide any roosting habitat for Eastern Bent-wing Bat.

4.4.4 Hydrological processes that sustain and interact with the rivers, streams and wetlands

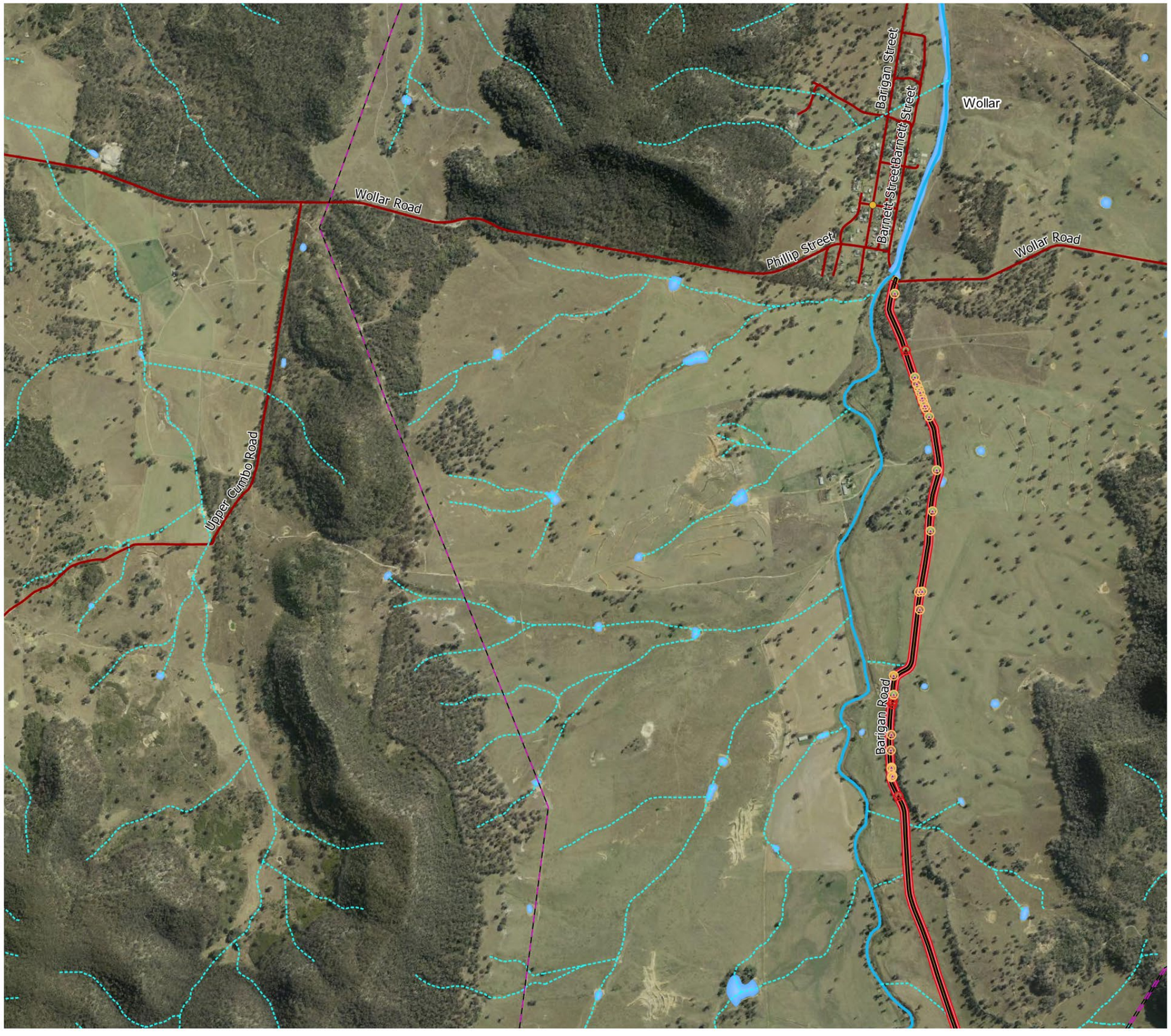
There are two main hydrological habitats within the Wollar Subject land. Spring Flat Creek (a fourth order watercourse) dissects through the middle of the development site (refer to Figure 4-). Spring Flat Creek did not contain any ponded water at the time of inspection during May 2018. The creek is ephemeral, only flowing during periods of high rainfall where it is presumed that much of this water lies under the ground within the sandy soils present. Several lesser order streams flow into Spring Flat Creek. All appeared dry at the time of inspection in May, August and October 2018.

There are numerous farm dams within the development footprint that provide water resources to sheep grazing over the land (Figure 4-).

There are 7 creek crossings consisting of 1 first order, 4 second order, 1 third order and 1 sixth order streams which may be impacted when widening this road.

A review of the candidate species (as listed in Table 4-3) indicates that some birds of prey like White-bellied Sea Eagle and Square-tail Kite may utilise hydrological habitats. Targeted surveys were carried out onsite that involved opportunistic survey of trees near water bodies and diurnal bird surveys (see Chapter 4.2.1).

Figure 4-5 Examples of hydrological habitats that are found within the development footprint. Farm dam (left) and dry creek bed (right).



Legend

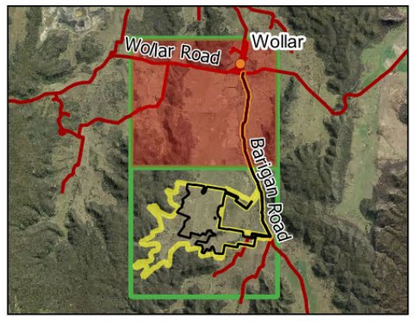
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial

Strahler stream order within subject land

- 1
- 2
- 3
- 4



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Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 4-6 Riparian habitat within Wollar development site
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

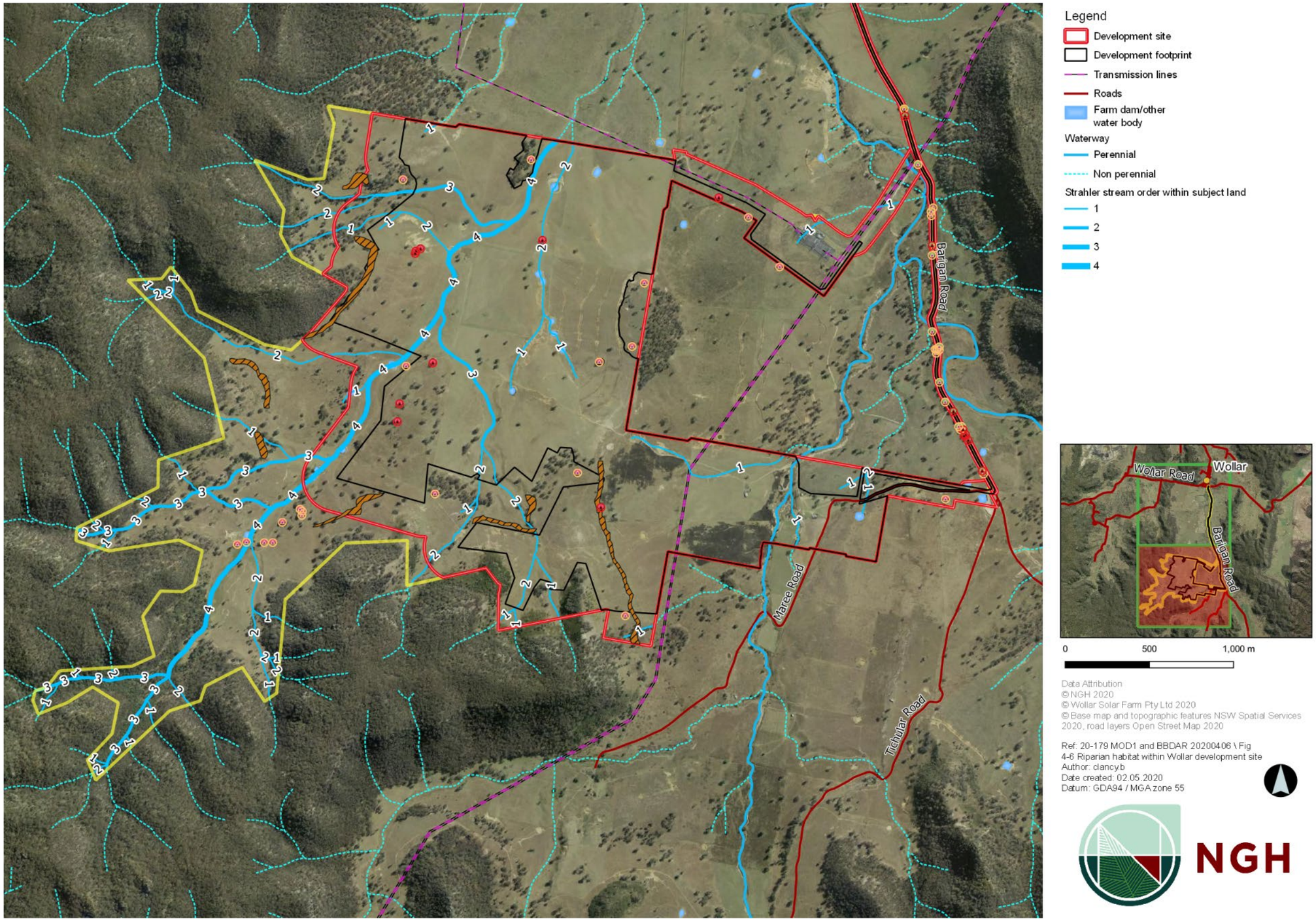


Figure 4-6 Riparian habitat within Wollar development site (shown over 2 maps)

5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on the 25th Jan 2018 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site (refer to Appendix C). Relevant to Biodiversity these include:

- Wetlands of International Importance
- Threatened Ecological Communities
- Threatened species
- Migratory species

Section 5.1 to 5.4 set out relevant matters to be considered under the Act.

Incorporation of MNES assessment in this BDAR

> *Following data collected during initial site surveys in May 2018, a referral to the Commonwealth Department of Environment and Energy commenced in July 2018. On 3 October 2018, the proposed Wollar Solar Farm was determined to be a controlled action for impacts on MNES protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Supplementary SEARs were issued for the project (provided in Appendix B: EPBC requirements which includes a checklist of where these matters are addressed in the EIS or this BDAR).*
>
> *The assessment of MNES is contained within this BDAR, as follows:*
>
> - *Sections 5.1 to 5.4 set out relevant matters to be considered under the Act.*
> - *Section 7.4 examines MNES impacts in detail, with reference to the additional surveys undertaken in October 2018 to address additional MNES requirements of the Supplementary SEARs.*
> - *Section 7.4 is supported by Appendix D EPBC Habitat Assessment Evaluations. This evaluation considers all entities returned in the MNES search and included in the Supplementary SEARs. In consideration of entity habitat requirements, the surveys undertaken onsite, the habitat that is available onsite and the likelihood of occurrence, the potential for impact is determined in this table.*
> - *Where entities are deemed to have less than a low risk of impact, an EPBC Assessment of Significant Impact is undertaken, Appendix E. The assessments also assist to target mitigation strategies as required.*
> - *Only for those entities where significant impact is evaluated likely to occur, are Commonwealth offsets required. Appendix F sets out the quantification of offsets for relevant entities.*
> - *Section 10.1.4 provides an offset strategy for relevant entities, as determined above.*

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Five wetlands of international importance were identified. The two closest wetlands (Hunter estuary wetlands & The Macquarie Marshes) are located 150-300km upstream of the Subject land. The remaining three wetlands are greater than 800 km from the development site and are not connected to the subject land.

There is no apparent connectivity between the Wollar Solar farm development site and the Macquarie River. All other wetlands returned from the search are over 500 km away.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Three Commonwealth listed Threatened Ecological Communities were identified in the PMST report. These TEC's are:

1. Central Hunter Valley eucalypt forest and woodland (Critically Endangered)
2. Upland Basalt Eucalypt forests of the Sydney Basin Bioregion (Endangered)
3. White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community.

One occurs onsite and would be impacted; 229.9 ha of remnant White Box – Yellow Box – Blakely's Red Gum Grassy Woodland (Box-gum woodland and derived native grassland). Of this 24.8 ha is considered high diversity structural woodland with 205.1 ha of derived native grassland (89%) which are relatively degraded.

Figure 5-1 illustrates the larger extent of Box-gum woodland/derived native grassland assumed to occur inside Wollar Valley. It was not possible to access these areas due to private property however trees and groundcovers were observed from public roads where possible to do so inside Wollar Valley.

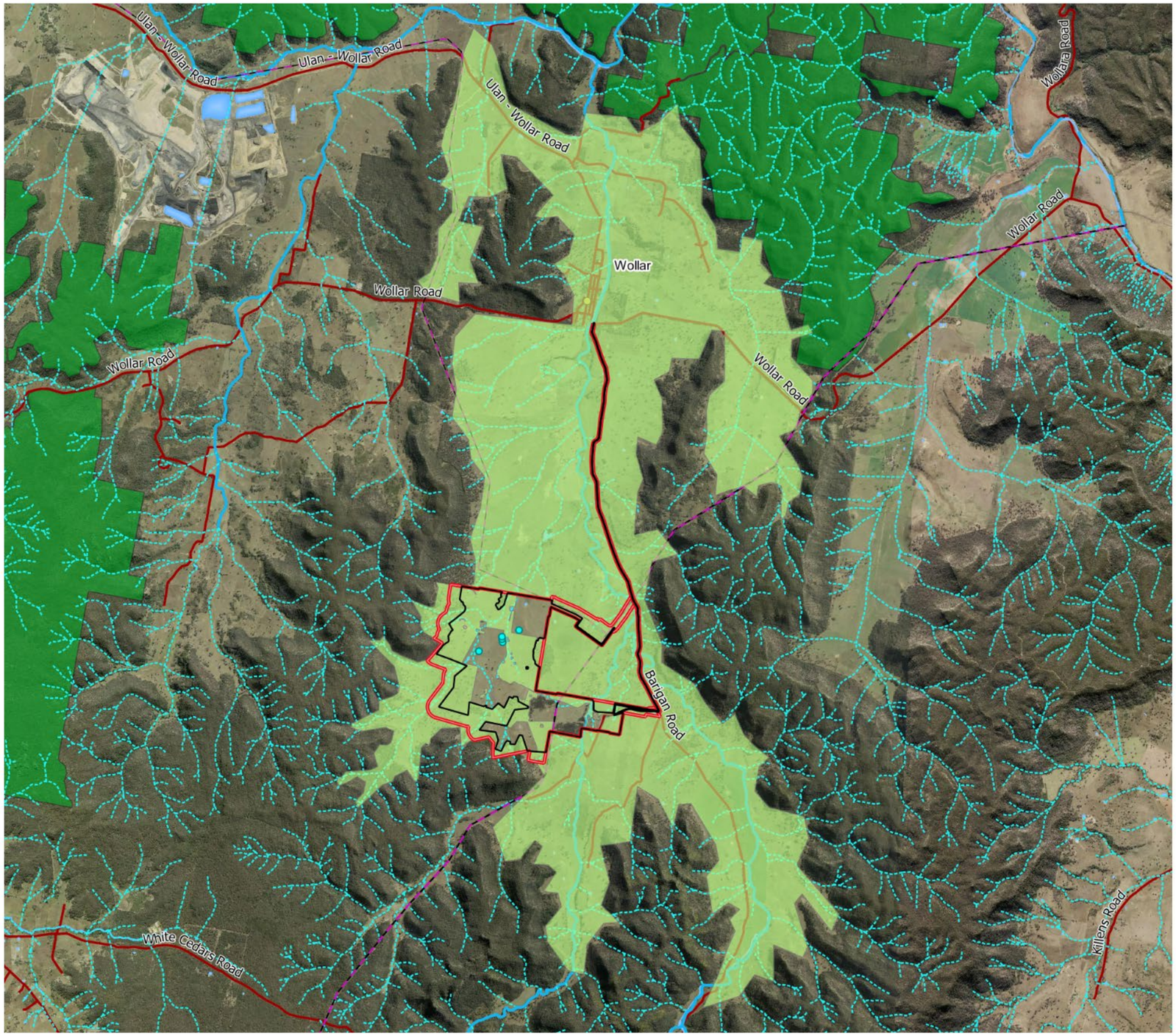


Fig 5-1 Larger extent of assumed box gum woodland

Legend

- NPWS Reserve
- Potential Box Gum Woodland or Derived Native Grassland
- Development site
- Development footprint
- Transmission lines
- Roads

Waterway

- Perennial
- Non perennial
- Farm dam/other water body

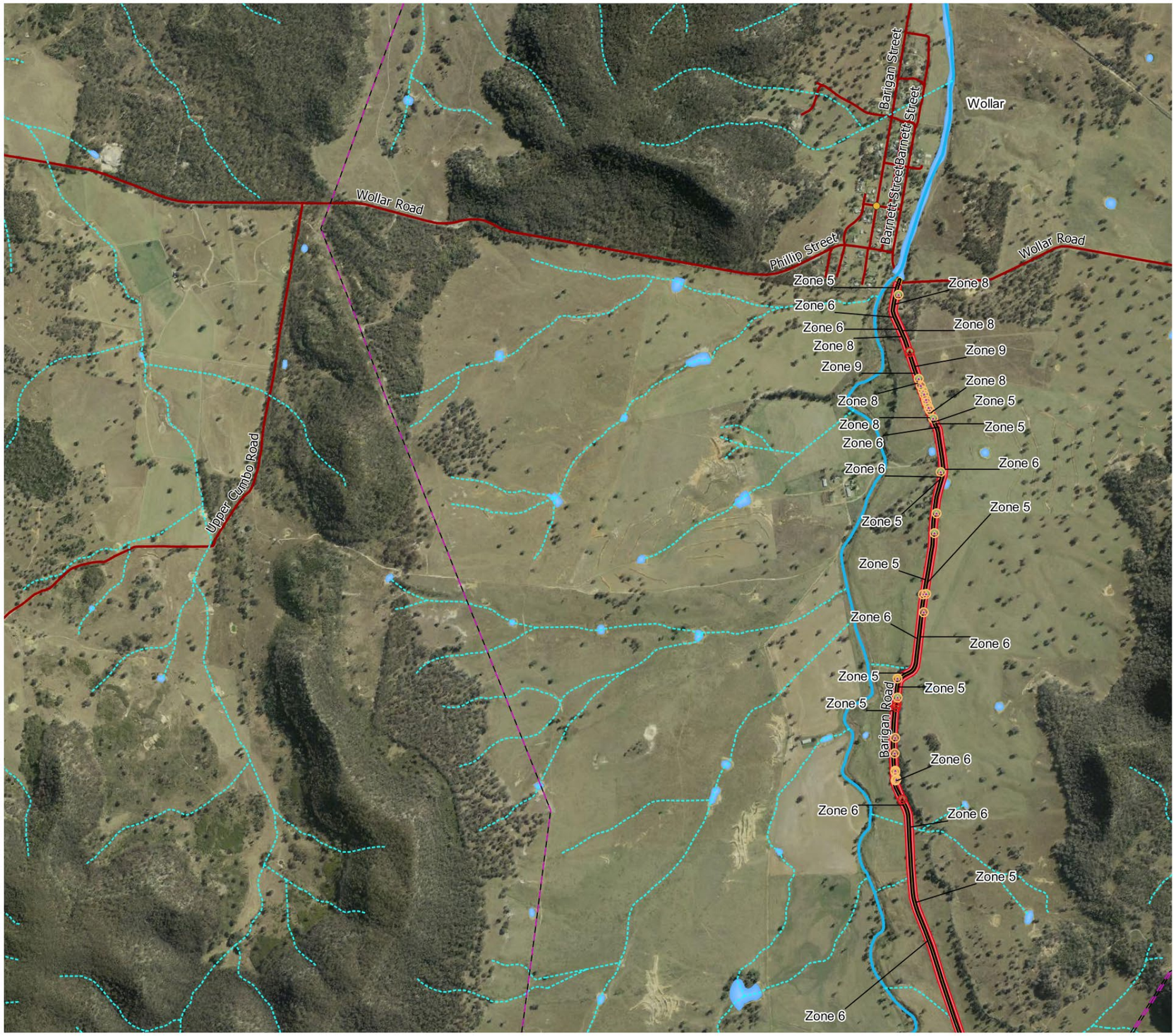
LGA: Mid-Western Regional
CMA: Hunter Central Rivers
IBRA Bioregion: Sydney Basin (SB)
IBRA Subregion: Kerrabee (SB01) and Wollemi (SB04)

0 1,000 2,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 5-1 Larger extent of assumed box gum woodland
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

Figure 5-1 Larger extent of assumed Box Gum Woodland inside Wollar Valley in relation to the development footprint.



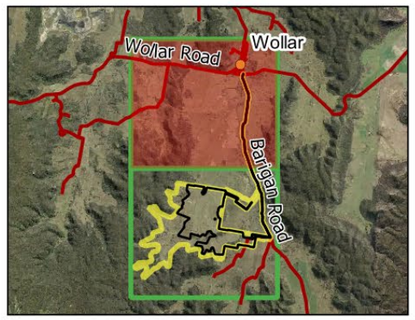
Legend

Vegetation zones

- EPBC Classified: Zone 5 PCT281: BGW
- EPBC Classified: Zone 6: PCT281: Derived
- Not EPBC Classified Zone 8: PCT1610: Forest
- Not EPBC Classified Zone 9: PCT1610: Degraded
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 6-1 Vegetation zones EPBC zones
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

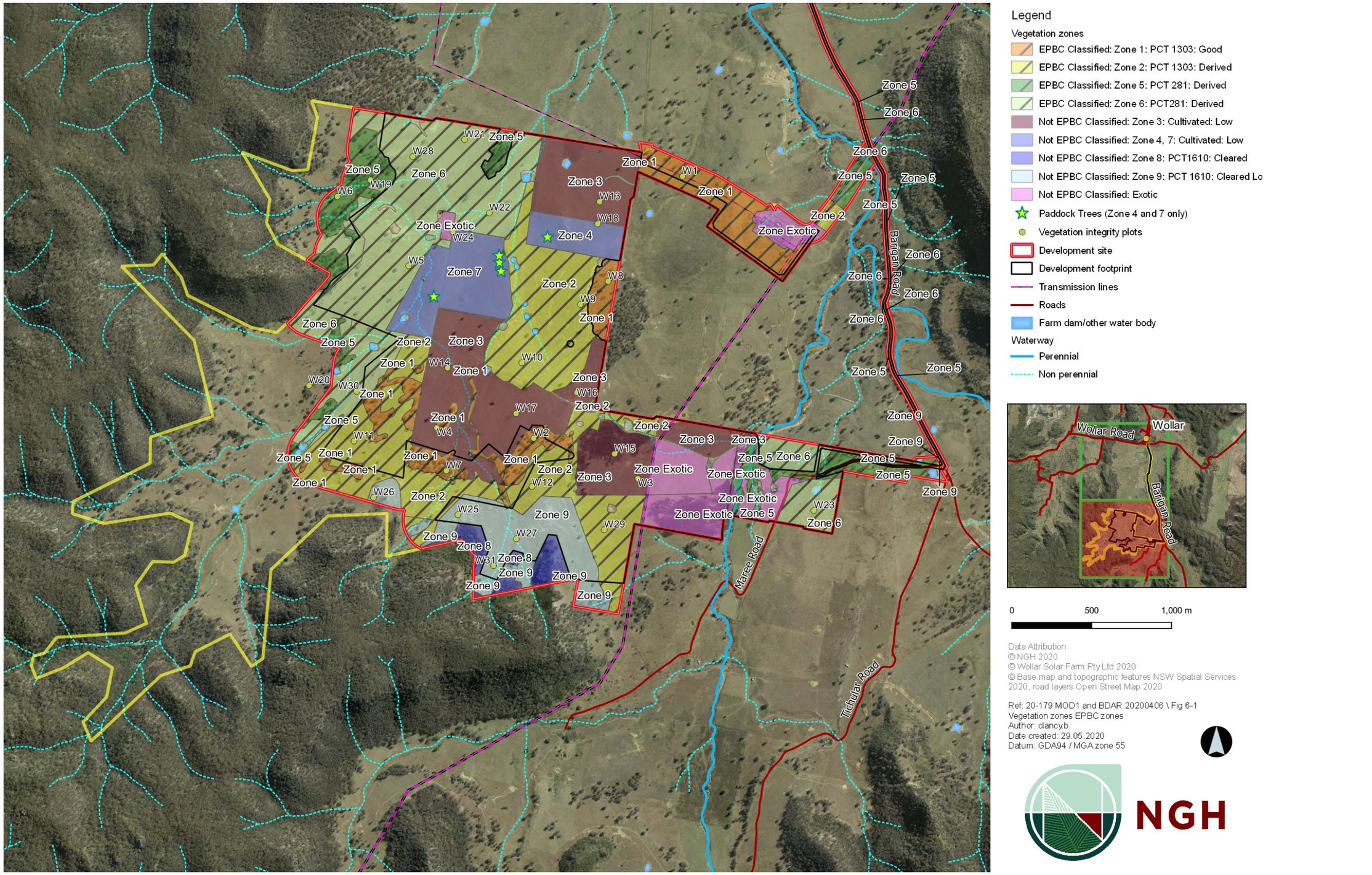


Figure 5-2 Confirmed extent of Box-Gum Woodland and Derived Native Grassland EPBC listed CEEC inside the development site (shown over 2 maps).

5.3 THREATENED SPECIES

Thirty-three threatened species were returned from the protected matters report. Of these, nine are considered to have the potential to utilise the habitats at the development site of which all have been adequately surveyed for to determine potential presence;

- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered EPBC Act
- Spotted-tailed Quoll (*Dasyurus maculatus*) – Endangered EPBC Act
- Painted Honeyeater (*Grantiella picta*) – Vulnerable EPBC Act
- Pink-tailed Legless Lizard (*Aprasia parapulchella*) – Vulnerable EPBC Act
- Brush-tailed Rock-wallaby (*Petrogale penicillata*) – Vulnerable EPBC Act
- Swift Parrot (*Lathamus discolor*) – Critically Endangered EPBC Act
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable EPBC Act
- Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable EPBC Act
- Koala (*Phascolarctos cinereus*) – Vulnerable EPBC Act

Based on the survey results, three were considered to have potential for greater than low impacts:

- Large-eared Pied Bat
- Regent Honeyeater
- Pink-tailed worm-lizard

The Large-eared Pied Bat was recorded via ultrasonic detector during the October surveys with further assessment of potential impacts undertaken and discussed in Section 7.

Based on the comprehensive reptile, mammal and bird surveys undertaken (in accordance to EPBC threatened survey guidelines and habitat evaluation), no other listed MNES are considered likely to occur in the development site regularly or rely on the habitats present.

5.4 MIGRATORY SPECIES

Eleven listed migratory species were returned from the protected matters report. Two of these species may utilise box gum woodland habitat within the development site.

- Satin Flycatcher (*Myiagra cyanoleuca*)
- Rufous Fantail (*Rhipidura rufifrons*)

None of these species were detected during diurnal bird surveys undertaken. It is concluded that they are unlikely to occur within the development site regularly or would rely on the habitats present.

6 AVOID AND MINIMISE IMPACTS

6.1 AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT

6.1.1 Site selection – consideration of alternative locations/routes

Photovoltaic solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. In terms of its impacts on biodiversity, PV solar installation creates minimal ground disturbances where footprint, mounts being either pile driven or on small footings.

However, the impacts of shading on groundcover species composition over the long term is largely unknown. Solar panels will cause extensive shading over the site. Seventy-four percent of the development footprint contains TEC. It is not known whether shading would lead to a change in groundcover species composition so in taking a precautionary approach it would have to be assumed to be an impact unless proven otherwise. The layout can be flexible to minimising impacts on site constraints and therefore avoid areas of better quality TEC. The Wollar Subject land was considered to be feasible because:

- It has been established within a landscape with little or sparse tree cover which is disturbed by farming practices, including cultivation and grazing,
- It has excellent solar exposure
- It has excellent access to local and major roads
- It has excellent access to the grid transmission network
- There are a low number of non-involved neighbouring dwellings
- It has favourable, low relief terrain

The Draft Large Scale Solar Energy Guideline for State Significant Development (SSD) provides recommendations regarding selection of suitable solar farm sites and areas of constraint that should be identified. These are addressed in Table 6-1 and Table 6-2 for the site.

Table 6-1 Site selection criteria: preferable site conditions

Preferable site condition	Site observation
Optimal solar resources	Good solar irradiance observed
Suitable Land	Low relief land far from existing development.
Local impacts minimised	Consultation underway.
Capacity to rehabilitate	Minimal site disturbance, if using pile driven array mounts.
Community support	Consultation underway
Proximity to electrical network	Close to existing substation. Connection point crosses site.
Connection capacity	Optimal location to connect to the existing transmission network with high grid system strength

Table 6-2 Site selection criteria: Areas of constraint

Areas of constraint	Site observation
Native vegetation	Much of the site is devoid of trees and has been subjected to past agricultural use.
Potential residences	Few residential receivers.
Waterways	Few permanent waterways.
Aboriginal/Heritage significance	Requires investigation.
Important agricultural land	Not mapped as Biophysical Strategic Agricultural Land (BSAL)
Residential zones	No residential zones.
Resource developments	No current mineral leases.

Photovoltaic solar technology was chosen because it is cost effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site.

The mixture of fixed and tracking panels is to be determined after further analysis.

6.1.2 Proposal components – consideration of alternate modes or technologies

Other alternative sources of energy generation include coal mining, hydro-electric, wind, tidal and thermal industries.

Coal is a finite resource and contributes to green-house gas emissions. Mudgee and Wollar Valley surrounds are known areas containing coal seams with Wilpinjong open cut mine to the north west of the development site. Establishing new coal mines is likely to generate more direct and indirect impacts as a result of extracting ore and the need for stockpiling the waste in tailings ponds.

For hydro-electric industries to work, they require specialised landscapes and large water bodies. These resources are not present at Wollar Valley.

According to the Clean Energy Council of Australia, wind turbines are proving a popular renewable energy resource contributing to 5.7 percent of Australia's electricity generation. Their success is dependent on exposure to consistent winds for the site to be feasible. According to Wind power Engineering and Development 2013, valleys (such as Wollar valley) are not optimal for wind turbines because the terrain surrounding the valley shelters the site from consistent winds leading to inefficient electricity generation.

Tidal energy requires oceanic waters to generate electricity. As Wollar Valley is inland this option is not a feasible choice for producing power at the site.

Geothermal energy uses the earth's natural internal heat to generate electricity and heating. Geothermal energy may be stored in granite rocks or trapped in liquids such as water and brine (referred to as hydrothermal process). AREANA's international geothermal expert group found that utility-scale generation from geothermal projects was not expected to be commercially viable by 2020. The technology was only

expected to become competitive with traditional fossil fuel power generation by 2030 with the help of a high carbon price and in the most favourable scenario for cost reductions.

6.1.3 Proposal planning phase – detailed design

A preliminary constraints analysis was conducted by NGH Environmental in April 2018, which was then followed up with further field work (to stratify the property into vegetation zones) which informed the site layout design. Vegetation constituting the highest ecological constraints such as forming high quality TECs, as well as providing key threatened flora and fauna habitat were avoided and minimised as far as practical by;

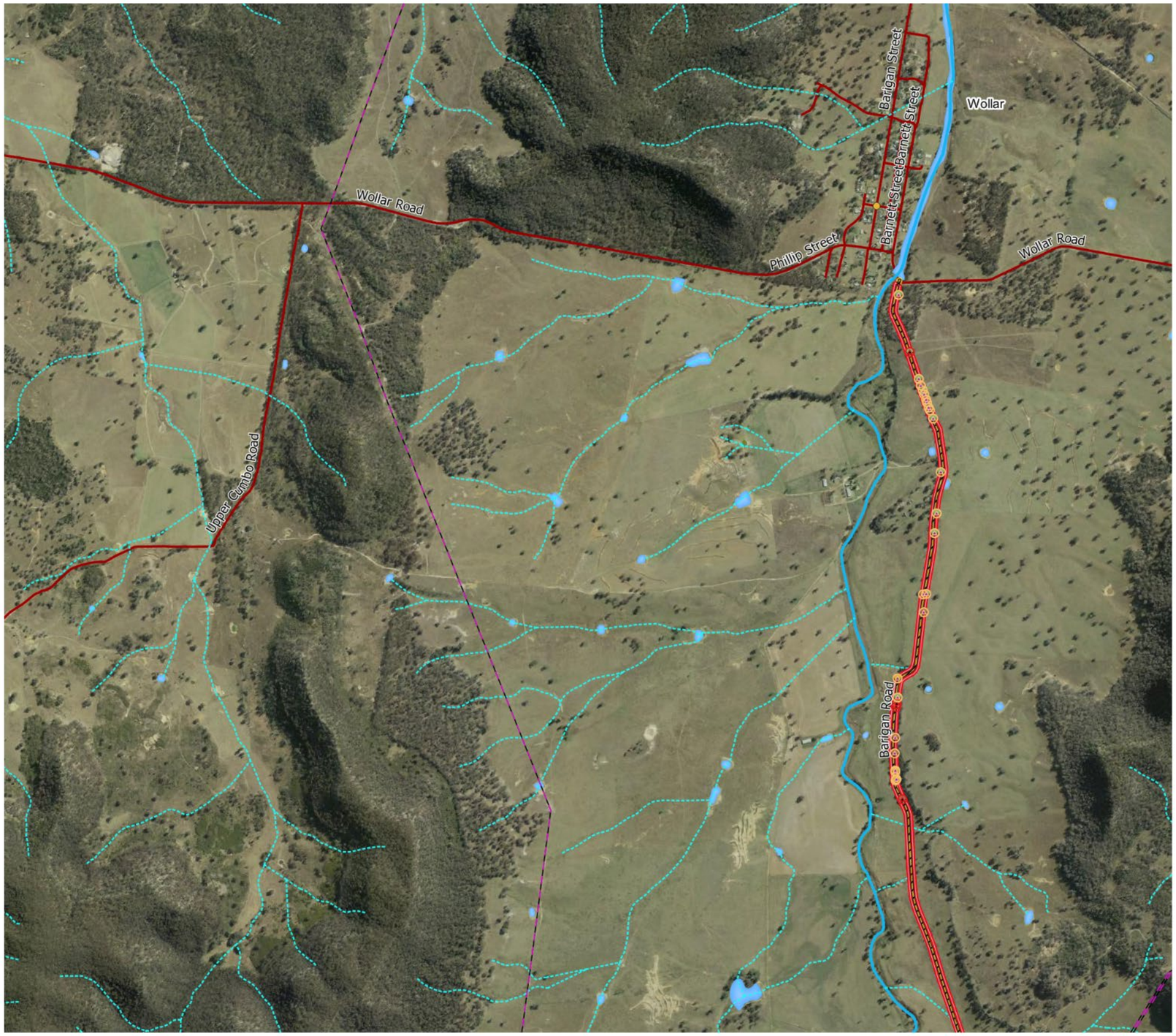
- Reducing the clearing footprint of the project and avoiding trees and woodland areas wherever possible to do so,
- Locating ancillary facilities in areas where there are minimal biodiversity values, such as where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score),
- Minimising development within areas containing high constraint vegetation (e.g. an EEC and CEEC),
- Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.

The current site layout and location has not been able to completely avoid all areas of native vegetation because of the distribution of resources over the development site and is still considered indicative and a worst-case scenario, ahead of final construction drawings.

Designing a panel layout to avoid all TEC onsite would essentially render the site unfeasible for solar panels. As such, some areas of the more degraded TEC will need to form part of the development footprint. Refer to Figure 6-1 below for a map of areas which are defined as TEC onsite. Although the indicative development footprint shows clearing across the whole area, solar panels are to be constructed in blocks across the development footprint, solar panels are able to be arranged in segmented rows to accommodate the area that is available. While a typical / generic layout for a 5 MW generation block (on open land) is generally proposed to cover an area of approximately 182 metres by 231 metres this physical layout can be easily modified where land constraints including some areas of TEC make this exact configuration impractical. In practice the rows of panels can be physically laid out in any geometric configuration and then electrically grouped to form a 5 MW generation block.

Additionally, road upgrades for access to the site along Maree Road will be reduced upon final design. As mentioned above, and although assumed that up to 24.59 ha of high diversity structural Box Gum Woodland (Zone 1 and Zone 5) may require removal, it is anticipated that following final design of the access roads along Maree Road and final proposal design, a reduction in the amount of better condition Box-gum Woodland can be reduced by a further 30%. The current design footprint is detailed in Figure 6-2. Specifically, it is noted that:

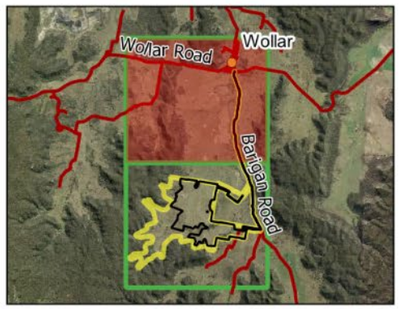
- Development areas maximise the use of cultivated and non-native vegetation.
- Most hollow bearing trees are avoided.
- All mapped Regent Honeyeater habitat has been able to be avoided.
- Most high diversity CEEC has been avoided.
- Waterway and riparian areas are buffered, and water crossings limited to the essential site requirements.



Legend

Vegetation zones
- Zone 6: PCT 281: Derived (NSW EEC)
- Development site
- Development footprint
- Transmission lines
- Roads
- Farm dam/other water body

Waterway
- Perennial
- Non perennial



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Ref: 20-179 MOD1 and BDAR 20200406 \ Fig 6-1
Vegetation zones NSW TEC
Author: clancy.b
Date created: 19.05.2020
Datum: GDA94 / MGA zone 55

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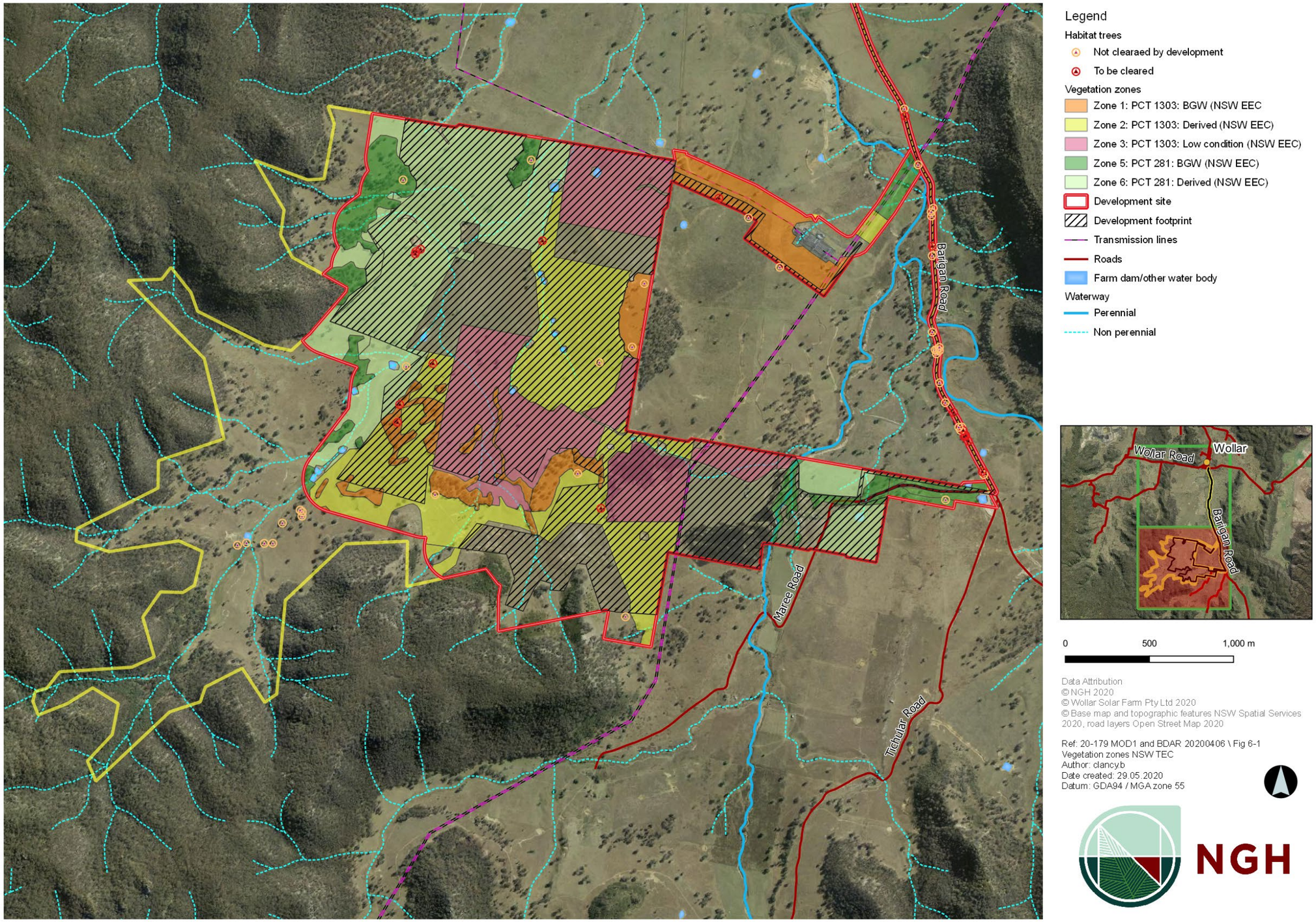
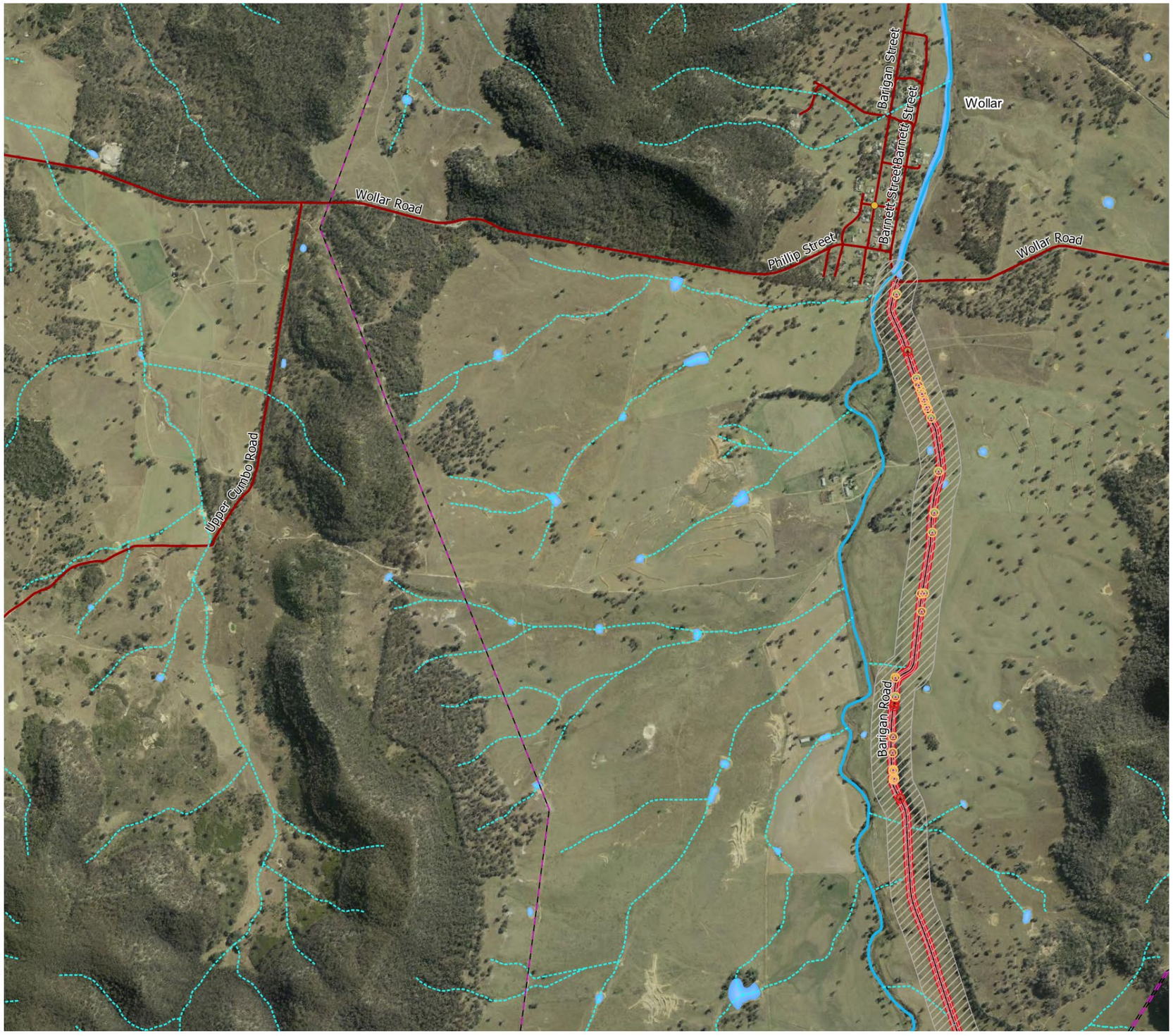


Figure 6-1 TEC (NSW EEC) within the development site (Zones 1, 2, 3, 5 and 6).

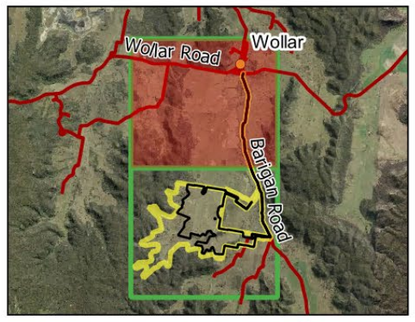


Legend

- Development site
- Development footprint
- Indirect impact area (100m buffer)
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 7-2 Indirect impacts
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

NGH

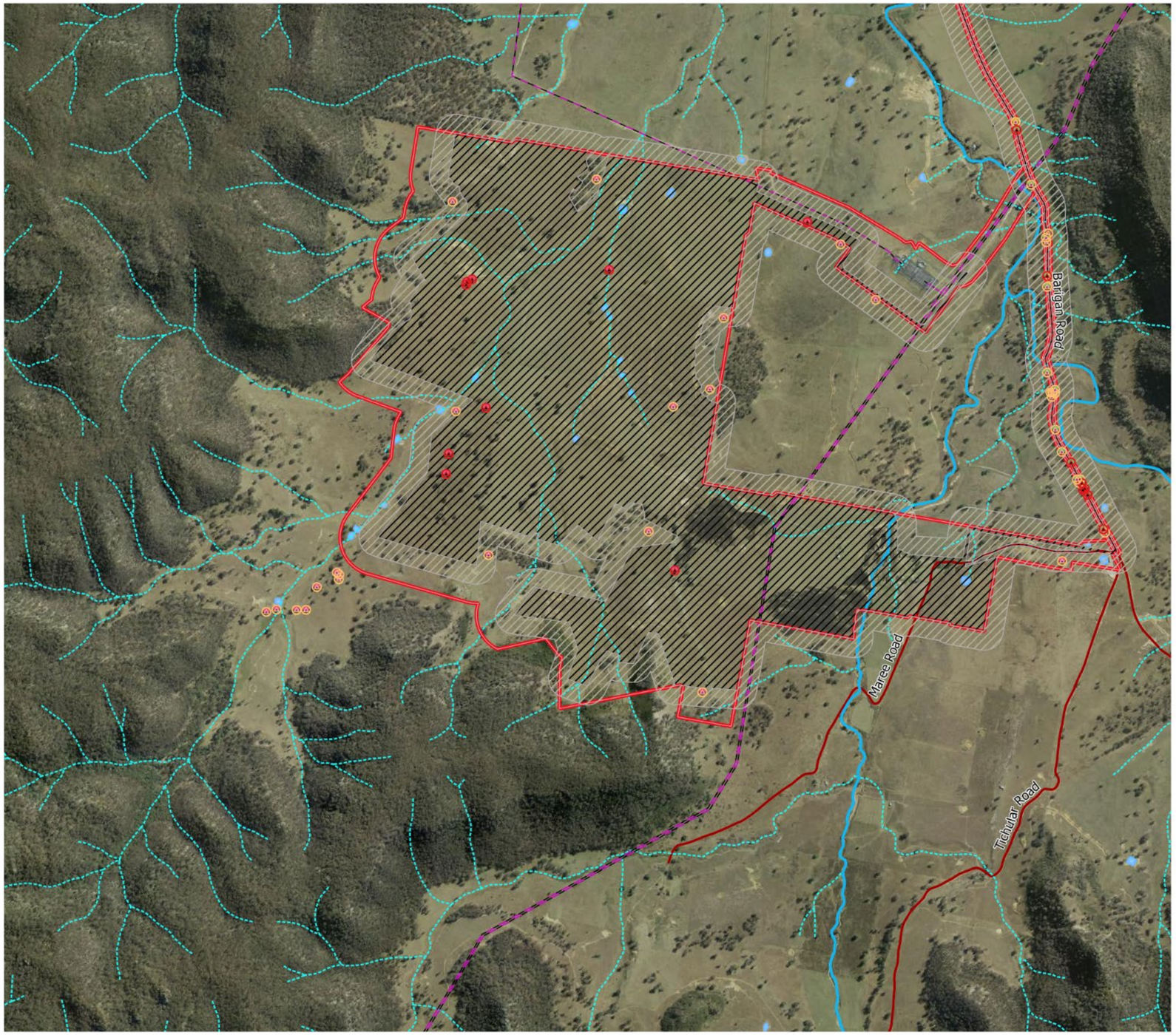


Figure 6-2 Development footprint, Development site and area of indirect impact (shown over 2 maps).

6.2 AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme:

The following prescribed impacts are relevant to the proposal:

- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range
- Impacts of development on movement of threatened species that maintains their life cycle
- Impacts of development on the habitat of threatened species or ecological communities associated with human made structures or non-native vegetation
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

How these prescribed impacts have been avoided and minimised by the proposal is detailed below.

6.2.1 Impacts of development on the connectivity of different areas of habitat or threatened species that facilitate the movement of these species across the range.

Major habitat features within the Wollar Valley include;

- Woody and steep ridgeline vegetation with rocky scarps found above the Wollar Valley,
- Box gum woodland and derived native grasslands found on the plains of Wollar Valley,
- Rivers and streams across the Wollar Valley.

In terms of connectivity of woody vegetation, there is some minor tree connectivity (where trees are less than 50m away from each other) running east to west across the southern section of the development footprint. The connectivity of trees (off the property boundary and to the east) is already broken by greater than one hundred metres separating isolated trees. As such the existing connection is considered very weak and generally not feasible in providing habitat links to more extensive woody vegetation that is found 2.5km east and would only provide connection habitat opportunity for highly mobile species such as birds (Parrots, Honeyeaters, Cockatoos).

In Version 1 and 2 of the BDAR, the Wollar Solar Farm layout purposefully avoided development within 'important areas mapping' for Regent Honeyeater based on latest mapping for Regent Honeyeater supplied by Shannon Simpson via email 3rd Sept 2018 (Refer to Figure 6-3). As of May 2020, updates to important areas mapping for Regent Honeyeater (provided online via BOAMS) was able to be downloaded and show that additional areas of mapping now exist within the approved development footprint. A phone call to the BCD (Pers comm. David Geering on 11/5/20) clarified that further assessment of important areas mapping was not needed within areas already approved and no further assessment under Ch 10.2 of the BAM is required for these areas.

The Version 3 BDAR has bee prepared to support a modification application to move an access track further south within the TransGrid substation. In reviewing the updated mapping downloaded from BOAMS (refer to Figure 6-4), it now illustrates a narrow linear polygon of 'important areas mapping' within this area. It intersects the approved TransGrid substation track (as assessed in BDAR Ver 2) as well as the relocated access track (0.016ha), the subject of this version 3 BDAR. In reviewing the habitat needs for Regent Honeyeater (being the presence of Box Gum trees), it is apparent that the updated mapping does not correlate with suitable habitat for Regent Honeyeater. The updated mapping is drawn over the existing TransGrid substation infrastructure and appears to be a mapping error. Advice was sought from the BCD (email from Gillian Young

to David Geering, dated 11/5/20) seeking clarification of this matter. A response was received from the BCD that vegetation mapping which classifies the area as Yellow Box -Blakelys Red Gum Grassy Woodland was incorporated into updated Regent Honeyeater important areas. It was confirmed to be a mapping error associated with past vegetation mapping. As such, no further assessment for SAII is considered necessary for Regent Honeyeater to support the Version 3 BDAR.

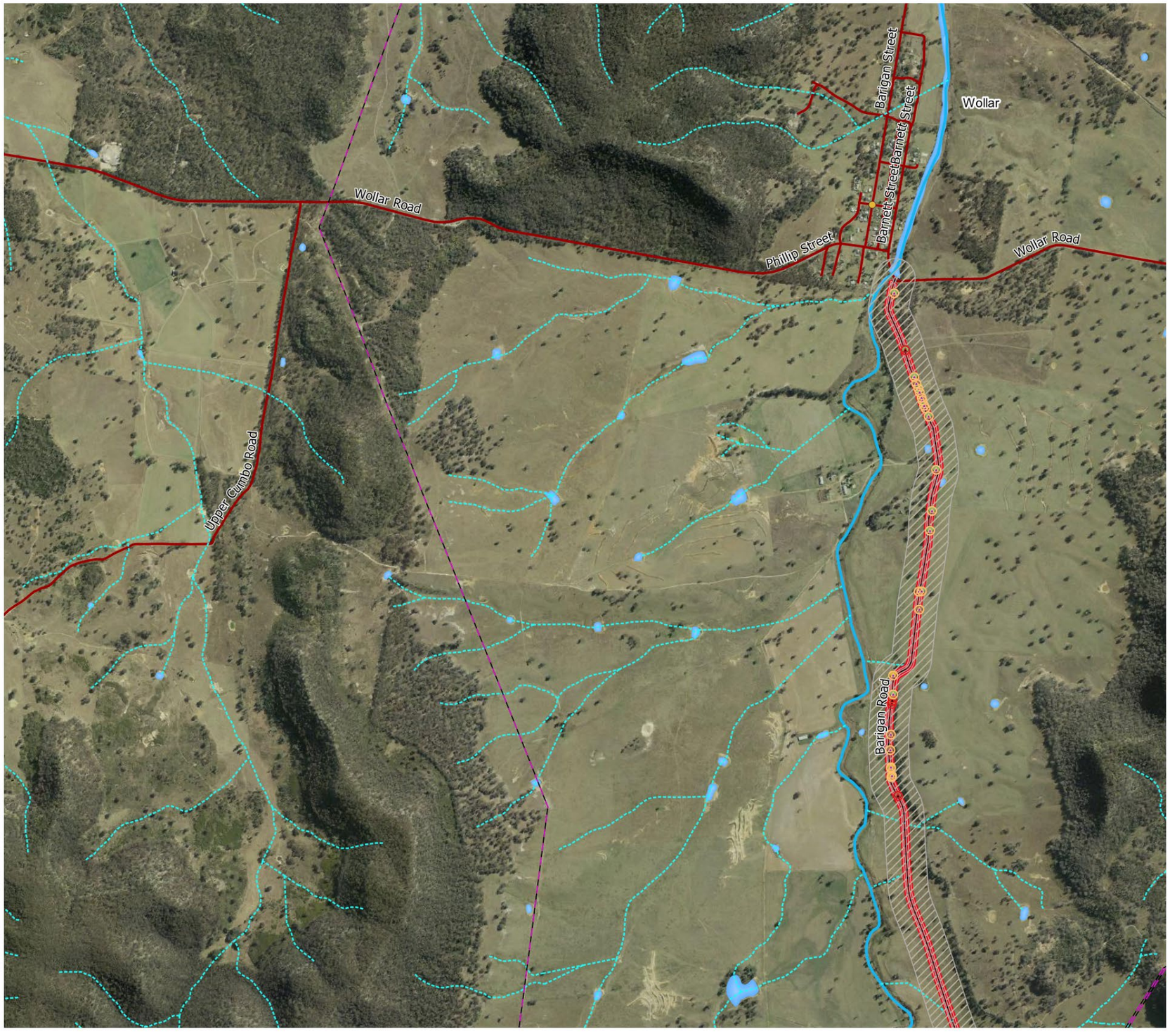
In terms of native groundcover requiring assessment under the BAM, it is assumed that the development footprint will impact on approximately 342.7 ha. Although the area of native grasslands to be impacted is quite large, the expanse of native grasslands remaining within the Wollar Valley (that will not be impacted) is greater than 8000ha. Also, the area of grassy groundcover within the development site has been subjected to intensive farming disturbances including cultivation and regular grazing by sheep. Vegetation integrity plots undertaken substantiate groundcover was influenced by exotic flora in many areas or compacted with many areas containing bare ground devoid of groundcover. As such, the removal of native groundcover in the context of impacting on a large quantity of derived grassland habitat is considered negligible.

6.2.2 Impacts of development on movement of threatened species that maintains their life cycle

In term of key habitat for threatened species onsite, they include:

- Box Gum Woodlands (where trees are less than 50m apart),
- Isolated hollow bearing trees,
- Rocky scarps,
- Areas of thick native groundcover,
- Watercourses, especially where areas contain large eucalypts.

The development footprint chosen has attempted to avoid as much key habitat as possible and where this cannot be avoided then more degraded habitat was targeted for impact. Modifications to the development footprint were undertaken to avoid important mapped areas for the regent honeyeater as well as avoiding the majority of better quality TEC that is considered to the meet the requirement of MNES. No impacts would occur to the movement of threatened species across the landscape. Refer to Figure 6-3 below.

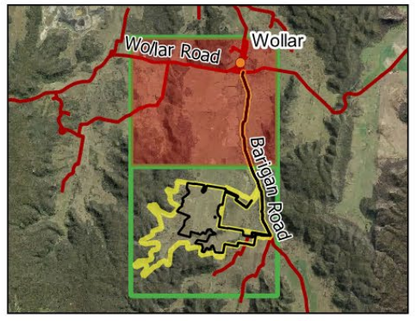


Legend

- Regent Honeyeater
- Development footprint
- Indirect impact area (100m buffer)
- Development site
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



Ref: 20-179 MOD1 and BBDAR 20200406 \ Fig 6-3 Regent honeyeater mapped
Author: clancy.b
Date created: 02.05.2020
Datum: GDA94 / MGA zone 55

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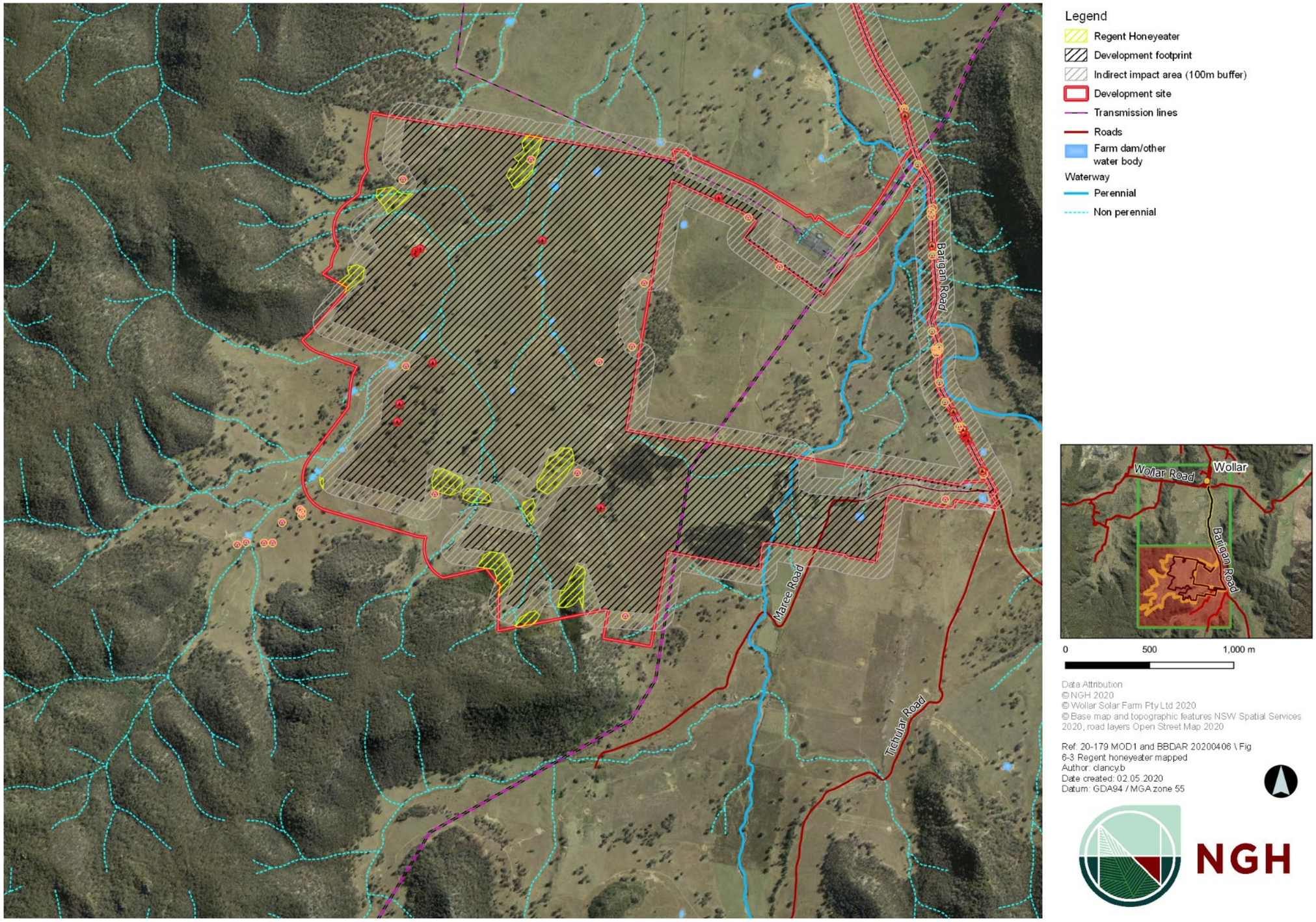
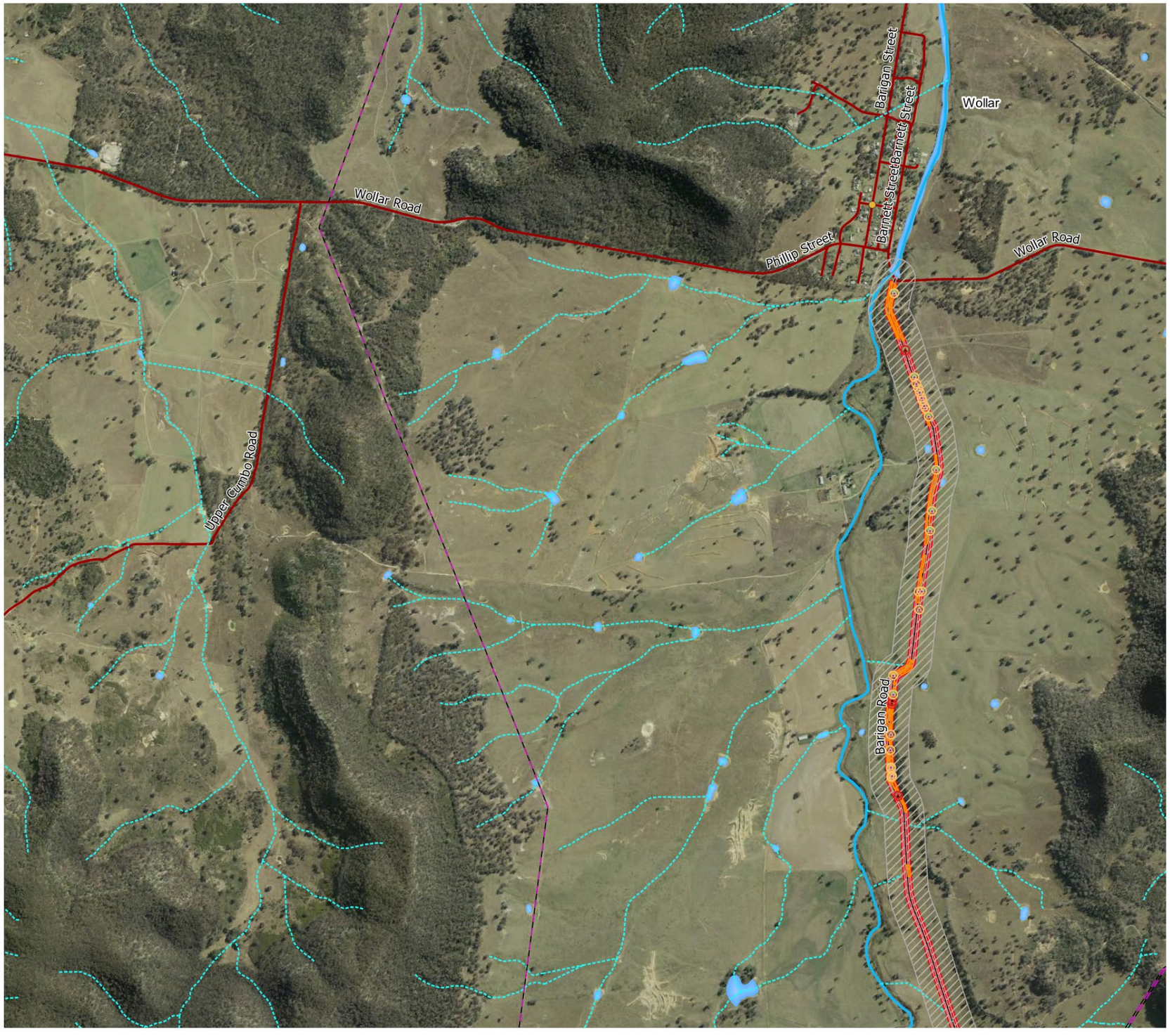


Figure 6-3 Original Regent Honeyeater 'Important Habitat Mapping' as presented by LMBC/OEH in Sept 2018 (yellow hatching) inside the development site (shown over 2 maps).

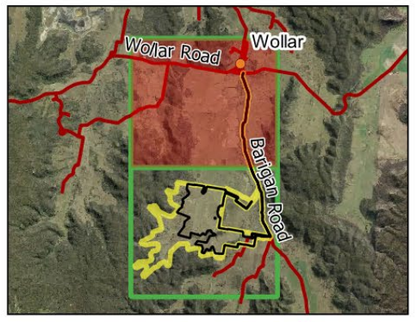


Legend

- Regent Honeyeater update
- Development footprint
- Indirect impact area (100m buffer)
- Development site
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



Ref: 20-179 MOD1 and BDAR 20200406 \ Fig 6-4
Regent honeyeater updated map
Author: clancy.b
Date created: 19.05.2020
Datum: GDA94 / MGA zone 55

NGH

Updated

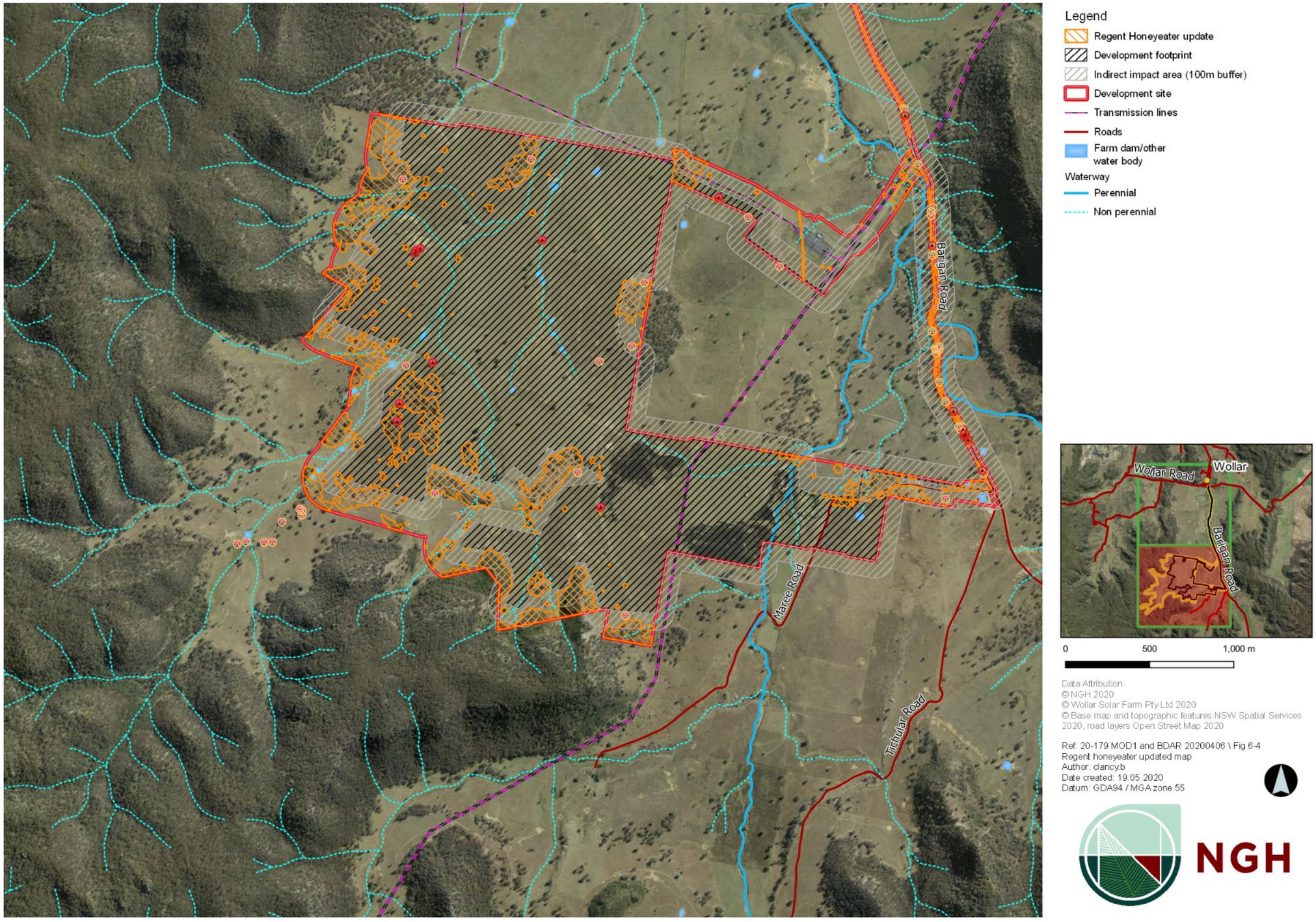


Figure 6-4 Updated Regent Honeyeater 'Important Habitat Mapping' downloaded from BOAMS in May 20 (orange hatching) inside the development site (shown over 2 maps)

6.2.3 Impacts of development on habitat of threatened species or ecological communities associated with human made structures or non-native vegetation

An agricultural shed (within the south east corner of the development site) could provide potential roosting habitat for Eastern Bentwing-bat and other threatened bats that roost in buildings. The Eastern Bent Wing Bat was detected onsite via ultrasonic detection during targeted survey however upon inspection of the agricultural shed, and there being no evidence of use by microbats this structure was ruled out in forming potential habitat. Better quality habitat occurs in the surrounding sandstone ridgelines with abundance of crevices and overhangs present.

A road culvert is present within Wollar creek road crossing on the access track to the substation (see Figure 4-4). On inspection the culvert is highly unlikely to be utilised for microbats due to its exposure onsite. The culvert will not be impacted directly but may be impacted indirectly, especially if there is an increase in the volume of traffic onsite and size of vehicles using the road.

No substantive impacts for habitat of threatened species or ecological communities associated with human made structures or non-native vegetation are anticipated.

6.2.4 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Spring Flat Creek is a fourth order watercourse, which runs through the centre of the Wollar subject land and development site. The creek itself, although a fourth order stream, has no distinguishable bed and banks, primarily due to the large size of Wollar Valley being a broad expansive flat where energy dissipation of water is very low. The creek itself is spread over a wide flat plain and any water does not concentrate into a channel. No ponded water was observed at the time of inspection in May 2018. Much of its water resources, especially during drier times would be contained within the alluvial sands underground. Based on observation during May 2018, it is assumed that Spring Flat Creek and its associated tributaries are dry most of the time and would only flow during heavy rainfall events. A network of dams exists on Spring Flat Creek providing more permanent water resources to stock.

Due to the ephemeral nature of Spring Flat Creek, the placement of infrastructure within riparian buffers is considered feasible. The designated 40 metre buffer zone either side of the centreline of this creek is devoid of trees and shrubs and is highly degraded. It is not optimal habitat for birds of prey due to the lack of permanent water onsite. The establishment of solar panels is not expected to generate many indirect impacts. There will be minimal ground disturbance when installing the infrastructure. The most impacting activity would be constructing new roads and hardstand areas with the highest impact occurring during construction. Due to the local topography being largely flat and mildly sloping, the momentum of runoff during heavy rainfall events is not expected to cause flash flooding or impact on any watercourses onsite.

The impacts on watercourses from road works to expand the width of Barigan road (to support large machinery during construction) cannot be avoided and is considered the most feasible for minimising impacts to riparian zones. The construction of alternative roads (to gain access) would also need to cross riparian land.

6.2.5 Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

The proposal would not directly increase impacts of vehicle strikes on threatened species. Threatened species would not be funnelled into transport corridors as a result of the development proposed. However, an increase in vehicle traffic is likely to indirectly increase (albeit marginally) the risk of vehicle strikes on common species such as Kangaroos and Wombats as well as common and threatened avifauna such as the Regent

Honeyeater. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes.

7 IMPACTS UNABLE TO BE AVOIDED

7.1 DIRECT IMPACTS

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure.

Table 7-1 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	463.28 ha (assuming total impact over development footprint)	Regular	Construction	Direct loss of native flora and fauna habitat Potential impacts of additional clearing outside the proposed development footprint Injury and mortality of fauna during clearing of fauna habitat and habitat trees Disturbance to stags, fallen timber, and bush rock
Displacement of resident fauna	Unknown	Regular	Construction, operation	Direct loss of native fauna Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction	Direct loss of native fauna Decline in local fauna populations
Removal of habitat features e.g. HBTs	9 HBTs (Wollar property) 55 HBTs (Barigan road reserve) 7 waterbodies	Regular	Construction	Direct loss of native fauna habitat Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	368 ha	Regular	Operational Phase: Long-term	Indirect impacts of altered light (i.e. shading) on derived native grasslands of TECs which could lead to altered species composition and cover abundance. Modification of native fauna habitat. Potential loss of ground cover

Nature of impact	Extent	Frequency	Duration and timing	Consequence
				resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent infrastructure (Fencing)	Approx. 15.6km	Regular	Operational Phase: long-term	Reduced fauna movements across landscape due to fencing. Collision risks to birds and microbats due to fencing.

7.1.1 Changes in vegetation integrity scores

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 7-2 below. For the purpose of this preliminary BDAR, it is assumed that there will be total removal/modification of all vegetation zones, leading to future scores of zero.

Table 7-2 Table of current and future vegetation integrity scores for each vegetation zone within the development footprint.

Zone ID	PCT	NSW EEC and/or threatened species habitat?	Area (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
1	1303_BoxGumWL	Yes	16.82	56.8	0
2	1303_Derived Native GL	Yes	102.30	9.4	0
3	1303_Cultivated_Low	Yes	110.72	11.4	0
4	1303_Exotic (Paddock tree)	No	12.81	NA	NA
5	281_BoxGumWL	Yes	7.99	59.6	0
6	281_Derived Native GL	Yes	102.83	11.9	0
7	281_Exotic (Paddock tree)	No	31.64	NA	NA
8	1610_Good	No	0.14	27	0
9	1610_Degraded	No	27.07	2.3	0

7.1.2 Loss of species credit species habitat or individuals

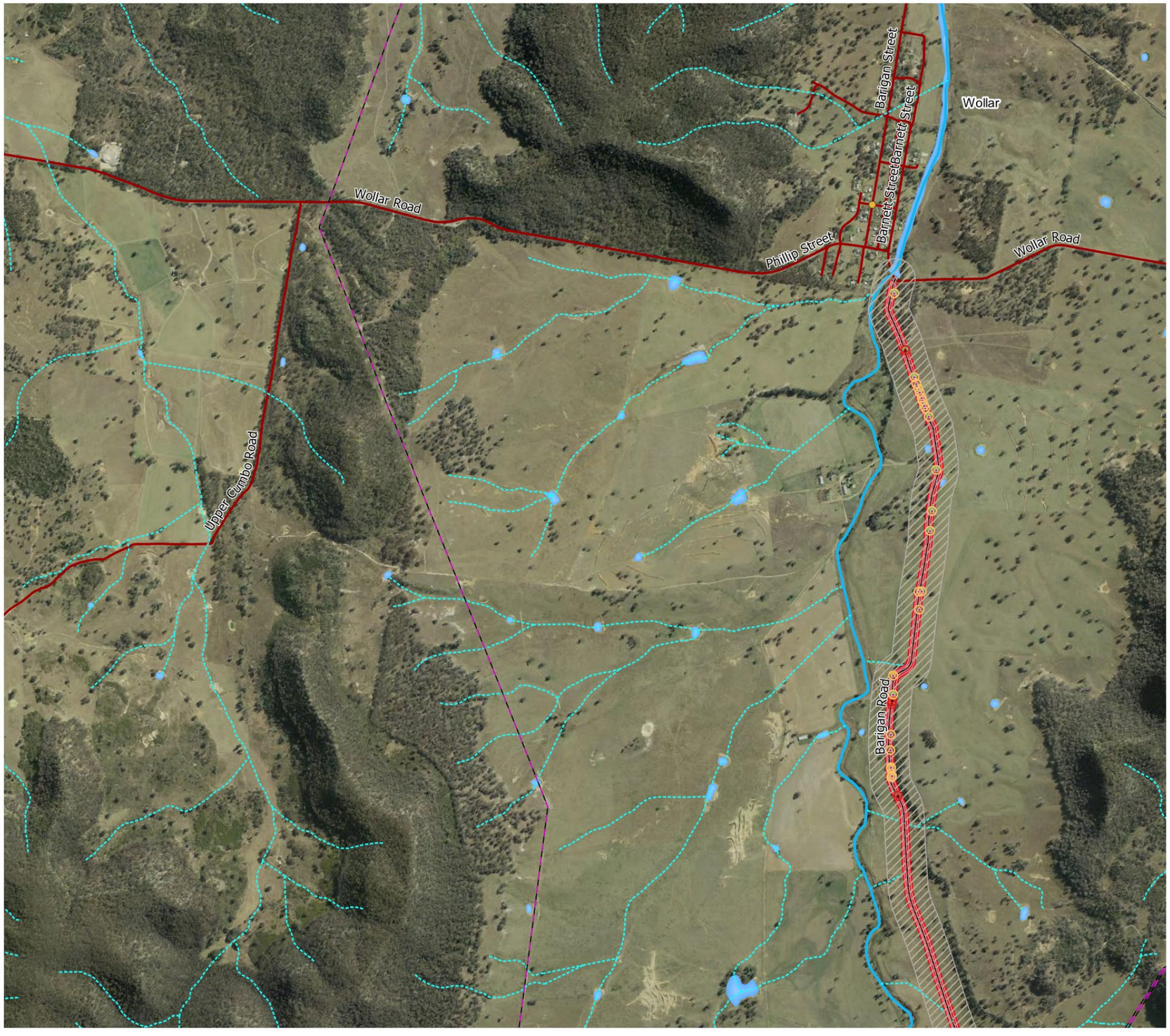
The proposal would not result in the loss of species credit species habitat or individuals. Although the Large-eared Pied Bat, Eastern Bentwing Bat and Eastern Cave bat were detected during surveys, optimal breeding, roosting or foraging habitat would not be impacted. Ecosystem credits have been generated to account for available foraging habitat which is mainly within wooded PCTs alongside Barigan Road.

7.1.3 Loss of hollow-bearing trees

Sixty-four hollow bearing trees (HBTs) were recorded inside the development footprint (see Table 7-3 and Figure 7-1 below). Five occur within the solar farm site and 55 within the Barigan Road impact area.

Table 7-3 Hollow bearing trees that would be removed and associated vegetation zone – Barigan Road.

ZONE	HBTs within zone (Wollar Property)	HBTs within zone Barigan Road
1) 1303_BoxGumWL	2	0
2) 1303_DerivedNativeGL	3	0
3) 1303_Cultivated_Low	0	0
4) 1303_Exotic (paddock tree)	0	0
5) 281_BoxGumWL	1	30
6) 281_DerivedNativeGL	3	13
7) 281_Exotic (paddock trees)	0	0
8) 1610_Good	0	11
9) 1610_Disturbed	0	1
TOTAL	**9**	**55**



Legend

Hollow bearing trees
- Not clearaed by development
- To be cleared

Development footprint

Indirect impact area (100m buffer)

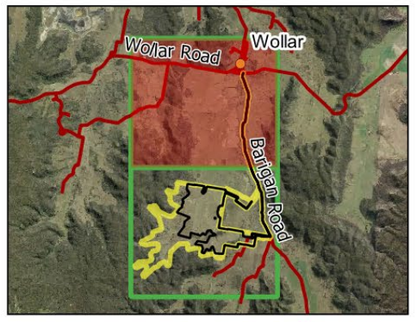
Development site

Transmission lines

Roads

Farm dam/other water body

Waterway
- Perennial
- Non perennial



Ref: 20-179 MOD1 and BDAR 20200406 \ Fig 7-1
HBTs to be removed
Author: clancy.b
Date created: 19.05.2020
Datum: GDA94 / MGA zone 55

NGH

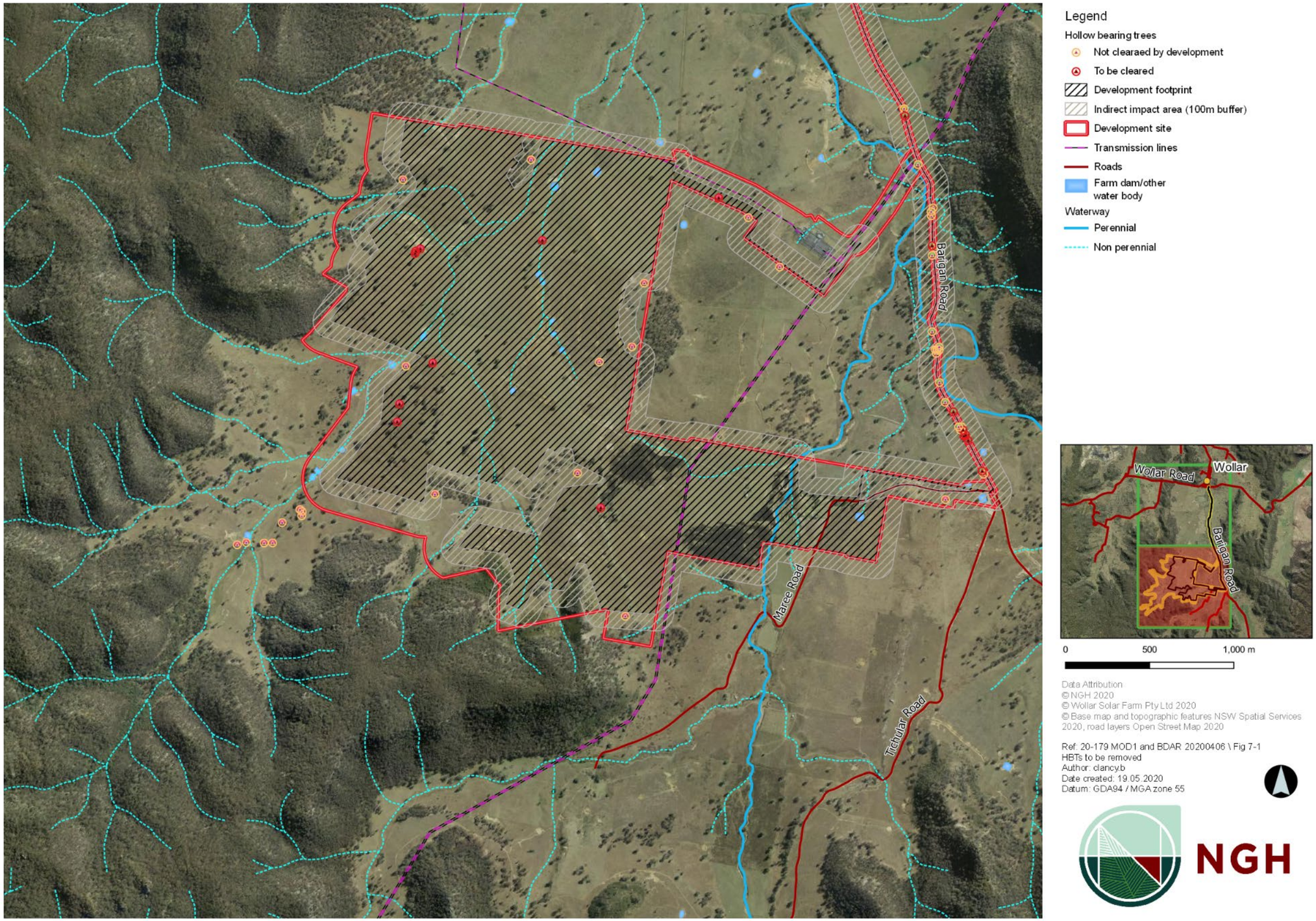


Figure 7-1 Hollow bearing trees (HBTs) within and within 150m of the development site (shown over 2 maps).

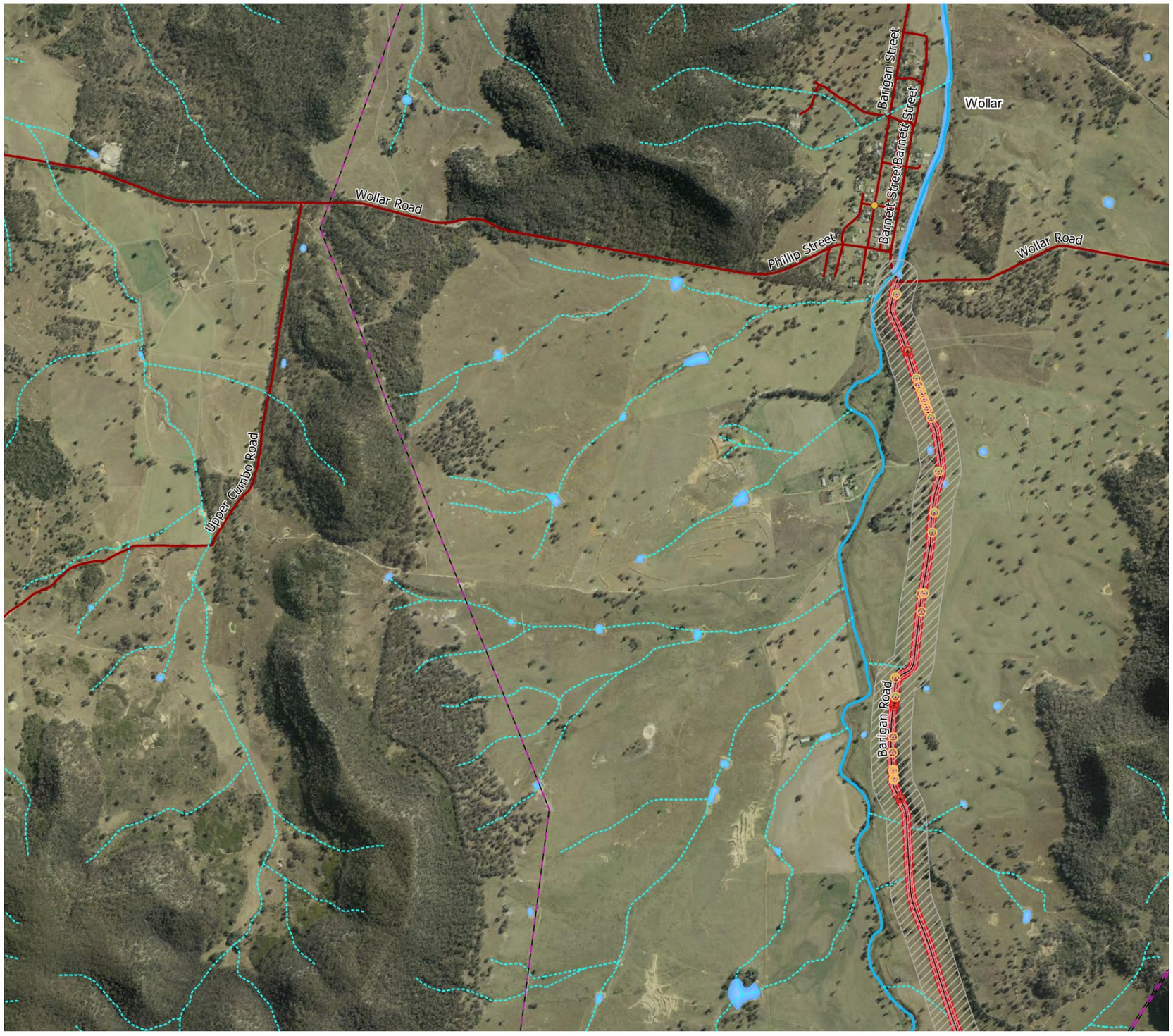
7.2 INDIRECT IMPACTS

Indirect impacts of the proposal include soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise and inadvertent disturbances to retained hollow bearing trees. Table 7-1 below details the type, frequency, intensity, duration and consequence of the direct and indirect impacts of the proposal. The zone of indirect impact is mapped on Figure 7-1 above and separately on Figure 7-2.

Table 7-4 Potential indirect impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Direct loss of native flora and fauna habitat • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock • Increased edge effects
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Further degradation of TECs. • Loss of native flora and fauna habitat
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operational Phase: Short-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• May alter fauna activities and/or movements • Loss of foraging or breeding habitat • Inhibit the function of plant species, soils and dams
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction & Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Degradation of TEC onsite through future weed invasion
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction & Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of foraging habitat

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Loss of breeding habitats	12 HBTS adjacent to impact areas	Constant	Construction Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of potential breeding habitat
Increase in pest animal populations	Devt footprint	Regular	Long term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Solar arrays may provide potential habitat for pest species like rabbits and foxes to take refuge under panels.
Bush rock removal and disturbance	TBA	One off	Long term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of potential breeding habitat



Legend

Habitat trees
- Not clearaed by development
- To be cleared

Development site

Development footprint

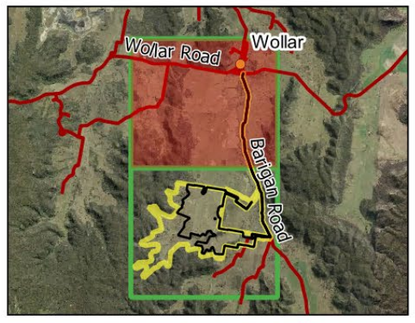
Indirect impact area (100m buffer)

Transmission lines

Roads

Farm dam/other water body

Waterway
- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BDAR 20200406 \ Fig 7-2
Indirect impacts
Author: clancy.b
Date created: 19.05.2020
Datum: GDA94 / MGA zone 55

NGH

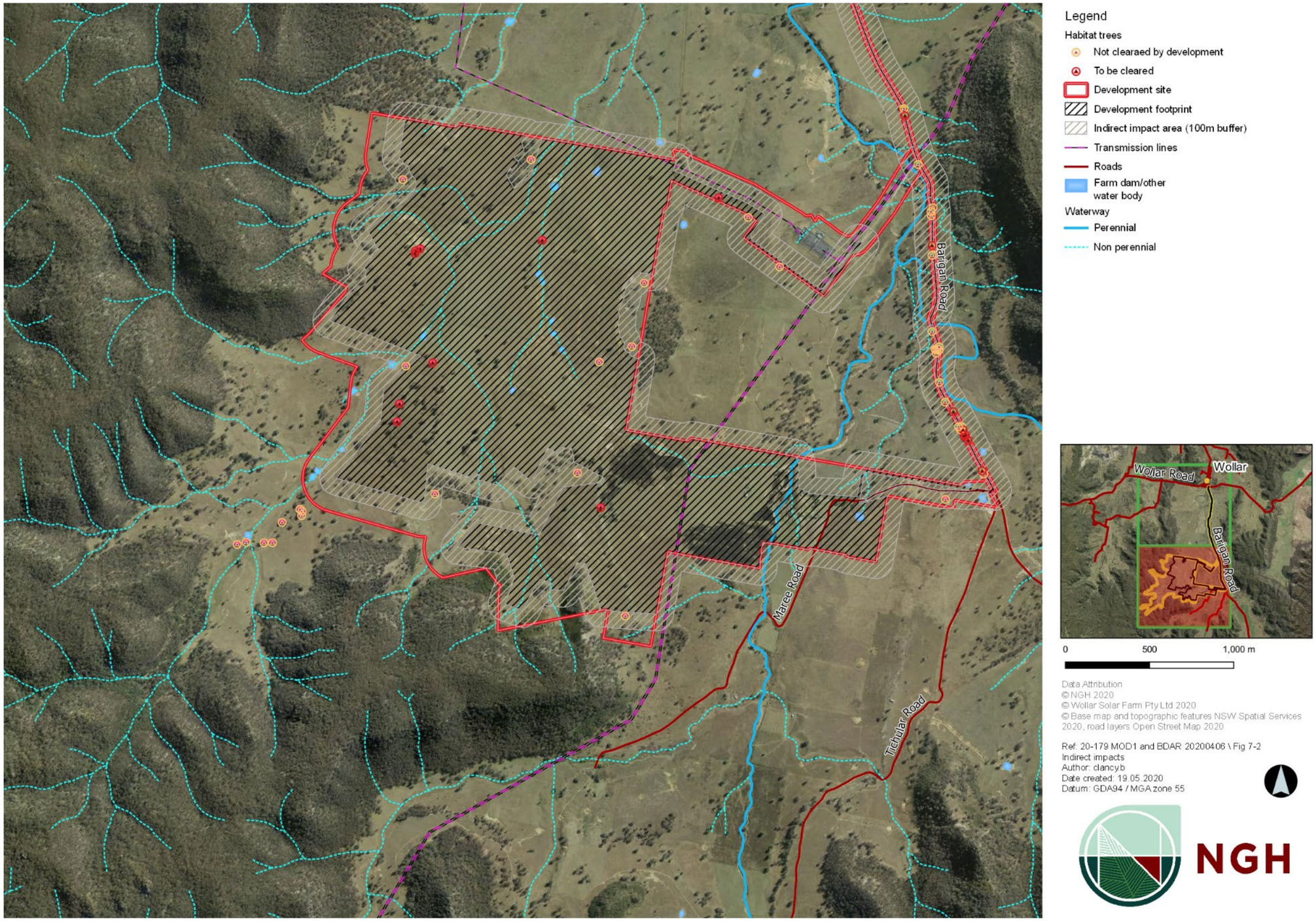


Figure 7-2 Zone of indirect impact for the proposal.

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts to karst, caves, crevices, cliffs, rocks and other features of geological significance
- Impacts of the development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range
- Impacts of the development on movement of threatened species that maintains their life cycle
- Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

These are discussed in detail below and the necessary information required by Section 9.2 of the BAM provided.

7.2.1 Impacts of development on the habitat of threatened species or ecological communities associated with rocks

There are several distinct bands of Narrabeen Sandstone outcropping along the 70-80m contour line south and west of the development site as can be seen in Figure 4-2 .

Fringing foraging habitat for the Large-eared Pied Bat, Eastern Bentwing-bat and Eastern Cave Bat occurs within the development site however would not be directly impacted by the proposal. Vegetated ridgelines surrounding the development contains significant sandstone caves, crevices and overhangs caves which is suitable roosting sites for Large-eared Pied Bats in the subject land. The Large-eared Pied Bat, Eastern Bentwing-bat and Eastern Cave Bat were all detected via ultrasonic detection during surveys in the sandstone ridgeline. Areas containing suitable roosting habitats will not be impacted. Surveys did not detect these species within the development site however it is considered that this species may utilise fringing vegetation within the lower slopes surrounding the development site. No suitable foraging habitat or roosting habitat occurs within the development footprint or will be impacted. Linear rocky outcrops that are within the development site largely contain embedded rock with shallow crevices unlikely to be utilised regularly. No observations or evidence of their use was observed during the field surveys in these areas. The proposed development will be avoiding some, but not all rocky scarps. Some of these areas were unable to be avoided due to their proximity inside the development site. As such, there will be some direct impacts to this habitat. There is unlikely to be any indirect impacts if solar panels are located close to rocky outcrops. The solar panels will be directed towards the sky to capture sunlight and impacts from glare and reflection are unlikely to affect species utilising adjacent rocky habitat. All outcrops within Wollar Valley development site are exposed to sunny weather elements. Solar panel glare is unlikely to impact rocky habitat providing dark caves or crevices.

Suitable and potential foraging and breeding habitat for the Pink-tailed worm-lizard occurs within the development site and would be removed by the proposal. Surveys did not detect this species and so the development site is not considered known habitat.

There is approximately 0.9 ha of suitable habitat within the development site, of which 0.1 ha of partially embedded and loose rock surrounded native grass species including *Themeda triandra* may be impacted. Additionally, there approximately 4.9 ha of rocky outcrop through the development site considered potential habitat of which 3.2 ha may be impacted during construction. The quality of potential habitat for this species is low, being largely embedded rock and subject to persistent grazing and dominated by predominately exotic grasses. With the implementation of the recommended mitigation measures, the proposal would not lead to a long-term decrease in the size of an important population of this species.

7.2.2 impacts of development on the habitat of threatened species or ecological communities associated with human made structures

There is one large agricultural building within the development footprint used to store farm machinery and one small tin shed within some stockyards located within the centre of the property. The shed may have potential to provide suitable roosting habitat for the Eastern Bentwing-bat. No evidence of use was observed during the surveys within the shed.

There is also one culvert installed over Wollar Creek on the substation access track near the intersection of Barigan Road (See Figure 4-4). This structure will not be impacted directly. This structure is not likely to provide roosting habitat for the Eastern Bent-wing Bat because the culvert structure does not provide good protection from the outdoor elements and would be unable to provide thermal benefits or offer high humidity which are required for suitable roosting habitat (BioNet). Therefore, it is unlikely to be considered habitat for any microbats addressed in this report.

7.2.3 impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation

Large portions of the development footprint contain areas of non-native vegetation which did not require assessment under the BAM. Most areas consisted of ploughed paddocks being sown with Lucerne and oats. These areas (excluding the paddock trees) are not expected to provide any unique habitat opportunities for any of the candidate species assessed.

7.2.4 impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Box-gum woodland is currently highly fragmented through the central portions of the development site due to historical land use with only small clumps and isolated paddock trees remaining. More connected and better condition box- gum woodland occurs on the boundary of the development site and lower slopes outside of the development site. Connectivity of the woodland would still be maintained through these areas. The loss of a number of paddock trees and smaller patches within the development footprint would result in minor loss of connectivity for more transient, agile and disturbance tolerant species, however as these areas occur as canopy species only, and lack the more complex vegetative structure of the lower slopes and larger patches of vegetation within and outside of the development site that would not be impacted, ensuring that species that rely of box-gum woodland as well as genetic variation would be maintained and not considered to significantly increase fragmentation of the box-gum woodland.

The remnant treed Box Gum Woodland habitat provides connectivity for threatened woodland birds such as Regent Honeyeater, Speckled Warbler, Brown Treecreeper, Varied Sittella, Little Lorikeet, Swift Parrot, Hooded Robin, Black-chinned Honeyeater, Turquoise Parrot, Scarlet Robin, Flame Robin, Grey-crowned Babbler and Diamond Firetail. Where hollow-bearing trees are present there are key breeding habitat opportunities for Gang-gang Cockatoo, Barking Owl, Powerful Owl, Masked Owl, Squirrel Glider and Brush-tailed Phascogale. These patches of woodland have been subjected to a history of clearing and farming and are fragmented. This has resulted in these patches becoming isolated and less viable, especially for terrestrial fauna such as Koalas and the Spotted-tail Quoll. The degree of impact on these already fragmented patches is not seen to pose a substantial impact on any threatened species.

The derived native grasslands and paddock trees and woodland habitat provide habitat for threatened birds of prey like the Spotted Harrier, White-bellied Sea Eagle, Little Eagle and Square-tailed Kite, especially around areas containing large dams found on Spring Flat Creek.

The proposal is therefore not likely to disrupt the movement of these species and would not have a substantive impact on their bioregional persistence.

7.2.5 impacts of the development on movement of threatened species that maintains their life cycle

In term of key habitat for threatened species onsite, they include;

- Box Gum Woodlands (where trees are less than 50m apart)
- Isolated hollow bearing trees
- Rocky scarps
- Areas of thick native groundcover
- Watercourses, especially where areas contain large eucalypts.

The development footprint chosen will not remove large quantities of key habitat such that the life-cycles of any Candidate species (assessed within the BDAR) will be significantly affected. Fringing foraging habitat for the Large-eared Pied Bat, Eastern Bentwing-bat and Eastern Cave Bat occurs within the development site however would not be directly impacted by the proposal. Vegetated ridgelines surrounding the development contains significant sandstone caves, crevices and overhangs caves which is suitable roosting sites for Large-eared Pied Bats in the subject land. The Large-eared Pied Bat, Eastern Bentwing-bat and Eastern Cave Bat were all detected via ultrasonic detection during surveys approximately 400m south of the development site in the sandstone ridgeline. Areas containing suitable roosting habitats will not be impacted.

No suitable foraging habitat or roosting habitat occurs within the development footprint or will be impacted. These microchiropteran bats are sub canopy foragers preferring to forage along the edges of vegetation and sandstone escarpments and are not known to utilises open grasslands or small area vegetated areas for foraging. Eastern Cave Bats may forage away from sub canopy and fringing shrubby vegetation and forage up to 500m over grassland areas on occasion, however the proposal would not impact upon the ability of this species to forage within these areas. Although detected within the subject land, no species credits have been generated for these species from the proposal as optimal breeding, roosting or foraging habitat would not be impacted.

7.2.6 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)

In terms of TECs onsite, the proposed solar farm will not alter water quality or influence hydrological processes onsite or cause any new impacts on Box Gum Woodlands beyond what is impacted by installing solar panels. The development footprint is located within the riparian zone where panels will be constructed either side of the watercourse. The watercourse (although 4th order) does not contain a definable bed and banks where most of its water flows under the ground. The designated 40 metre buffer zone either side of the bank is devoid of trees and shrubs and is highly degraded.

The establishment of solar panels is not expected to generate many indirect impacts on threatened species. There will be minimal ground disturbance when installing the infrastructure. The most impacting activity would be constructing new roads and hardstand areas with the highest impact occurring during construction. Due to the local topography being largely flat and mildly sloping, the momentum of runoff during heavy rainfall events is not expected to generate indirect impacts from stormwater runoff.

Two of the candidate species rely on aquatic habitat for food and shelter. These are the White-bellied Sea Eagle and Square-tail Kite. Neither species were observed during any of the field assessment inspections including targeted survey and it is therefore assumed that they do not utilise habitat onsite. No stick nest trees were observed inside the development footprint or site. Based on these inspections, it is concluded that the area is not optimal breeding or foraging habitat for birds of prey, primarily because of the lack of permanent water onsite.

7.2.7 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

An increase in vehicle traffic during construction and required maintenance may slightly increase the risk of vehicle strike on threatened species occurring in or near the development site. As most machinery will be large it is likely to travel at lower speeds thus lowering the incidence of vehicle strikes.

Fencing may act as a barrier to the movement and may funnel species into transport corridors.

Mitigation measures will be implemented to enforce a site speed. With the recommended mitigation measures, it is therefore not likely that vehicles associated with the proposal will have a substantive impact on any species.

7.3 IMPACTS TO BIODIVERSITY VALUES THAT ARE UNCERTAIN

The majority of the development footprint (55%) will consist of solar panels. The impacts of shading and diversion of rainfall runoff from the panels themselves is largely unknown. This aspect is discussed in more detail under section 7.5 below in relation to potential impacts on the composition and cover abundance of groundcover.

For the purpose of this BDAR report, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial peripheral areas are likely to be unimpacted and it is likely that a number of perennial native species will persist underneath the solar arrays. Certainly, only a minor proportion of the seed bank will be impacted, given the limited excavation proposed.

In this assessment an assumption has been made that all vegetation within the development footprint would be removed. This is a 'worst case' conservative approach. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact; such as the results of ground cover monitoring beneath the solar array. Therefore, the costs associated with purchasing and retiring ecosystem and species credits or the need for offset areas is currently an 'over estimated result' of the impacts of this solar farm undertaken to address current uncertainty.

7.4 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

To address the Supplementary SEARs regarding MNES:

- Additional field survey was undertaken in October 2018 to better characterise CEEC vegetation and undertake targeted surveys for other species listed under the EPBC.
- Evaluation of floristics was undertaken.
- A condition threshold evaluation was undertaken against the Commonwealth criteria
- Assessments of Significance were undertaken.

The results are summarised below.

7.4.1 Threatened Ecological Communities

One EPBC listed community – 'White Box -Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grassland' (PCT 281 & 1303) was present within the development site.

382.4 ha of Box Gum Woodland (BGW) and Derived Native Grasslands (DNG) occurs within the development site of which 229.7 ha will be directly impacted. Of the BGW component impacted, 24.8 ha (6.3%) of this is considered high diversity structural woodland and the residual areas (93.7%) of derived native grassland are relatively degraded. Development footprint revisions were undertaken to exclude as much of the high diversity CEEC as possible.

It is interesting to note that while much of the site is very weedy and degraded, native species persisting is perennial and therefore the proportion of native biomass (ignoring exotic annuals) is often over 50%. While occurring at low density and in low numbers, the total number of native grass and forb species was often relatively high. This may be due to effects of recent fire, stimulating the soil seed bank or perhaps the use of cattle grazing in preference to sheep grazing. Excluding the high diversity areas mapped for the site, the residual areas are considered to have relatively low conservation value despite meeting the CEEC criteria. Table 7-5 below illustrates the analysis of floristics and cover abundance undertaken of the BAM plots to assess the status of vegetation and its classification of box gum woodland and derived native grassland requiring assessment under Matters of National Significance (MNES).

An EPBC Assessment of significance was completed for Box Gum Woodland EEC (Appendix E) and concluded the proposal will result in the loss of 229.9 ha of BGW/DNG, approximately 68% of the known extent of BGW/DNG within the development site. Although additional areas of box-gum woodland occur within the Wollar Valley, many of areas are fragmented and subjected to degradation of invasion of exotic flora and other land use practices. As all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria are considered critical to the survival of this ecological community, as well as degraded woodland areas not considered part of the listed ecological community being considered essential to the long-term conservation of Box-Gum Grassy Woodland, due to landscape setting or habitat features, the assessment has concluded that although unlikely, there is a potential for a significant impact and referral to the Commonwealth Department of Environment is recommended for legal certainty.

Table 7-5 Analysis of floristics and cover abundance of BAM plots for classifying box gum woodland and derived native grassland requiring assessment under EPBC Act criteria.

Zone ID and PCT	Area	Plot ID	Field BAM Plot ID (refer to Figure 3-2)	Trees present	No of grass species	No of forb/fern /Other species	% proportion of native biomass over plot (ignoring exotic annuals)	EPBC Act criteria met	Presence of one important species for this CEEC.	VI score BAM C
Zone 1 1303_BGW	16.46 ha	1	W1	No trees but present <75m away	9	**6**	>50%	No	*Calotis lappulacea*	**56.8**
		2	W7	Yes trees	8	26	>50%	Yes	***Calotis lappulacea***	
		3	W2	Yes trees	11	18	>50%	Yes	***Calotis lappulacea***	
		4	W8	No trees	13	**16**	>50%	Yes	***Calotis lappulacea***	
Zone 2 1303_DNG	102.30 ha	1	W9	No trees	13	**5**	<50%	No	*Calotis lappulacea*	9.4
		2	W10	No trees	8	**11**	>50%	No	*Calotis lappulacea*	
		3	W29	No trees	2	**10**	>50%	No	*Vittadinia cuneata*	
		4	W12	No trees	8	**11**	>50%	No	*Calotis lappulacea*	
		5	W11	No trees	6	**13**	**>50%**	Yes	***Calotis lappulacea***	
		6	W4	No trees	15	**15**	**>50%**	Yes	***Vittadinia muelleri***	
Zone 3 1303_Cultivated_Low	110.72 ha	1	W3	No trees	6	**2**	>50%	No	*Calotis lappulacea*	11.4
		2	W13	No trees	7	**5**	>50%	No	*Calotis lappulacea*	
		3	W16	No trees	10	**7**	>50%	No	*none*	
		4	W14	No trees	7	**9**	>50%	No	*Calotis lappulaceae*	
		5	W17	No trees	5	**11**	>50%	No	*Vittadinia muelleri*	
		6	W15	No trees	3	**4**	**<50% (rye grass)**	No	*Goodenia pinnatifolia*	
Zone 4 1303_Paddock tree	12.83 ha	1	W18	No trees	1	**2**	**<50% (Lucerne)**	No	**none**	-
Zone 5 281_BGW	7.99 ha	1	W6	Yes trees/16 forbs	20	**16**	**>50%**	Yes	***Glycine clandestina***	**59.4**
		2	W20	Yes trees/10 forbs	4	**12**	**>50%**	Yes	***Glycine clandestina***	
		3	W19	Yes trees/22 forbs	5	**26**	**>50%**	Yes	***Glycine clandestina***	
Zone 6 281_DNG	102.83 ha	1	W5	No trees	11	**15**	**>50%**	Yes	***Calotis lappulaceae***	11.9
		2	W21	No trees	5	**14**	**>50%**	Yes	***Calotis lappulaceae***	
		3	W28	No trees	7	**15**	**>50%**	Yes	***Calotis lappulaceae***	

Zone ID and PCT	Area	Plot ID	Field BAM Plot ID (refer to Figure 3-2)	Trees present	No of grass species	No of forb/fern /Other species	% proportion of native biomass over plot (ignoring exotic annuals)	EPBC Act criteria met	Presence of one important species for this CEEC.	VI score BAM C
		4	W22	No trees	6	**13**	**>50%**	Yes	***Calotis lappulaceae***	
		5	W30	No trees	8	**9**	>50%	No	*Calotis lappulaceae*	
		6	W23	No trees	7	10	>50%	No	*Calotis lappulaceae*	

7.4.2 Threatened species

One EPBC-listed species was recorded during the surveys; the Large-eared Pied Bat.

A habitat evaluation (Appendix D) assessing the presence of habitat and likelihood for potential EPBC listed species including species identified within supplementary SEARS being impacted was undertaken, after the October 2018 targeted field surveys. The habitat evaluation determined EPBC Assessments of significance were completed for Regent Honeyeater, Pink-tailed worm-lizard and Large-eared Pied Bat; these were the only species required to be considered as the other species were evaluated as having no to very low likelihood to occur onsite and be impacted.

While considered to have low potential to occur, a Koala habitat assessment was undertaken using the Commonwealth tool to characterise the potential for impact to this species.

Large-eared Pied Bat, Regent Honeyeater, Pink-tailed worm-lizard

The Large-eared Pied Bat was recorded via ultrasonic detection. Optimal breeding and roosting habitat for this species is primarily limited to sandstone crevices and overhangs within the surrounding ridgelines outside of the development site. Additionally, foraging habitat consisting of complex forest or woodland structure which is not considered to occur within the development footprint. As this is a sub canopy forager and species would unlikely utilise grasslands for foraging, therefore only utilising areas within the development footprint for transient purposes, impacts to this species are not considered to occur as a result of the proposal.

The Assessments of significance (provided in full Appendix E) concluded that a significant impact was unlikely for Regent Honeyeater, Pink-tailed worm-lizard and Large-eared Pied Bat, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species

Koalas

No Koalas were found during targeted SAT surveys onsite in May 2018. Habitat for this species within the development site is isolated and highly degraded. It is considered unlikely that the Koala would utilise the habitats available.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 7-6 below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 7-6 resulted in a score of 3 and as such, habitat within the subject land is not considered to be critical to the survival of the Koala. An assessment of significant impact according to the EPBC Act significant impact criteria is not required.

Table 7-6 Koala habitat assessment tool for inland areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	No evidence of Koalas recorded during the surveys
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	
	0 (low)	None of the above.	✓ (0)
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	✓ (2) White Box & Yellow Box are listed food tree species, and both are present in the upper strata
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	
	0 (low)	None of the above.	✓ (0)
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	✓(1) No Koala mortality observed during the survey
	0	Evidence of frequent or regular koala mortality from vehicle strike or dog attack	

Attribute	Score	Inland	Applicable to the proposal?
	(low)	in the subject land at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓(0) Subject land is not considered a habitat refuge, nor does it provide important connectivity to large areas surrounding a habitat refuge
Total	**3**	**Decision: Habitat is NOT critical to the survival of the Koala—assessment of significance NOT required**	

7.5 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

7.5.1 Assumptions about impact extent

For the purpose of this report, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial peripheral areas are likely to be unimpacted and it is likely that a number of perennial native species will persist underneath the solar arrays. Certainly, only a minor proportion of the seed bank will be impacted, given the limited excavation proposed.

In this assessment an assumption has been made that all vegetation within the development footprint would be removed. This is a 'worst case' and highly conservative approach. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact; such as the results of ground cover monitoring beneath the solar array. Therefore, the costs associated with purchasing and retiring ecosystem and species credits or the need for offset areas is currently an 'over estimated result' of the impacts of this solar farm.

7.5.2 Survey timing and efficacy

The seasonal conditions at the time of targeted survey for threatened plants, especially *Monotaxis macrophylla* were not ideal. A declared drought during the optimal time for survey (August) means there are limited resources available for this plant to grow and set seed. The optimal habitat zone would also be frequented by hungry stock causing a further decline in groundcover from overgrazing and trampling onsite.

The calculation of hollow-bearings trees, in particular the size and number of hollows, was made from ground level. It is possible that some hollows are present that were not visible from ground level, which may result in underestimates of the number of hollows (Gibbons and Lindenmayer, 2000). However, it was noted where it was considered likely that hollows were present but not visible from ground level.

It is possible that some species were not recorded during the survey due to the timing of the survey outside their recommended survey period. Where survey effort or timing is not consistent with the BAM or relevant guidelines, this is stated explicitly in the assessment and measures identified to address the limitation; i.e. assumption of occurrence for species whose survey window could not be met.

8 MITIGATING AND MANAGING IMPACTS

8.1 MITIGATION MEASURES

A general summary of the key measures required to mitigate the impacts of the proposal are provided below. Mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency, responsibility for implementing each measure, risk of failure and an analysis of the consequences of any residual impacts are provided in Table 8-1.

8.1.1 Impacts from the clearing of vegetation and habitats

1. Time works to avoid critical life cycle events on threatened species
2. Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler
3. Relocate habitat features (fallen timber, hollow logs) from within the development site

8.1.2 Indirect impacts

1. Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed
2. Adaptive dust monitoring programs to control air quality
3. Temporary fencing to protect significant environmental features such as riparian zones
4. Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas
5. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented

8.1.3 Prescribed impacts

1. Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation Adaptive dust monitoring programs to control air quality
2. Sediment barriers and spill management protocols to control the quality of water runoff from the site into the receiving environment Temporary fencing to protect significant environmental features such as riparian zones
3. Enforce site speed limits to reduce impacts of vehicle strikes on threatened fauna.

Table 8-1 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Displacement of resident fauna through vegetation clearing and habitat removal						
Time works to avoid critical life cycle events	• Hollow-bearing trees would not be removed during breeding season (spring to summer) for threatened hollow dependant fauna. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler	• A tree clearing procedure would be implemented to minimise harm to resident fauna.	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
Relocate habitat features (fallen timber, hollow logs) from within the development site	• Procedure for relocation of habitat features to adjacent area for habitat enhancement would be implemented.	Construction	Regular	Contractor	Low	None
Indirect impacts on native vegetation and habitat						
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where	• Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. • Access and laydown in areas of	Construction	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
partial clearing is proposed	Box-Gum Woodland TEC will be minimised to reduce impacts. • Exclusion fencing and signage or similar would be installed around habitat to be retained.					
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	Construction	Regular	Contractor	Low	None
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	• Avoid Night Works where possible • Direct lights away from vegetation	Construction/ Operation	Regular	Contractor	Low	None
Adaptive dust monitoring programs to control air quality	• Daily monitoring of dust generated by construction activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	Construction	Regularly	Contractor	Moderate	Sedimentation in ephemeral waterways and dams.
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	• A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would	Construction, Operation	Regular	Contractor	Moderate	Weed encroachment

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	include: ○ Management protocol for declared priority weeds under the Biosecurity Act 2015 during and after construction ○ Weed hygiene protocol in relation to plant, machinery, and fill • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported. • The weed management procedure would be incorporated into the Biodiversity Management Plan.					
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	• Site induction and toolbox talks for ecologically sensitive areas would be undertaken.	Construction	Regular	Contractor	Moderate	Impacts to native vegetation or threatened species for Staff training not being followed
Preparation of a vegetation management plan to regulate activity in vegetation and habitat adjacent to the proposed development	• Preparation of a Biodiversity management plan that would include protocols for: ○ Protection of native vegetation to be retained ○ Best practice removal and disposal of vegetation ○ Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance	Construction	One-off	Contractor	Moderate	Impacts to native vegetation or threatened species for Biodiversity Management Plan not being followed.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	by an ecologist ○ Weed management ○ Unexpected threatened species finds ○ Exclusion of vehicles through sensitive areas. ○ Rehabilitation of disturbed areas					
Preparation of a vegetation management plan to monitor ground cover beneath the solar array modules.	• A Ground cover management plan would be developed to: ○ Ensure that ground cover is retained beneath panels, to resist erosion and weeds ○ Preserve the native composition as much as possible	Operation	Regula	Contractor	Moderate	Weed cover and erosion may increase. Native species composition may decline.
Erosion and sediment controls	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented	Construction	Regular	Contractor	Moderate	Impacts may occur if erosion and sedimentation control plan not implemented.
Prescribed biodiversity impacts						
Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented • Spill management procedures would be implemented.	Construction	Regular	Contractor	Moderate	Impacts may occur to waterway if erosion and sedimentation control plan not implemented.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Appropriate landscape plantings of local indigenous species (where possible) within the development site	• Landscape plantings will be comprised of local indigenous species.	Operation	Regular	Client	Moderate	Plants not surviving
Staff training and site briefing to communicate impacts of traffic strikes on native fauna.	• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles

8.2 ADAPTIVE MANAGEMENT STRATEGY

The largest impact expected from this solar farm is the impact of solar panels and shading on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland onsite. The assumption that solar panel arrays will result in 100% impact on groundcover is used because there is a lack of scientific data proving otherwise. It is recommended that monitoring of groundcover under the solar panels is undertaken:

1. Primarily to ensure that ground cover is retained to resist erosion and potential weed ingress managed,
2. But also, to provide information to the scientific community regarding the impact of shading on native grasslands in this location.

It may be that the conservative assumptions of this assessment (regarding 100% impact on vegetation) are an unnecessarily high impost on projects that assist the transition to reduced greenhouse gas emissions and that thereby have many broader environmental benefits.

9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline, or
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size, or
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

9.1.1 Threatened ecological communities

One threatened ecological community will be impacted on by the proposal that is listed as a potential SAII entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*. This is the;

- White Box-Yellow Box- Blakely's Red Gum Woodland (Box-gum Woodland).

9.1.2 Threatened species

The following are SAII candidate species that have been identified for assessment within the Wollar development site.

- Regent Honeyeater (important habitat mapping)

9.1.3 Additional potential entities

No further species were considered to be potential SAII entities.

9.2 ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS

9.2.1 White Box – Yellow Box – Blakely's Red Gum Woodland (Box-gum Woodland)

An assessment of the impacts to the NSW EEC Box-gum woodland was undertaken. Figure 6-1 shows the location of the Box-gum woodland EEC in context to the development footprint.

a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

340.61 ha of vegetation that meets the NSW criteria for Endangered Ecological Communities, most (315.8 ha, 92.7%) in degraded condition that does not generate offsets.

Around fifty percent of the Wollar development site contains vegetation matching White Box – Yellow Box – Blakely's Red Gum Woodland (Box Gum Woodland). This makes the option to fully avoid this TEC impossible if

the solar farm is to proceed. Most of the higher quality woodlands with trees are found towards the southern parts of the development footprint, where larger patches of intact wooded TEC have been avoided.

b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

Table 9-1 Vegetation Zones defined as BGW/DNG inside the development site. The development proposal is not expected to indirectly impact any vegetation zones.

Zone ID and PCT	Vegetation Integrity Score	Area of direct impact	Area of indirect impact	Condition
Veg zone 1 1303_BoxGumWL	56.8	16.82	0	Good
Veg zone 2 1303_DerivedNativeGL	9.4	102.70	0	Moderate
Veg zone 3 1303_Low cultivation	11.4	110.59	0	Low
Veg Zone 5 281 BoxGumWL	59.6	7.98	0	Good
Veg Zone 6 281 DerivedNativeGL	11.9	102.73	0	Moderate

c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

No threshold has yet been defined by OEH for the extent of Box-gum Woodland to be removed that constitutes a serious and irreversible impact**.**

d) the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint

The development footprint is 463.28 ha in area and 343.24 ha consists of vegetation defined as Box-gum Woodland /Derived native grassland TEC. Using Google Earth to view aerial imagery, it is estimated that approximately the same percentage (51%) of the surrounding landscape also contains Box Gum Woodland. Confirmation of groundcover outside of the Wollar study locality site, however, cannot be verified by field survey.

e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

It was not possible to accurately assess the percentage of Box Gum Woodlands and Derived Native Grasslands inside the Kerribee IBRA Subregion. This was because of the lack of vegetation mapping covering Wollar and surrounds. The use of GIS programs to estimate the percentage of mapped Box Gum Woodlands TEC could not be undertaken.

To try and overcome this constraint, a general review of Google Earth aerial photography was viewed in conjunction with Kerribee Subregion mapping. Areas of Box Gum Woodlands are most likely be confined to broad valleys within Kerribee Subregion which generally relate to cleared farming land. It is estimated that around 30% of Kerribee Subregion consists of farming country with potential for Box Gum Woodlands. Of this 30%, it is estimated that the Wollar solar farm would constitute about 1% of this area.

f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

In NSW Box-gum grassy Woodland is known to occur within at least 42 reserve systems. Approximately 8,000 ha of Box-gum woodland is estimated to occur in national parks and nature reserves within the NSW South Western Slopes IBRA Region (Benson 2008).

g) the development proposal's impact on:

i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

It is predicted that the proposal could have impacts on,

- surface water flows across the ground, this would be limited as minimal excavation is proposed and panels would be mounted above the ground,
- change in light levels reaching the ground due to shading of panels, mitigated by spacing between panels,
- modification to ground moisture levels where solar panels may block or concentrate rain over certain areas.

The proposal could potentially benefit the BGW/DNG by;

- Removing disturbances caused by farming activities such as application of fertilisers and overgrazing by stock.

There is little scientific information on the effects of solar farms on these factors. Until sufficient monitoring of Solar farms is carried out, it is largely unknown whether solar farms are likely to have a detrimental impact on abiotic factors. A 'worst case' assumption would be that alterations to sunlight reaching the ground and changes to surface water flows due to the large surface area of solar panels over the ground, could modify abiotic factors necessary for survival of the TEC.

A review of the National Recovery Plan for BGW/DNG, indicates that;

- Altered hydrological regimes may lead to impacts,
- Prolonged shading may lead to impacts and
- Mowing and slashing associated with managing grasslands may lead to impacts

To address the uncertainty, it is therefore assumed that this proposal may lead to modification and destruction of important abiotic factors for preserving the integrity of this TEC onsite.

ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

The proposal would impact on the character and function of Box Gum Woodland in the following ways;

- Removing 64 hollow bearing trees (with small, medium and large hollows) within this TEC. Most occur alongside Barigan Road.
- Removing (or shading) 343.24 ha of this TEC (24.8 ha of which is structural woodland).

Groundcover inside the development site is modified due to weed invasion, trampling by stock, past cultivation and past application of fertilisers which have all impacted on groundcover diversity. This reduces the severity of impacts that may result from any further changes to species composition.

No introduced fire or flooding regimes would occur and no increase of natural occurrences of these events is anticipated from the development. The harvesting of plants will not occur within the remaining Box-gum woodland.

iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts

In relation to confirmed BGW TEC inside the development footprint, 24.8 ha (7.3%) is intact Box Gum Woodland with trees and 315.8 ha (92.7%) is degraded native grasslands of varying condition (but requiring assessment and offsetting under BOS). The proposed development is not expected to indirectly impact on any additional areas of this TEC (within the development site). It may be that remaining land is used as an offset and if this is the case then management action would be expected to improve any remaining patches of TEC not directly impacted.

h) direct or indirect fragmentation and isolation of an important area of the potential TEC

Upper assumed extent

The proposal occurs within a much larger patch of BGW/DNG within the Wollar Valley. At present, this patch is bordered to the north (extending 11km from the subject site), to the south west and west (extending approximately 500m from the subject site) and to the east (extending approximately 2km), by vegetated mountains not defined or likely to constitute BGW/DNG.

The location of the area of direct impact will isolate a portion of BGW/DNG directly south-west of the subject site. This patch is estimated to be 210 ha in area which would become separated from the existing patch of BGW/DNG. It is estimated that the proposal would isolate around 4% of the current patch of BGW/DNG (not including the 4% to be removed for solar panels).

Smallest extent

The proposal forms the majority of the patch of BGW/DNG which extends off the property to the south west. The proposal will not result in fragmentation of this patch however it will substantially reduce its extent as outlined in a).

i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

The 24.8 ha of Box-gum woodland generating offsets will be offset in accordance with the Biodiversity Conservation Act 2016 to ensure protection in perpetuity for similar habitat in the IBRA region.

There is strong potential to offset the south western portion of the property (all remaining areas of Box Gum Woodland and other non-Box Gum Woodland vegetation) to preserve and enhance TEC habitat onsite. These areas are in better condition and have better connectivity values due to the more mature/hollow bearing trees. There is scope to improve connectivity values within this area. Key abiotic factors inside these areas (like rocky scarp habitat) can also be protected for targeted candidate species.

9.2.2 Threatened species assumed present

No SAII species are assumed present. The development footprint has been modified to avoid impacting any important mapped habitat for the Regent Honeyeater. Please refer to chapter 6.2.1 about the discussion around recent mapping updates for Regent Honeyeater.

10 REQUIREMENT TO OFFSET

10.1 IMPACTS REQUIRING AN OFFSET

The total offset requirement for the project is 723 ecosystem credits. This section shows which zones generate the offset requirement.

Figure 10-1 (below) shows areas requiring offsets, areas not requiring offsets and non-native areas not requiring assessment under the BAM

10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or
b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented and mapped within Table 10-1 below.

Table 10-1 Zones that require offsets

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
1_BoxGumWL	1303	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	16.82	56.8	56.8	478
5_BoxGumWL	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	7.99	59.6	59.6	238
8_Good	1610	White Box - Black Cypress Pine shrubby woodland of the Western Slopes	0.14	27	27	2

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix G.

10.1.2 Paddock tree credits

Offsets are required for the clearing of Class 2 & 3 paddock trees.

There are five class 3 paddock trees inside the development site. Four of the paddock trees form part of PCT 281 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion. The remaining paddock tree forms part of PCT 1303 White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion. The combined PCT ecosystem credits required are documented in Table 10-2.

Table 10-2 Paddock trees that require offsets

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Number of Credits Required	Ecosystem credits required
Class 3 **>50cm DBH**	**No**	5	5	5

10.1.3 Species credits

Offsets are required for some candidate species assessed. See Table 10-3. Most candidate species credit have been generated through the assumption of impact alongside Barigan Road, where targeted surveys have not been able to be undertaken.

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix G.

Table 10-3 Candidate species generating species credits

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Acacia ausfeldii Austfeld's Wattle	2	1.2	**34**
Burhinus grallarius Bush Stone-curlew	2	1.2	**34**
Callocephalon fimbriatum Gang-gang Cockatoo	2	8.8	**67**
Chalinolobus dwyeri Large-eared Pied Bat	3	1.2	**50**
Commersonia procumbens	2	0.4	**2**
Monotaxis macrophylla Large-leafed Monotaxis	2	1.2	**34**

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Ninox connivens *Barking Owl*	2	1.3	**16**
Ninox strenua *Powerful Owl*	2	1.3	**16**
Petaurus norfolcensis Squirrel Glider	2	1.1	**34**
Phascogale tapoatafa Brush-tailed Phascogale	2	0.2	**13**
Phascolarctos cinereus Koala	2	1.2	**34**
Tyto novaehollandiae *Masked Owl*	2	1.3	**16**
TOTAL species credits			***350***

10.1.4 Commonwealth offset strategy

Current legislative context

Prior to the introduction of the NSW *Biodiversity Conservation Act 2016*, the NSW Framework for Biodiversity Assessment was the Commonwealth endorsed NSW offset scheme for Major Projects such as the Wollar Solar Farm proposal. Assessment and offset requirements were able to be determined through the NSW scheme, with final approval then provided by the Commonwealth Department of Environment (DoE).

The updated NSW BOS has now been endorsed but for comprehensiveness, the Commonwealth offset quantification and options are considered using Commonwealth tools below.

Quantification of the offset requirement

For MNES, offsets are required only where significant impacts may result. For this project, that is limited to White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community.

Appendix F sets out the offset requirement using the EPBC offset tool. The minimum direct offset requirement (90% direct offset required for Commonwealth physical offsets) equates to 385 ha in total comprised of:

- 195 ha for treed BGW.
- 190 ha for derived native grassland BGW.

Offset options under consideration

It is noted that the Wollar Valley comprises largely of BGW and Derived Native Grassland (DNG) habitat on the valley flats and foot slopes. It is estimated around 5497ha of BGW/DNG in area (inclusive of powerlines and dirt roads running through Wollar valley) is present within the wider area (i.e. outside the project area). This figure has been assumed from aerial photography, knowledge of the landscape, and observation of vegetation within the landscape during field surveys. The occurrence of BGW/DNG however, has not been validated through quantitative field surveys.

Within the project boundaries, in areas that would not be impacted by the development, around 217 ha of CEEC is available for protection under an offset agreement. Based on available mapping, though not subject to detailed survey, it is estimated that an additional 258 ha remains within the property boundary, that would not be impacted by the development and may provide suitable direct offsets. If suitable, this exceeds the required amount by 90 ha.

A Wollar Solar Farm offset strategy will be developed to satisfy Commonwealth requirements. At this time, offset investigations are outlined to demonstrate that:

- Securing in perpetuity physical offsets within the subject land are likely to be feasible.
- Similar vegetation occurs in the locality and could also be considered, if required, for physical offsets.

Payment options may also be considered, such as making payments into the NSW Biodiversity Conservation Fund using the offset payments calculator or funding a biodiversity action.

Pending project approval, consultation would be undertaken with NSW OEH and Commonwealth DoE to provide a detailed offset strategy that meets legislative requirements that are currently in flux.

10.2 IMPACTS NOT REQUIRING AN OFFSET

Table 10-4 Zones that do not require offsets

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score
2	1303_Derived Native GL	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	102.17	9.4
3	1303_Cultivated_Low	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	110.59	11.4
6	281_Derived Native GL	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	102.73	11.9
9	1610_Degraded	White Box - Black Cypress Pine shrubby woodland of the Western Slopes	27.04	2.3

The BAM assessment tools adequately address all the impacts associated with this solar farm. No other impacts triggering offset requirements are anticipated.

10.3 AREAS NOT REQUIRING ASSESSMENT

The areas that do not require assessment in accordance with BAM and are not defined as native vegetation are mapped below. These areas are cultivated and non-native.

10.4 OPTIONS TO RETIRE CREDITS IN STAGES

The project is likely to proceed in four distinct stages of construction. Stage 1 (road upgrades) will proceed in advance of Stages 2 and 3 (site access and solar farm development). Stage 4 (the alternative southern access, referred to above) may never be constructed. The Version 3 BDAR now shows the offset obligation for the project in terms of these stages. Refer to the figure below.

To calculate the credits related to each stage, four additional revisions of the BAM calculator were created, one for each stage. Compared to the credit calculations for the entire project, the additional BAM revisions by stage (specifically Stage 1 and 4, related to Barigan Road upgrades and to a number of hollow bearing trees generating different species credits), delivered slightly different numbers of species credits. This does not appear to be an error in data entry as all zone areas were checked multiple times. The reason for credit differences is assumed to be within the BAM calculator. As credit differences were small, the difference was added to Stage 1 to ensure the sum of species credits between stages 1 and 4 matched the overall submitted BAM calculation and that if Stage 4 did not proceed, a conservative approach allocated the difference to Stage 1.

The results per stage are set out below

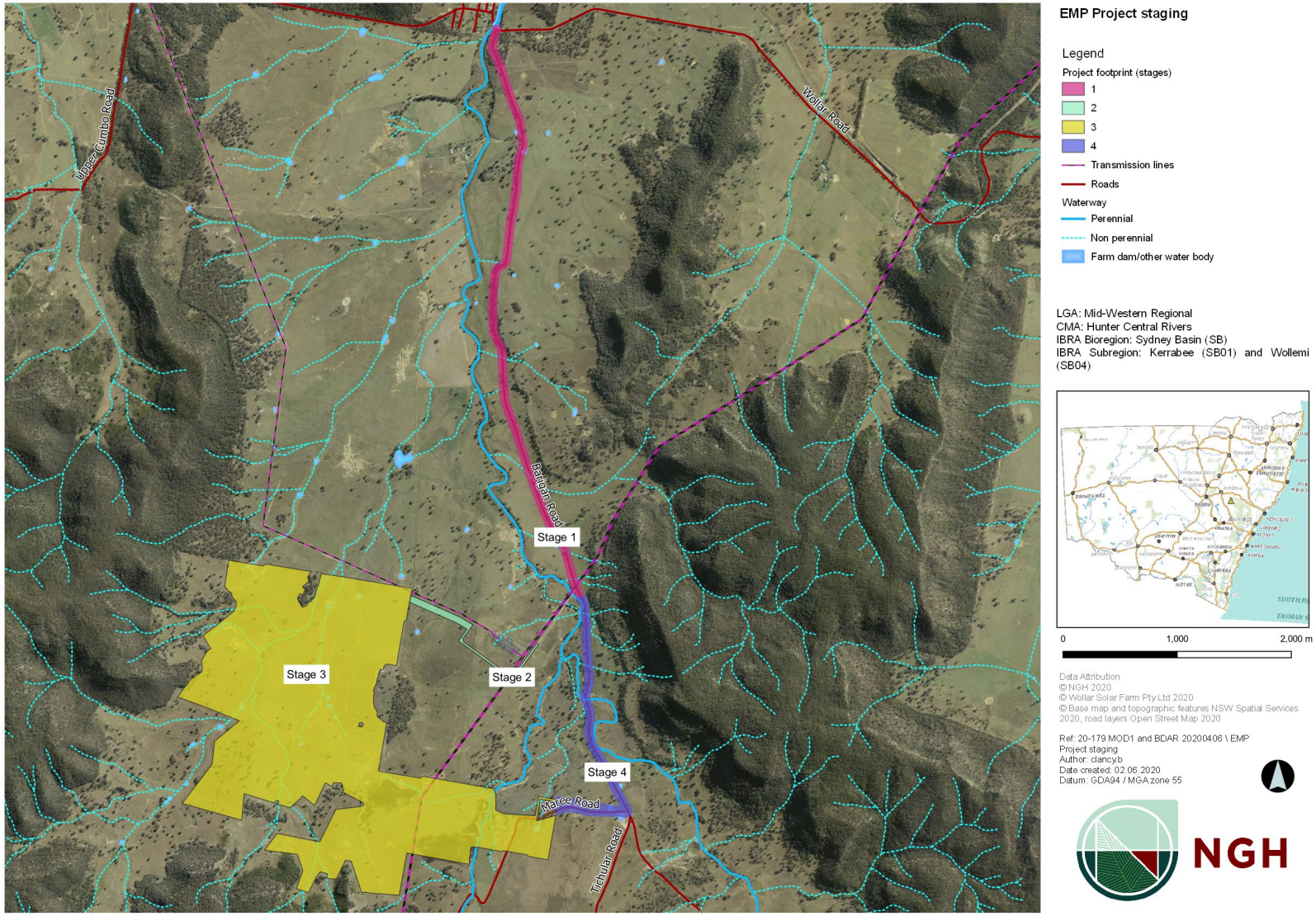


Figure 10-1 Illustration of stages 1-4 of the Wollar Solar farm development

10.4.1 Stage 1 Upgrades to Barigan Road (Nth)

Barigan Road widening will be the first stage of construction onsite. As such, this will be the first stage of development. It includes the northern section of road between the township of Wollar and the TransGrid substation intersection (see Figure 10-1 above). As targeted survey was not undertaken in this area there is the assumption of species credits based on vegetation zone areas and buffering of habitat trees for hollow dependant fauna. A breakdown of relevant ecosystem and species credit offset obligations in provided in Table 10-5 and Table 10-6 below.

Table 10-5 Ecosystem credit obligations required to offset stage 1

Zone ID	PCT ID	PCT name	Stage 1 Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
5_BoxGumWL	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	0.7	59.6	59.6	**19**
8_Good	1610	White Box - Black Cypress Pine shrubby woodland of the Western Slopes	0.11	27	27	**2**

Table 10-6 Species credit obligations required for Stage 1

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Acacia ausfeldii Austfeld's Wattle	2	0.8	**22**
Burhinus grallarius Bush Stone-curlew	2	0.8	**22**
Callocephalon fimbriatum Gang-gang Cockatoo	2	1.9	**26**
Chalinolobus dwyeri Large-eared Pied Bat	3	0.8	**32**
Commersonia procumbens	2	0.2	**2**
Monotaxis macrophylla Large-leafed Monotaxis	2	0.8	**22**
Ninox connivens *Barking Owl*	2	0	**0**
Ninox strenua *Powerful Owl*	2	0	**0**
Petaurus norfolcensis Squirrel Glider	2	0.8	**22**
Phascogale tapoatafa Brush-tailed Phascogale	2	1.9	**5**
Phascolarctos cinereus Koala	2	0.8	**22**
Tyto novaehollandiae *Masked Owl*	2	0	**0**
TOTAL species credits			**175**

10.4.2 Stage 2 'Northern Access' (track around TransGrid substation)

Stage 2 is the development footprint planned around the TransGrid substation (see Figure 10-1 above). It is a modified section of the development footprint which is subject to this BDAR modification. All candidate species were surveyed for within this area and none found and therefore no species credits associated with this stage. Table 10-7 presents a breakdown of the ecosystem credits generated from this area.

Table 10-7 Ecosystem credit obligations required to offset Stage 2

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation Integrity loss	Ecosystem credits required
1_BoxGumWL	1303	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	5.5	56.8	56.8	**156**

10.4.3 Stage 3 Wollar Solar Farm panel array

Construction of the road between Barigan Road and Lot 80 DP755430 (northwest entry into Wollar Solar Farm panel area) will form stage 2 of construction onsite (see Figure 10-1 above). As no credit species offset obligations are associated with this section, only ecosystem credits are generated and presented in Table 10-8 below.

Table 10-8 Ecosystem credit obligations required to offset Stage 3

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation Integrity loss	Ecosystem credits required
1_BoxGumWL	1303	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	11.3	56.8	56.8	**322**
4_Paddock Tree	1303	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	12.81	-	-	**1**
5_BoxGumWL	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	5.7	59.6	59.6	**171**
7_Paddock Tree	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	31.6	-	-	**4**

10.4.4 Stage 4 Alternative southern access via Maree Road

Stage 4, if required, would involve construction to widen Barigan Rd (directly south of Stage 1, see Figure 10-1 above). It also includes widening of Maree Rd (for approximately 600m). Stage 4 will only be utilised if Stage 1 is not feasible. As candidate species habitat was present and no targeted survey undertaken along Barigan or Maree Road, there is the assumption of species credits based on vegetation zone areas and buffer areas around habitat trees for hollow dependant fauna. A breakdown of relevant ecosystem and species credit offset obligations in provided in table 10-9 and table 10-10 below.

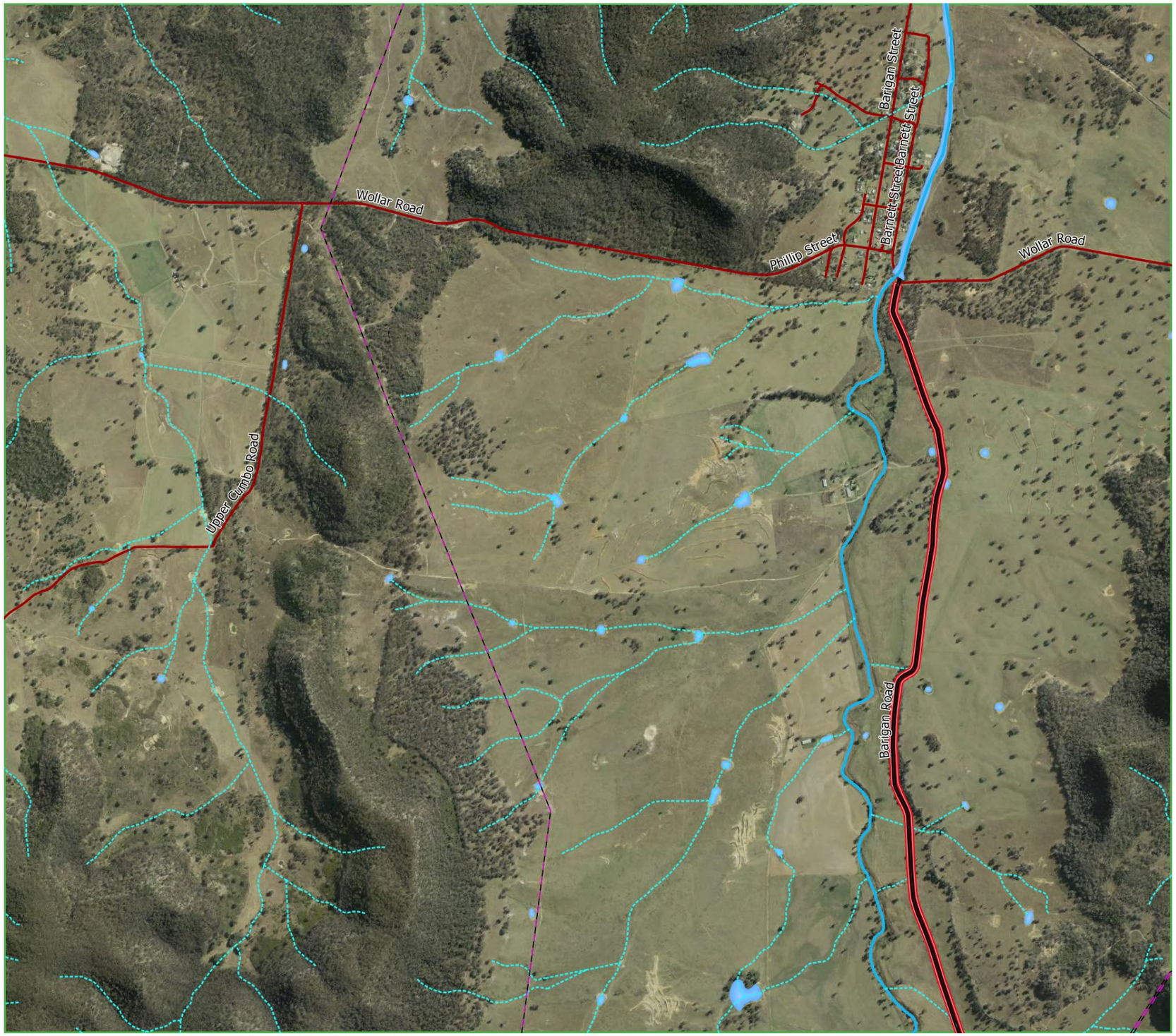
Table 10-9 Ecosystem credit obligations required to offset Stage 4

Zone ID	PCT ID	PCT name	Stage 1 Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
5_BoxGumWL	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	1.8	59.6	59.6	**48**

Table 10-10 Species credit obligations required for Stage 4

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Acacia ausfeldii Austfeld's Wattle	2	1.6	**12**
Burhinus grallarius Bush Stone-curlew	2	1.6	**12**
Callocephalon fimbriatum Gang-gang Cockatoo	2	1.9	**41**
Chalinolobus dwyeri Large-eared Pied Bat	3	1.6	**18**
Commersonia procumbens	2	0.2	**0**
Monotaxis macrophylla Large-leafed Monotaxis	2	1.6	**12**
Ninox connivens *Barking Owl*	2	0.7	**16**
Ninox strenua *Powerful Owl*	2	0.7	**16**
Petaurus norfolcensis Squirrel Glider	2	1.6	**12**
Phascogale tapoatafa Brush-tailed Phascogale	2	1.9	**8**

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Phascolarctos cinereus Koala	2	1.6	**12**
Tyto novaehollandiae Masked Owl	2	0.6	**16**
TOTAL species credits			**175**



Legend

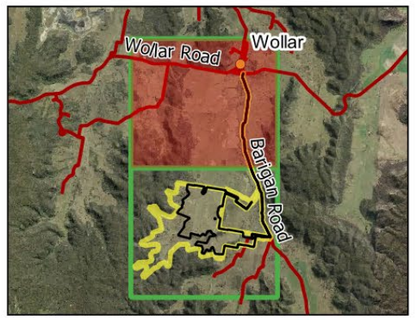
- Paddock trees

Vegetation offset requirements

- Not offset
- Offset
- Development footprint
- Development site
- Transmission lines
- Roads
- Farm dam/other water body

Waterway

- Perennial
- Non perennial



0 500 1,000 m

Ref: 20-179 MOD1 and BDAR 20200406 \ Fig 10-2 Paddock trees and offset areas
Author: clancy.b
Date created: 19.05.2020
Datum: GDA94 / MGA zone 55

NGH

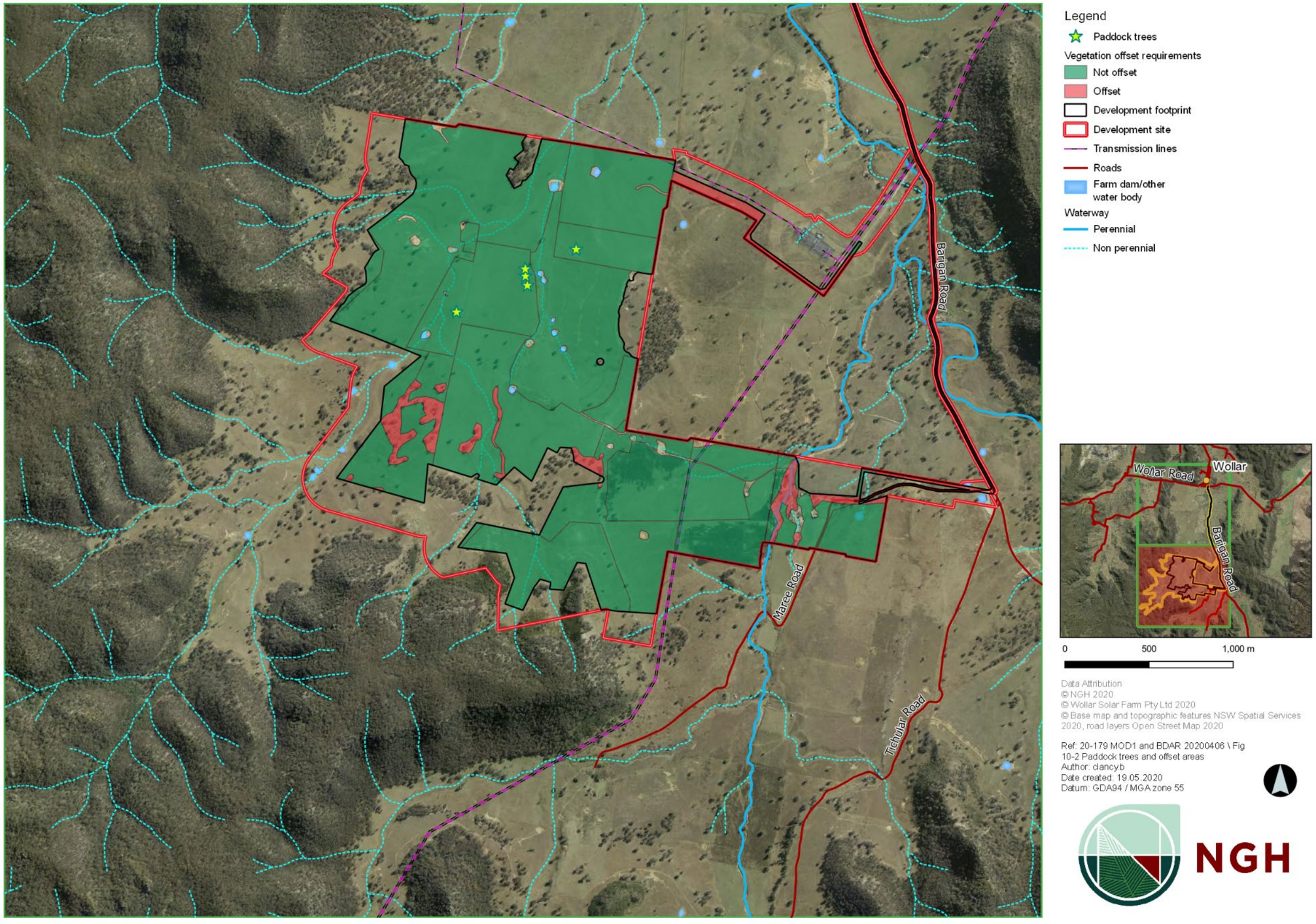


Figure 10-1 Areas requiring offsets, areas not requiring offsets and non-native areas not requiring assessment under the BAM (shown on 2 maps).

11 CONCLUSIONS

11.1 NSW BAM ASSESSMENT

NGH Environmental has prepared this BDAR for the Wollar Solar Farm, located within the Mid-Western Regional Local Government Area (LGA), NSW. The purpose of this BDAR was to address the requirements of the BAM and to address the biodiversity matters raised in the SEARs and supplementary SEARs.

This updated BDAR Version 3 now supersedes the BDAR Version 2, which was provided pre-project approval. Version 3 has been updated to:

- Relocate the main site access outside of the previously assessed development site, resulting in a slight increase (0.32ha) of native vegetation impact. This change has triggered the need for a Modification Application, which this BDAR supports.
- Clarify the offset obligation for the four stages of construction. Stage 1 (road upgrades) will proceed in advance of Stages 2 and 3 (site access and solar farm development). Stage 4 (an alternative southern access, referred to above) may never be constructed.
- Recalculate species credit polygons along Barigan Road (stages 1 & 4), to more accurately reflect trees that would be removed versus trees that would be retained but indirectly impacted, deleting overlaps that previously overestimated credits.

In this BDAR, biodiversity impacts have been assessed through comprehensive mapping and assessment completed in accordance with the BAM. Regarding onsite surveys, three targeted survey programs were undertaken to address all candidate species. Three were confirmed onsite: The Large-eared Pied Bat (*Chalinolobolus dwyeri*), Large Bentwinged-bat (*Miniopterus orianae oceanensis*) and Eastern Cave Bat (*Vespadelus troughtoni*). These were detected on Anabat recordings. Although detected onsite, it was concluded after extensive inspection of rocky scarp habitat that no specialised breeding/roosting/refuge habitat was present inside the development footprint.

As no targeted survey was undertaken for proposed widening of Barigan Road, the assumption of presence for several candidate species has occurred which has generated species credits.

Five paddock trees occur within areas that are primarily exotic. These were assessed using the paddock tree calculator. The paddock tree assessment generated 5 ecosystem credits that will need to be retired to remove these trees. In addition to the paddock trees, impacted native vegetation was of sufficient quality to generate an offset requirement, totalling 723 credits. This is comprised of White Box Yellow Box Blakely's Red Gum Woodland listed under the BC Act.

The credit requirement has therefore been defined as:

- 723 ecosystem credits (5 of these credits generated by paddock tree removal)
- 350 species credits

Mitigation measures which have been outlined to reduce the impacts to biodiversity.

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets scheme, and will be achieved by either;

(a) Retiring credits under the Biodiversity Offsets Scheme, or

(b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or

(c) Funding a biodiversity action that benefits the threatened entity impacted by the development.

11.2 COMMONWEALTH ASSESSMENT

Following data collected during initial site surveys in May 2018, a referral to the Commonwealth Department of Environment and Energy commenced in July 2018. On 3 October 2018, the proposed Wollar Solar Farm was determined to be a controlled action for impacts on MNES protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Supplementary SEARs were issued for the project (provided in Appendix B: EPBC requirements). As such the project is subject to a 'streamlined assessment', to capture MNES as well as NSW matters.

- Additional field survey was undertaken in October 2018 to better characterise White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland vegetation and undertake targeted surveys for other species listed under the EPBC.
- A condition threshold evaluation was undertaken against the Commonwealth criteria
- Assessments of Significance were undertaken.

Regarding MNES, potential impacts on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community are considered likely to be significant and warrant offsets. 229.90 ha of vegetation that meets the Commonwealth criteria for Critically Endangered Ecological Communities, most (89%) in degraded condition, would be impacted.

Within the project boundaries, in areas that would not be impacted by the development, around 217 ha of CEEC is available for protection under an offset agreement. Based on available mapping, though not subject to detailed survey, it is estimated that an additional 258 ha remains within the property boundary, that would not be impacted by the development and may provide suitable direct offsets. If suitable, this exceeds the required amount by 90 ha.

A Wollar Solar Farm offset strategy will be developed to satisfy Commonwealth requirements. In this document, offset investigations are outlined to demonstrate that:

- Securing in perpetuity physical offsets within the subject land are likely to be feasible.
- Similar vegetation occurs in the locality and could also be considered, if required, for physical offsets.

Payment options may also be considered, such as making payments into the NSW Biodiversity Conservation Fund using the offset payments calculator or funding a biodiversity action.

12 REFERENCES

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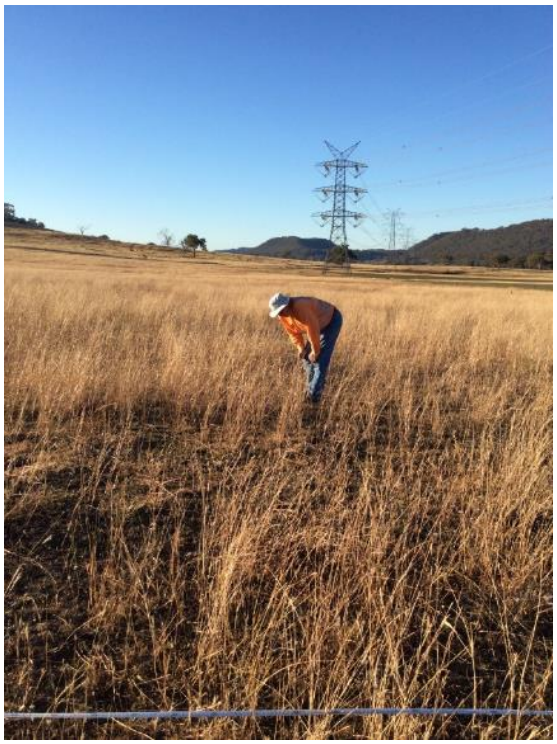
APPENDIX A VEGETATION INTEGRITY PLOT DATA

REPRESENTATIVE VEGETATION INTEGRITY PLOT PHOTOS

BAM VI Plot 1

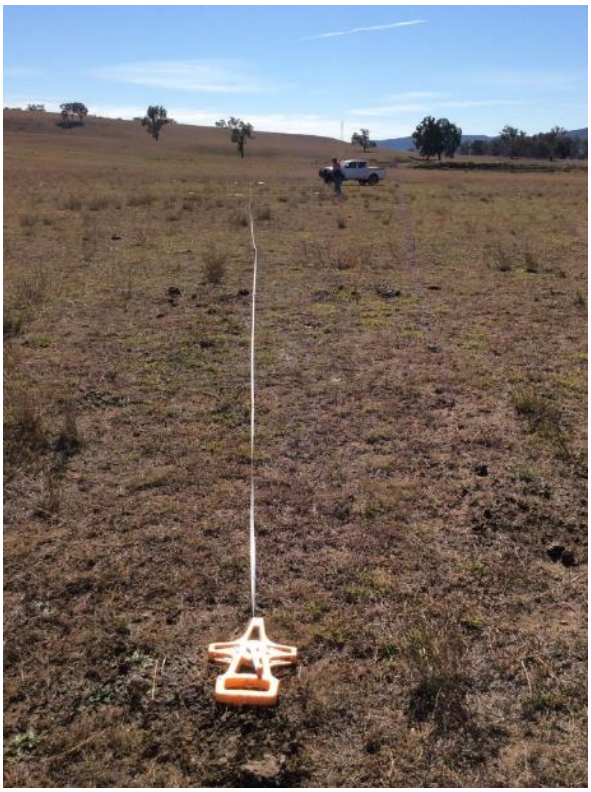
BAM VI Plot 2

VI Plot 3



VI Plot 4

VI Plot 5



VI Plot 6

A.1.1 BAM Electronic Field Data Sheets

BAM Vegetation Integrity Plot data

BAM Site Field Survey								
Project:	18-012 Wollar Solarfarm	**Plot Identifier**	Plot 1/W1	**Pic 20x20**	GIS pro	**Pic 20x50**	GIS pro	
Survey date:	23/05/2018		**Compass Orientation (head of 20x20 plot)**				Northwest	
Recorders	Gyoung		**PCT:**	1303				
GPS Easting	777164	**GPS Northing**	6410444		**Datum**	UTM	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology	simple slope		**Soil Texture**		sandy clay	**Slope**	5 degrees	
Land Element	Lower slope		**Soil Colour**		red/brown	**Aspect**	north west	
Landform	bottom		**Soil Depth**		>1m	**Drainage**	well drained	
Microrelief	vegetation		**Geology**		sandstone	**Watercourses**	None	

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing	0		
Cultivation	0		
Soil erosion	0		
Firewood	0		
Grazing	1	R	Cow pats
Fire Damage	0		
Storm Damage	0		
Weediness	1	R	Light weed cover
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information	
Current land use	
Grazing land	
Age class, condition,disturbance (dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution)	
Cattle, thick grour dcover	
High Threat Weeds	
Carthamnus lanat s	
Significant and threatened species and communities	
Dominant Species outside Plot	E. albens 50m to south

Plot 1/W1

	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	6
	Grass/Sedge (GG)	0
	Fern (EG)	0
	Other (OG)	0
	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	0.6
	Grass/Sedge (GG)	56.3
	Fern (EG)	0
	Other (OG)	0
	TOTAL 'HT'	0.2

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	30%	47%	6308
	15m	60%		6309
	25m	40%		6310
	35m	70%		6311
	45m	35%		6312
Bare	5m	5%	1%	6308
	15m	0%		6309
	25m	2%		6310
	35m	0%		6311
	45m	0%		6312
Cryptogam cover	5m	0%	0%	6308
	15m	0%		6309
	25m	0%		6310
	35m	0%		6311
	45m	0%		6312
Rock Cover	5m	0%	0%	6308
	15m	0%		6309
	25m	0%		6310
	35m	0%		6311
	45m	0%		6312

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	N/A
<5	0	0	N/A
Length of logs (m)		0	

Species recorded for	Plot 1/W1								
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**N, E or 'HT'**	**Exotic**	**BCA Status**	**EPBC Status**
TREE (TG)									
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Cover%**	**Abundance**	**N, E or 'HT'**	**Exotic**	**TSC Status**	**EPBC Status**
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Cover%**	**Abundance**	**N, E or 'HT'**	**Exotic**	**TSC Status**	**EPBC Status**
Verb bona	*Verbena bonariensis*	Purpletop	Verbenaceae	0.5	15	E	*		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	4	N			
Glyc taba	*Glycine tabacina*	Variable Glycine	Fabaceae (Faboidea	0.1	5	N			
Cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	0.2	20	HT	*		
Datu stra	*Datura stramonium*	Common Thornapple	Solanaceae	0.2	15	E	*		
schk pinn abro	*Schkuhria pinnata var. abrotanoid*	Dwarf Marigold	Asteraceae	3	500	E	*		
Rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	2	N			
Eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiaceae	0.1	3	N			
Port oler	*Portulaca oleracea*	Pigweed	Portulacaceae	0.1	1	N			
Modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.1	4	E	*		
Lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1	1	E	*		
Alte pung	*Alternanthera pungens*	Khaki Weed	Amaranthaceae	0.1		E	*		
Sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.1	10	N			
Malv	*Malva spp.*	Mallow	Malvaceae	0.1	1	E	*		
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A
GRASS/SEDGE (G	***Scientific Name***	**Common Name**	**Family**	**Cover%**	**Abundance**	**N, E or 'HT'**	**Exotic**	**TSC Status**	**EPBC Status**
Both macr	*Bothriochloa macra*	Red Grass	Poaceae	15	200	N			
Aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae	3	40	N			
Pasp dist	*Paspalidium distans*		Poaceae	30	500	N			
Erag alve	*Eragrostis alveiformis*		Poaceae	2	50	N			
Ryti fulv	*Rytidosperma fulvum*	Wallaby Grass	Poaceae	0.1	10	N			
Phal Aqua	*Phalaris aquatica*	Phalaris	Poaceae	0.2	6	E	*		
Ryti	*Rytidosperma spp.*		Poaceae	0.5	50	N			
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.4	20	N			
Echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	0.1	3	E	*		

Erio pseu	*Eriochloa pseudoacrotricha*	Early Spring Grass	Poaceae	0.2	50	N			
Pasp dila	*Paspalum dilatatum*	Paspalum	Poaceae	0.1	4	E	*		
Aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	5	80	N			
Plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginaceae	0.1	1	N	*		
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Cover%**	**Abundance**	**N, E or 'HT'**	**Exotic**	**TSC Status**	**EPBC Status**
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Cover%**	**Abundance**	**N, E or 'HT'**	**Exotic**	**TSC Status**	**EPBC Status**
	#N/A	#N/A	#N/A				#N/A	#N/A	#N/A

BAM Site Field Survey

Project:	18-012	**Plot Identifier**	Plot 2	**Pic 20x20**	GIS pro	**Pic 20x50**	GIS pro	
Survey date:	23/05/2018		**Compass Orientation (head of 20x20 plot)**				223	
Recorders	G Young		**PCT:**					
GPS Easting	776262	**GPS Northing**	6408847		**Datum**	UTM	**Zone**	55

Landform			**Soils**			**Drainage & Slope**		
Morphology	Simple slope		**Soil Texture**		Sandy clay	**Slope**		
Land Element	Mid slope		**Soil Colour**		Light Brown	**Aspect**	300 degrees w	st
Landform	Valley footslope		**Soil Depth**		>1m	**Drainage**	Well drained	
Microrelief	Vegetation		**Geology**		Sandstone	**Watercourses**	None	

Plot Disturbance

	Severity	**Age**	**Observational Evidence**
Clearing	0		
Cultivation	0		
Soil erosion	0		
Firewood	3	R	Mostly clean d up - occasional fallen timber
Grazing	2	R	Cattle
Fire Damage	2	R	Fire in Feb 20 7 (according to land owner)
Storm Damage	0		
Weediness			
Other			

Additional information

Current land use

Grazing country

Age class, condition,disturbance (inc. dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)

Senescent with re eneration occurring, fire Feb 2017, cattle grazing and fire wood collection. Some mistletoe in surrounding Eucs

High Threat Weeds

None

Significant and threatened species and communities (if present, note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Dominant Species outside Plot	**E. blakelyi**

Plot 2

	Tree (TG)	2
	Shrub (SG)	0
	Forb (FG)	16
	Grass/Sedge (GG)	20
	Fern (EG)	0
	Other (OG)	0
	Tree (TG)	12.1
	Shrub (SG)	0
	Forb (FG)	1.8
	Grass/Sedge (GG)	31
	Fern (EG)	0
	Other (OG)	0
	TOTAL 'HT'	0

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	40%	18%	6313
	15m	30%		6314
	25m	10%		6315
	35m	5%		6316
	45m	7%		6317
Bare	5m	20%	36%	6313
	15m	40%		6314
	25m	25%		6315
	35m	5%		6316
	45m	90%		6317
Cryptogam cover	5m	0%	0%	6313
	15m	0%		6314
	25m	0%		6315
	35m	0%		6316
	45m	0%		6317
Rock Cover	5m	0%	0%	6313
	15m	0%		6314
	25m	0%		6315
	35m	0%		6316
	45m	0%		6317

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	1	0	0
30-49	0	0	0
20-29	3	0	0
10-19	0	0	0
5-9	1	0	N/A
<5	37	0	N/A
Length of logs (m)		26	

Species recorded for	Plot 2								
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**Exotic**	**% Cover**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**BCA Status**
TREE (TG)									
Euca blak	*Eucalyptus blakelyi*	Blakely's Red Gum	Myrtaceae		12	35	N		
Euca	*Eucalyptus spp.*		Myrtaceae		0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Alte sp.	*Alternanthera sp. A*		Amaranthac		0.1	20	N		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae		0.1	10	N		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae		0.2	20	N		
Good hede	*Goodenia hederacea*	Ivy Goodenia	Goodeniacea		0.1	15	N		
Glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa		0.1	1	N		
Glyc sten	*Glycine stenophita*		Fabaceae (Fa		0.1	10	N		
Eina nuta	*Einadia nutans*	Climbing Saltbush	Chenopodiac		0.1	15	N		
Tric elat	*Tricoryne elatior*	Yellow Autumn-lily	Anthericacea		0.1	4	N		
Dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac		0.2	40	N		
Eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac		0.1	6	N		
Port oler	*Portulaca oleracea*	Pigweed	Portulacacea		0.1	2	N		
Paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllac	*	0.1	3	E		
Cony bona	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae	*	0.1	1	E		
Modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	*	0.1	1	E		
Sper rubr	*Spergularia rubra*	Sandspurry	Caryophyllac	*	0.1	4	E		
Eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	*	0.1	4	E		
Mair ench	*Maireana enchylaenoides*	Wingless Fissure-wee	Chenopodiac		0.1	1	N		
Lepi afri	*Lepidium africanum*	Common Peppercress	Brassicaceae	*	0.1	4	E		
Sola nigr	*Solanum nigrum*	Black-berry Nightshad	Solanaceae	*	0.1	1	E		
Wahl	*Wahlenbergia spp.*	Bluebell	Campanulace		0.1	3	N		
Sole domi	*Solenogyne dominii*		Asteraceae		0.1	1	N		
Gono tetr	*Gonocarpus tetragynus*	Poverty Raspwort	Haloragacea		0.1	1	N		
Hype gram	*Hypericum gramineum*	Small St John's Wort	Clusiaceae		0.1	1	N		

	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
GRASS/SEDGE (G	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Ente acic	*Enteropogon acicularis*	Curly Windmill Grass	Poaceae		10	500	N		
Aust scab	*Austrostipa scabra*	Speargrass	Poaceae		0.2	45	N		
Chlo trun	*Chloris truncata*	Windmill Grass	Poaceae		15	800	N		
Pani simi	*Panicum simile*	Two-colour Panic	Poaceae		0.1	10	N		
Ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae		0.2	50	N		
Aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae		3	200	N		
Eula aure	*Eulalia aurea*	Silky Browntop	Poaceae		0.5	100	N		
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gras	Poaceae		0.4	100	N		
Chlo vent	*Chloris ventricosa*	Tall Chloris	Poaceae		0.1	20	N		
Erag cili	*Eragrostis cilianensis*	Stinkgrass	Poaceae	*	0.1	1	E		
Cyno dact	*Cynodon dactylon*	Common Couch	Poaceae		0.2	5	N		
Erag parv	*Eragrostis parviflora*	Weeping Lovegrass	Poaceae		0.1	20	N		
Micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae		0.2	50	N		
Erag lacu	*Eragrostis lacunaria*	Purple Lovegrass	Poaceae		0.1	10	N		
Aust seta	*Austrostipa setacea*	Corkscrew Grass	Poaceae		0.1	1	N		
Ryti race	*Rytidosperma racemosum*	Wallaby Grass	Poaceae		0.2	50	N		
Ryti caes	*Rytidosperma caespitosum*	Ringed Wallaby Grass	Poaceae		0.1	20	N		
Ryti bipa	*Rytidosperma bipartitum*	Wallaby Grass	Poaceae		0.1	20	N		
Digi brow	*Digitaria brownii*	Cotton Panic Grass	Poaceae		0.1	5	N		
Junc fili	*Juncus filicaulis*		Juncaceae		0.1	20	N		
Loma mult mult	*Lomandra multiflora subsp*	Many-flowered Mat-r	Lomandracea		0.2	5	N		
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W7	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**					
Recorders	MP BT		**PCT:**	1303 good				
GPS Easting	775684	**GPS Northing**	6408603		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W7

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	2
	Shrub (SG)	3
	Forb (FG)	21
	Grass & grasslike (GG)	8
	Fern (EG)	1
	Other (OG)	4
	TOTAL	39

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	30.1
	Shrub (SG)	2.1
	Forb (FG)	33.8
	Grass & grasslike (GG)	7.7
	Fern (EG)	0.1
	Other (OG)	0.4
	TOTAL Native	74.2
	TOTAL 'HTE'	0

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	3	0	3
30-49	0	0	0
20-29	3	0	0
10-19	4	0	0
5-9	0	0	0
<5	0	0	N/A
Length of logs (m)		52	

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	20%	18.40%	
	15m	12%		
	25m	18%		
	35m	37%		
	45m	5%		
Bare ground cover	5m	3%	49%	
	15m	45%		
	25m	40%		
	35m	60%		
	45m	95%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	35%	7%	
	15m	2%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W7								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
euca albe	*Eucalyptus albens*	White Box	Myrtaceae	30			Tree (TG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	10			Forb (FG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	5			Forb (FG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	5			Forb (FG)	No		
eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac	5			Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	5			Forb (FG)	No		
gono tetr	*Gonocarpus tetragynus*	Poverty Raspwort	Haloragaceae	0.1	1		Forb (FG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.1	5	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.2	10	*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	1			Grass & grasslike (GG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	5			Grass & grasslike (GG)	No		
vitt muel	*Vittadinia muelleri*	A Fuzzweed	Asteraceae	0.5	20		Forb (FG)	No		
eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac	0.5	5		Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1			Grass & grasslike (GG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.1	5		Other (OG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.1	2		Grass & grasslike (GG)	No		
tric elat	*Tricoryne elatior*	Yellow Autumn-lily	Anthericacea	0.1	1		Forb (FG)	No		
glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.1	1		Other (OG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	2		Forb (FG)	No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	10		Forb (FG)	No		
euca blak	*Eucalyptus blakelyi*	Blakely's Red Gum	Myrtaceae	0.1	1		Tree (TG)	No		
micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae	0.2	10		Grass & grasslike (GG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.5	100		Forb (FG)	No		
eina nuta	*Einadia nutans*	Climbing Saltbush	Chenopodiac	0.1	1		Forb (FG)	No		
swai gale	*Swainsona galegifolia*	Smooth Darling Pea	Fabaceae (Fa	1			Forb (FG)	No		
conv erub	*Convolvulus erubescens*	Pink Bindweed	Convolvulace	0.1	2		Other (OG)	No		
hydr laxi	*Hydrocotyle laxiflora*	Stinking Pennywort	Apiaceae	0.1	10		Forb (FG)	No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.2	5		Grass & grasslike (GG)	No		
sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae	1			Shrub (SG)	No		
acac impl	*Acacia implexa*	Hickory Wattle	Fabaceae (Mi	1			Shrub (SG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.2	20	*		No		
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	0.2	20		Forb (FG)	No		
pand pand	*Pandorea pandorana*	Wonga Wonga Vine	Bignoniaceae	0.1	1		Other (OG)	No		
chei	*Cheilanthes spp.*	Cloak Fern, Mulga Fe	Pteridaceae	0.1	2		Fern (EG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
conv	*Convolvulus spp.*	A Bindweed	Convolvulace	0.1	1	*		No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	1		Forb (FG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	1	*		No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	1		Forb (FG)	No		

tolp barb	*Tolpis barbata*	Yellow Hawkweed	Asteraceae	0.1	10	*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	0.5	50	*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	10	*		No		
sola nigr	*Solanum nigrum*	Black-berry Nightsha	Solanaceae	0.2	1	*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1	1	*		No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	1		Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.1	10	*		No		
aris pers	*Aristida personata*		Poaceae	0.1	2		Grass & grasslike (GG)	No		
arth minu	*Arthropodium minus*	Small Vanilla Lily	Anthericacea	0.1	1		Forb (FG)	No		
acac deco	*Acacia decora*	Western Silver Wattl	Fabaceae (Mi	0.1	1		Shrub (SG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W8	**Pic 20x20**		**Pic 20x50**		
Survey date:	25/10/2018		**Compass Orientation (head of 20x20 plot)**				270	
Recorders	MP BT		**PCT:**	303 DNG goc d				
GPS Easting	776697	**GPS Northing**	6409790		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W8

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	1
	Forb (FG)	14
	Grass & grasslike (GG)	13
	Fern (EG)	1
	Other (OG)	1
	TOTAL	30

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	10
	Forb (FG)	10
	Grass & grasslike (GG)	53.8
	Fern (EG)	1
	Other (OG)	0.1
	TOTAL Native	74.9
	TOTAL 'HTE'	5.1

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	3%	4.20%	
	15m	5%		
	25m	5%		
	35m	3%		
	45m	5%		
Bare ground cover	5m	25%	20%	
	15m	10%		
	25m	25%		
	35m	20%		
	45m	20%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	20%	14%	
	15m	3%		
	25m	25%		
	35m	20%		
	45m	1%		

COMPOSITION & STRUCTURE

Species recorded for		W8								
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
Aust scab	*Austrostipa scabra*	Speargrass	Poaceae	20			Grass & grasslike (GG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	5			Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	1			Fern (EG)	No		
vitt muel	*Vittadinia muelleri*	A Fuzzweed	Asteraceae	0.5	1		Forb (FG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	10			Grass & grasslike (GG)	No		
dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac	0.1	1			No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.1	5	*		No		
eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac	2			Forb (FG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.1	2	*		No		
cony	*Conyza spp.*	A Fleabane	Asteraceae	0.1	1	*		No		
sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae	10			Shrub (SG)	No		
eina nuta	*Einadia nutans*	Climbing Saltbush	Chenopodiac	0.2	5		Forb (FG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	5	*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	5		Forb (FG)	No		
aris vaga	*Aristida vagans*	Threeawn Speargrass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	1		*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	10			Grass & grasslike (GG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	1		*		No		
aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae	1			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	5		*		HTE		
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	0.1	2		Forb (FG)	No		
them tria	*Themeda triandra*		Poaceae	5			Grass & grasslike (GG)	No		
cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae	0.1	1		Forb (FG)	No		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae	0.1	1		Forb (FG)	No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	1		Forb (FG)	No		
alte pung	*Alternanthera pungens*	Khaki Weed	Amaranthace	0.1	1	*		HTE		
erag brow	*Eragrostis brownii*	Brown's Lovegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
erag alve	*Eragrostis alveiformis*		Poaceae	0.2	5			No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	1		*		No		
pani simi	*Panicum simile*	Two-colour Panic	Poaceae	0.5	5		Grass & grasslike (GG)	No		
digi brow	*Digitaria brownii*	Cotton Panic Grass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.2	5		Grass & grasslike (GG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
verb bona	*Verbena bonariensis*	Purpletop	Verbenaceae	0.1	1	*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.1	2		Other (OG)	No		

erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.1	10	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	2	*		No		
vero pleb	*Veronica plebeia*	Trailing Speedwell	Plantaginacea	0.5	10		Forb (FG)	No		
paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllace	0.2	10	*		No		
cras colo	*Crassula colorata*	Dense Stonecrop	Crassulaceae	0.1	5		Forb (FG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	2		Forb (FG)	No		

BAM Site Field Survey

Project:	18-012 Wollar solarfarm	**Plot Identifier**	Plot 4 / W4	**Pic 20x20**	GIS pro	**Pic 20x50**	GIS pro		
Survey date:	24/05/2018		**Compass Orientation (head of 20x20 plot)**						
Recorders	G Young		**PCT:**						
GPS Easting	775649	**GPS Northing**	6408917		**Datum**	UTM	**Zone**	55	
Landform			**Soils**			**Drainage & Slope**			
Morphology	Lower slope		**Soil Texture**		Clay	**Slope**	4 degrees		
Land Element	Lower slope		**Soil Colour**		Orange brown	**Aspect**	NN E		
Landform	footslope		**Soil Depth**		>1m	**Drainage**	Well drained		
Microrelief	None		**Geology**		A luvial sandstor	**Watercourses**	56m SW		

Plot Disturbance

	Severity	Age	Observational Evidence
Clearing	3	O	
Cultivation	0		
Soil erosion	1	NR	
Firewood	0		
Grazing	2	R	Cattle
Fire Damage	2	R	Fire Feb 2017
Storm Damage	0		
Weediness	2	R	
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information

Current land use

Grazing for cattle

Age class, condition,disturbance (inc. dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)

Rabbit scats obser ved

High Threat Weeds

Carthamnus lanat s

Significant and threatened species and communities (if present, note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	E. albens directly east of plot

Plot 4 / W4

	Tree (TG)	1
	Shrub (SG)	0
	Forb (FG)	15
	Grass/Sedge (GG)	15
	Fern (EG)	0
	Other (OG)	0
	Tree (TG)	12
	Shrub (SG)	0
	Forb (FG)	1.7
	Grass/Sedge (GG)	15.5
	Fern (EG)	0
	Other (OG)	0
	TOTAL 'HT'	0.1

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter	5m	5%	9%	
	15m	7%		
	25m	15%		
	35m	17%		
	45m	3%		
Bare	5m	40%	35%	
	15m	50%		
	25m	35%		
	35m	40%		
	45m	10%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	N/A
<5	0	0	N/A
Length of logs (m)		0	

Species recorded for	Plot 4 / W4								
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**Exotic**	**% Cover**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**BCA Status**
TREE (TG)									
euca albe	*Eucalyptus albens*	White Box	Myrtaceae		12	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiace		0.1	8	N		
Erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	*	0.3	100	E		
Arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	*	0.2	40	E		
Dich repe	*Dichondra repens*	Kidney Weed	Convolvulace		0.2	25	N		
Modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	*	0.1	20	E		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae		0.1	20	N		
Plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginace	*	0.2	200	E		
Vitt muel	*Vittadinia muelleri*	A Fuzzweed	Asteraceae		0.1	10	N		
Erod crin	*Erodium crinitum*	Blue Crowfoot	Geraniaceae		0.1	1	N		
Mair ench	*Maireana enchylaenoide*	Wingless Fissure-wee	Chenopodiac		0.1	6	N		
Eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac		0.1	5	N		
Alte pung	*Alternanthera pungens*	Khaki Weed	Amaranthace	*	0.1	1	E		
Malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	*	0.1	10	E		
Cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	*	0.1	20	HT		
Lepi afri	*Lepidium africanum*	Common Peppercress	Brassicaceae	*	0.1	3	E		
Glyc taba	*Glycine tabacina*	Variable Glycine	Fabaceae (Fa		0.1	1	N		
Eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	*	0.1	2	E		
Eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac		0.1	1	N		
Cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	*	0.1	1	E		
plan hisp	*Plantago hispida*		Plantaginace		0.1	3	N		
Medi	*Medicago spp.*	A Medic	Fabaceae (Fa	*	0.1	2	E		
Vitt	*Vittadinia spp.*	Fuzzweed	Asteraceae		0.1	1	N		
Paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllac	*	0.1	1	E		

Good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea		0.2	100	N		
Good hede	*Goodenia hederacea*	Ivy Goodenia	Goodeniacea		0.1	20	N		
Wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace		0.1	6	N		
Trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	*	0.1	20	E		
Cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae		0.1	2	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
GRASS/SEDGE (G	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Chlo trun	*Chloris truncata*	Windmill Grass	Poaceae		3	300	N		
Chlo vent	*Chloris ventricosa*	Tall Chloris	Poaceae		1	200	N		
Both macr	*Bothriochloa macra*	Red Grass	Poaceae		5	500	N		
Ryti bipa	*Rytidosperma bipartitum*	Wallaby Grass	Poaceae		5	500	N		
Erio pseu	*Eriochloa pseudoacrotric*	Early Spring Grass	Poaceae		0.1	10	N		
Cyno dact	*Cynodon dactylon*	Common Couch	Poaceae		0.1	5	N		
Pani simi	*Panicum simile*	Two-colour Panic	Poaceae		0.1	10	N		
Ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae		0.5	100	N		
Aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae		0.1	5	N		
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gras	Poaceae		0.1	2	N		
Dich seri	*Dichanthium sericeum*	Queensland Bluegrass	Poaceae		0.1	10	N		
Cony bona	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae	*	0.1	2	E		
Ryti caes	*Rytidosperma caespitosu*	Ringed Wallaby Grass	Poaceae		0.1	6	N		
Erag lept	*Eragrostis leptostachya*	Paddock Lovegrass	Poaceae		0.1	3	N		
Cype grac	*Cyperus gracilis*	Slender Flat-sedge	Cyperaceae		0.1	1	N		
Care inve	*Carex inversa*	Knob Sedge	Cyperaceae		0.1	2	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W9	**Pic 20x20**		**Pic 20x50**		
Survey date:	25/10/2018		**Compass Orientation (head of 20x20 plot)**				180	
Recorders	MP BT		**PCT:**	1303 DGL				
GPS Easting	776523	**GPS Northing**	6409645		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W9

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	1
	Forb (FG)	4
	Grass & grasslike (GG)	13
	Fern (EG)	0
	Other (OG)	1
	TOTAL	19

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	1
	Forb (FG)	1.2
	Grass & grasslike (GG)	33.4
	Fern (EG)	0
	Other (OG)	0.1
	TOTAL Native	35.7
	TOTAL 'HTE'	10

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	3%	2.40%	
	15m	3%		
	25m	3%		
	35m	2%		
	45m	1%		
Bare ground cover	5m	5%	4%	
	15m	5%		
	25m	5%		
	35m	3%		
	45m	1%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	1%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for W9

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	5			Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	10		*		HTE		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	30		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	5		*		No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	0.5	20		Grass & grasslike (GG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.2	20	*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	1		*		No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	5			Grass & grasslike (GG)	No		
aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae	0.5	5		Grass & grasslike (GG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.1	50		Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	10			Grass & grasslike (GG)	No		
sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae	1			Shrub (SG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5	20		Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	1		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	0.5	20	*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.1	5		Other (OG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	1	*		No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	1			Grass & grasslike (GG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.5	20	*		No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.5	20	*		No		
ryti fulv	*Rytidosperma fulvum*	Wallaby Grass	Poaceae	5			Grass & grasslike (GG)	No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	1		*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	10		Forb (FG)	No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	1		*		No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	2		Forb (FG)	No		
ente acic	*Enteropogon acicularis*	Curly Windmill Grass	Poaceae	0.2	2		Grass & grasslike (GG)	No		
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	0.1	1	*		No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.1	5	*		No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	0.1	5	*		No		
pani simi	*Panicum simile*	Two-colour Panic	Poaceae	0.1	5		Grass & grasslike (GG)	No		
ryti dutt	*Rytidosperma duttonian*	Brown-back Wallaby	Poaceae	0.1	1		Grass & grasslike (GG)	No		
dich seri	*Dichanthium sericeum*	Queensland Bluegras	Poaceae	0.5	20		Grass & grasslike (GG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W10	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				170	
Recorders	MP and BT		**PCT:**	1303 DGL				
GPS Easting	776157	**GPS Northing**	6409279		**Datum**	GDA 94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W10

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	1
	Forb (FG)	10
	Grass & grasslike (GG)	8
	Fern (EG)	0
	Other (OG)	1
	TOTAL	20

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0.1
	Forb (FG)	4.3
	Grass & grasslike (GG)	36.2
	Fern (EG)	0
	Other (OG)	0.1
	TOTAL Native	40.7
	TOTAL 'HTE'	20.3

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	1.60%	
	15m	2%		
	25m	2%		
	35m	1%		
	45m	1%		
Bare ground cover	5m	35%	32%	
	15m	40%		
	25m	32%		
	35m	28%		
	45m	23%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m			

COMPOSITION & STRUCTURE

Species recorded for		W10								
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	1			Forb (FG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.2	5		Forb (FG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	1			Forb (FG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	15			Grass & grasslike (GG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	1			Forb (FG)	No		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae	0.1	2		Forb (FG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	5			Grass & grasslike (GG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.1	5		Other (OG)	No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	0.5	20		Grass & grasslike (GG)	No		
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	2		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	20		*		HTE		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.5	20	*		No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	10		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	20	*		No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	2		Forb (FG)	No		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	0.1	3	*		HTE		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	2		Forb (FG)	No		
trif repe	*Trifolium repens*	White Clover	Fabaceae (Fa	0.2	10	*		No		
linu	*Linum spp.*		Linaceae	0.1	1	*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	10			Grass & grasslike (GG)	No		
pasp dila	*Paspalum dilatatum*	Paspalum	Poaceae	0.2	2	*		HTE		
phyl hirt	*Phyllanthus hirtellus*	Thyme Spurge	Phyllanthacea	0.1	1		Shrub (SG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.5	10		Forb (FG)	No		
cent meli	*Centaurea melitensis*	Maltese Cockspur	Asteraceae	0.2	10	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.2	50		Forb (FG)	No		
erag alve	*Eragrostis alveiformis*		Poaceae	0.5	10		Grass & grasslike (GG)	No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	5		*		No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	5			Grass & grasslike (GG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.5	10	*		No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.2	10	*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	0.5	10	*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	0.1	5	*		No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.1	1		Forb (FG)	No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.1	1	*		No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.1	1	*		No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.5	50	*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W11	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2013		**Compass Orientation (head of 20x20 plot)**					
Recorders	MP BT		**PCT:**	1303 GL				
GPS Easting	775105	**GPS Northing**	6408789		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information	
Current land use	
Age class of trees (DBH range) , Condition of Vegetation, Hollows	
10 - 100cm DBH	
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)	
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)	
Dominant Species outside Plot	

FUNCTION

Function attributes for	W11

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	11
	Grass & grasslike (GG)	6
	Fern (EG)	0
	Other (OG)	2
	TOTAL	19

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	8.7
	Grass & grasslike (GG)	17.5
	Fern (EG)	0
	Other (OG)	1.1
	TOTAL Native	27.3
	TOTAL 'HTE'	20

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	1.20%	
	15m	2%		
	25m	1%		
	35m	1%		
	45m	1%		
Bare ground cover	5m	75%	62%	
	15m	72%		
	25m	50%		
	35m	75%		
	45m	37%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W11								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	5		*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	1			Other (OG)	No		
wahl comm	*Wahlenbergia communi*	Tufted Bluebell	Campanulace	1			Forb (FG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	5			Forb (FG)	No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.5	20	*		No		
aspe conf	*Asperula conferta*	Common Woodruff	Rubiaceae	1			Forb (FG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	5	10		Grass & grasslike (GG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	5		Forb (FG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	20		*		HTE		
ryti	*Rytidosperma spp.*		Poaceae	1			Grass & grasslike (GG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	1		*		No		
cham drum	*Chamaesyce drummond*	Caustic Weed	Euphorbiacea	0.5	1		Forb (FG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	0.5		Forb (FG)	No		
brun aust	*Brunonia australis*	Blue Pincushion	Goodeniacea	0.1	1		Forb (FG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.1	2		Forb (FG)	No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	1	5		Grass & grasslike (GG)	No		
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	0.5	5		Grass & grasslike (GG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.2	10	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	1		Forb (FG)	No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.2	20		Forb (FG)	No		
linu	*Linum spp.*		Linaceae	0.2	5	*		No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.5	10	*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.5	10	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	2	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.5	10	*		No		
cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	1		*		No		
cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae	0.1	1		Forb (FG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.5	20	*		No		
conv erub	*Convolvulus erubescens*	Pink Bindweed	Convolvulace	0.1	1		Other (OG)	No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	1		*		No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	5			Grass & grasslike (GG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.5	50	*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W12	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				260	
Recorders	MP BT		**PCT:**	1303				
GPS Easting	776220	**GPS Northing**	6408504		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W12

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	9
	Grass & grasslike (GG)	8
	Fern (EG)	1
	Other (OG)	1
	TOTAL	19

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	4
	Grass & grasslike (GG)	17.8
	Fern (EG)	0.1
	Other (OG)	1
	TOTAL Native	22.9
	TOTAL 'HTE'	40

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	1.60%	
	15m	2%		
	25m	1%		
	35m	3%		
	45m	1%		
Bare ground cover	5m	40%	37%	
	15m	21%		
	25m	35%		
	35m	27%		
	45m	60%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	1%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for W12

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	5			Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	10			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	40		*		HTE		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	1			Forb (FG)	No		
boer domi	*Boerhavia dominii*	Tarvine	Nyctaginacea	0.1	10		Forb (FG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	5		*		No		
them tria	*Themeda triandra*		Poaceae	0.1	10		Grass & grasslike (GG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1	100		Grass & grasslike (GG)	No		
erag alve	*Eragrostis alveiformis*		Poaceae	0.5	50			No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	0.5	50		Grass & grasslike (GG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.1	20		Grass & grasslike (GG)	No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	1				No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	1			Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.5	100		Forb (FG)	No		
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	1			Grass & grasslike (GG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	1			Other (OG)	No		
brom	*Bromus spp.*	A Brome	Poaceae	0.1	5	*	Grass & grasslike (GG)	No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.1	5	*		No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.1	5		Fern (EG)	No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1	2	*		No		
ryti fulv	*Rytidosperma fulvum*	Wallaby Grass	Poaceae	0.2	10			No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	20		Forb (FG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	5	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.5	50	*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	10		Forb (FG)	No		
sile	*Silene spp.*		Caryophyllace	0.1	20	*		No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	1	*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	0.1	5	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	1		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	1		*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	1		Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	2		Forb (FG)	No		
linu usit	*Linum usitatissimum*	Flax	Linaceae	0.1	1	*		No		
Schk pinn abro	*Schkuhria pinnata var. a*	Dwarf Marigold	Asteraceae	0.1	2	*		No		
tolp barb	*Tolpis barbata*	Yellow Hawkweed	Asteraceae	0.1	1	*		No		
conv	*Convolvulus spp.*	A Bindweed	Convolvulace	0.1	2	*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W29	**Pic 20x20**		**Pic 20x50**		
Survey date:	22/10/2018		**Compass Orientation (head of 20x20 plot)**				50	
Recorders	MP BT		**PCT:**	1610 Low				
GPS Easting	776672	**GPS Northing**	6408233		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W29

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	10
	Grass & grasslike (GG)	2
	Fern (EG)	0
	Other (OG)	0
	TOTAL	12

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	4.4
	Grass & grasslike (GG)	5.1
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	9.5
	TOTAL 'HTE'	22.2

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	3%	9.40%	
	15m	5%		
	25m	5%		
	35m	4%		
	45m	30%		
Bare ground cover	5m	12%	13%	
	15m	15%		
	25m	20%		
	35m	11%		
	45m	7%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	3%	1%	
	15m	3%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for	W29									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
Trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	30		*		No		
Trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	10		*		No		
Trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	5		*		No		
Both Macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	2			Forb (FG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	20		*		HTE		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	1			Forb (FG)	No		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	2		*		HTE		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.2	20		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
schk pinn abro	*Schkuhria pinnata var. a*	Dwarf Marigold	Asteraceae	1		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.2	20		Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.1	10		Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	10		Forb (FG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	5	*		No		
vulp	*Vulpia spp.*	Rat's-tail Fescue	Poaceae	0.5	50	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	50		Forb (FG)	No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	1		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	0.2	50	*		No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1	1	*		No		
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	0.1	1		Grass & grasslike (GG)	No		
rosa rubi	*Rosa rubiginosa*	Sweet Briar	Rosaceae	0.2	1	*		HTE		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.1	5		Forb (FG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	1	*		No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.5	50		Forb (FG)	No		

BAM Site Field Survey

Project:	18-012 Wollar	**Plot Identifier**	Plot 3	**Pic 20x20**	GIS pro	**Pic 20x50**	Not done	
Survey date:	23/05/2018		**Compass Orientation (head of 20x20 plot)**					
Recorders	G Young		**PCT:**					
GPS Easting	776872	**GPS Northing**	6408534		**Datum**	UTM	**Zone**	55

Landform			**Soils**			**Drainage & Slope**		
Morphology	Lower slope		**Soil Texture**		Sandy Clay	**Slope**	2 degrees	
Land Element	Lower slope		**Soil Colour**		Cream Orange	**Aspect**	eastly	
Landform	Bottom		**Soil Depth**		<1m?	**Drainage**	Well drained	
Microrelief	Vegetation		**Geology**		Sandstone	**Watercourses**	None	

Plot Disturbance

	Severity	**Age**	**Observational Evidence**
Clearing	3	O	Historically cu ltivated (signs of plouging)
Cultivation	1	O	As above
Soil erosion	0		
Firewood	0		
Grazing	2	R	Cattle/horses
Fire Damage	0		
Storm Damage	0		
Weediness	3		Carthamnus l natus
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information

Current land use

Grazing for horses

Age class, condition,disturbance (inc. dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)

Good cover of pla ts over ground

High Threat Weeds

Carthamnus lanat s

Significant and threatened species and communities (if present, note pop. size/area, structure, repro status, habit, habitat, threats, photos)

NOTE - Not enough time to complete 20 x 50 so 5 random photos taken inside 20 x 20 to estimate litter cover. No trees within 50m

Dominant Species outside Plot	None observed

Plot 3

	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	2
	Grass/Sedge (GG)	6
	Fern (EG)	0
	Other (OG)	0
	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	0.2
	Grass/Sedge (GG)	47.8
	Fern (EG)	0
	Other (OG)	0
	TOTAL 'HT'	15.5

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	70%	42%	6319
	15m	50%		6320
	25m	35%		6321
	35m	15%		6322
	45m	40%		6323
Bare	5m	0%	0%	6319
	15m	0%		6320
	25m	1%		6321
	35m	0%		6322
	45m	0%		6323
Cryptogam cover	5m	0%	0%	6319
	15m	0%		6320
	25m	0%		6321
	35m	0%		6322
	45m	0%		6323
Rock Cover	5m	0%	0%	6319
	15m	0%		6320
	25m	0%		6321
	35m	0%		6322
	45m	0%		6323

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	N/A
<5	0	0	N/A
Length of logs (m)		0	

Species recorded for	Plot 3								
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**Exotic**	**% Cover**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**BCA Status**
TREE (TG)									
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	*	15	2000	HT		
Trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	*	10	1000	E		
Medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	*	0.2	20	E		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae		0.1	3	N		
Hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	*	0.5	50	HT		
Chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae		0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
GRASS/SEDGE (G	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Both macr	*Bothriochloa macra*	Red Grass	Poaceae		40	2000	N		
Aris pers	*Aristida personata*		Poaceae		5	30	N		
Erag alve	*Eragrostis alveiformis*		Poaceae		0.2	40	N		
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gras	Poaceae		0.5	100	N		
Cyno dact	*Cynodon dactylon*	Common Couch	Poaceae		2	50	N		
Ryti	*Rytidosperma spp.*		Poaceae		0.1	1	N		
Eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	*	1	100	E		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W13	**Pic 20x20**		**Pic 20x50**		
Survey date:	25/10/2018		**Compass Orientation (head of 20x20 plot)**				180	
Recorders	MP BT		**PCT:**	Cultivated				
GPS Easting	776634	**GPS Northing**	6410281		**Datum**	UTM	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W13

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	5
	Grass & grasslike (GG)	7
	Fern (EG)	1
	Other (OG)	0
	TOTAL	13

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	0.5
	Grass & grasslike (GG)	13.5
	Fern (EG)	0.1
	Other (OG)	0
	TOTAL Native	14.1
	TOTAL 'HTE'	30

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	1.80%	
	15m	1%		
	25m	1%		
	35m	3%		
	45m	2%		
Bare ground cover	5m	3%	3%	
	15m	2%		
	25m	3%		
	35m	3%		
	45m	2%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W13								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	2		Forb (FG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	30		*		HTE		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	10			Grass & grasslike (GG)	No		
trif camp	*Trifolium campestre*	Hop Clover	Fabaceae (Fa	2		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	10		*		No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	10		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
tolp barb	*Tolpis barbata*	Yellow Hawkweed	Asteraceae	0.1	10	*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	10		*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.2	10		Grass & grasslike (GG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	5		Forb (FG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	10	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	1			Grass & grasslike (GG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	1		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	0.5	50	*		No		
junc fili	*Juncus filicaulis*		Juncaceae	0.1	1		Grass & grasslike (GG)	No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1	5	*		No		
trif repe	*Trifolium repens*	White Clover	Fabaceae (Fa	0.1	5	*		No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	2			Grass & grasslike (GG)	No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	0.1	10	*		No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.1	10	*		No		
sile	*Silene spp.*		Caryophyllace	0.1	5	*		No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	1		Forb (FG)	No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.1	2	*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	5		Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.1	5		Fern (EG)	No		
sonc aspe	*Sonchus asper*	Prickly Sowthistle	Asteraceae	0.1	1	*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W14	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				110	
Recorders			**PCT:**	Cultivated				
GPS Easting	775692	**GPS Northing**	6409247		**Datum**	GD 94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W14

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	9
	Grass & grasslike (GG)	7
	Fern (EG)	0
	Other (OG)	0
	TOTAL	16

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.8
	Grass & grasslike (GG)	12.3
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	14.1
	TOTAL 'HTE'	5

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	2.40%	
	15m	1%		
	25m	3%		
	35m	5%		
	45m	2%		
Bare ground cover	5m	20%	13%	
	15m	11%		
	25m	13%		
	35m	8%		
	45m	13%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W14								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	10		*		No		
sile	*Silene spp.*		Caryophyllace	0.2		*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	10		*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1			Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	2		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	20		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	5		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	2		*		No		
plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginacea	1		*		No		
trif repe	*Trifolium repens*	White Clover	Fabaceae (Fa	0.5		*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	1		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	2		*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1			Grass & grasslike (GG)	No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1		*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.2		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5			Forb (FG)	No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1			Forb (FG)	No		
cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	1		*		No		
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	0.1			Forb (FG)	No		
cham drum	*Chamaesyce drummond*	Caustic Weed	Euphorbiacea	0.1			Forb (FG)	No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	5		*		No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1			Forb (FG)	No		
linu	*Linum spp.*		Linaceae	0.1		*		No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.2			Forb (FG)	No		
erag alve	*Eragrostis alveiformis*		Poaceae	0.1			Grass & grasslike (GG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	5			Grass & grasslike (GG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1			Forb (FG)	No		
gomp frut	*Gomphocarpus fruticosu*	Narrow-leaved Cotto	Apocynaceae	0.1		*		No		
junc fili	*Juncus filicaulis*		Juncaceae	0.1			Grass & grasslike (GG)	No		
care inve	*Carex inversa*	Knob Sedge	Cyperaceae	0.1			Grass & grasslike (GG)	No		
Eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	0.1		*		No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1		*		No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1		*		No		
Echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	1		*		No		
verb bona	*Verbena bonariensis*	Purpletop	Verbenaceae	0.1		*		No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.1		*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.5		*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	1			Grass & grasslike (GG)	No		

calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5			Forb (FG)	No		
echi plan	*Echium plantagineum*	Patterson's Curse	Boraginaceae	0.1		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	5		*		HTE		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W15	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				186	
Recorders	MP BT		**PCT:**	Cultivated				
GPS Easting	776738	**GPS Northing**	6408708		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W15

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	4
	Grass & grasslike (GG)	3
	Fern (EG)	0
	Other (OG)	0
	TOTAL	7

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.3
	Grass & grasslike (GG)	1.7
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	3
	TOTAL 'HTE'	35

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	6%	5.20%	
	15m	7%		
	25m	3%		
	35m	4%		
	45m	6%		
Bare ground cover	5m	6%	3%	
	15m	4%		
	25m	1%		
	35m	2%		
	45m	1%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for	W15									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	0.1	2	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	5		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	30		*		HTE		
junc fili	*Juncus filicaulis*		Juncaceae	0.5	10		Grass & grasslike (GG)	No		
trif camp	*Trifolium campestre*	Hop Clover	Fabaceae (Fa	0.5	20	*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	5		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	10		*		No		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	5		*		HTE		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	10		*		No		
sile	*Silene spp.*		Caryophyllace	5		*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	25		*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	1			Grass & grasslike (GG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	0.2	5		Grass & grasslike (GG)	No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	1			Forb (FG)	No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.5	10	*		No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	1		Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	5		*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	5	*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	0.2	10	*		No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	1		Forb (FG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	1			No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	1		Forb (FG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	1	*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W16	**Pic 20x20**		**Pic 20x50**		
Survey date:	25/10/2018		**Compass Orientation (head of 20x20 plot)**				85	
Recorders	MP BT		**PCT:**	Cultivated				
GPS Easting	776501	**GPS Northing**	6409093		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W16

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	7
	Grass & grasslike (GG)	10
	Fern (EG)	0
	Other (OG)	0
	TOTAL	17

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.4
	Grass & grasslike (GG)	3.7
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	5.1
	TOTAL 'HTE'	25

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	3%	2.00%	
	15m	2%		
	25m	1%		
	35m	2%		
	45m	2%		
Bare ground cover	5m	40%	26%	
	15m	10%		
	25m	40%		
	35m	10%		
	45m	30%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	9%	
	15m	0%		
	25m	30%		
	35m	7%		
	45m	10%		

COMPOSITION & STRUCTURE

Species recorded for W16

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	0.2	10	*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	1			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	25		*		HTE		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	2		*		No		
tolp barb	*Tolpis barbata*	Yellow Hawkweed	Asteraceae	0.1	2	*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	15		*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	10		Forb (FG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	10		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.2	50		Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.2	10		Forb (FG)	No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	5		Forb (FG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.2	10	*		No		
erag brow	*Eragrostis brownii*	Brown's Lovegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.5	10		Grass & grasslike (GG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	20		*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	5		*		No		
paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllace	0.2	10	*		No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	2		*		No		
pani simi	*Panicum simile*	Two-colour Panic	Poaceae	0.1	1		Grass & grasslike (GG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1			Grass & grasslike (GG)	No		
sile	*Silene spp.*		Caryophyllace	0.5	20	*		No		
ryti fulv	*Rytidosperma fulvum*	Wallaby Grass	Poaceae	2				No		
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	2		*		No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	0.2	5		Grass & grasslike (GG)	No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	1		*		No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	2				No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.2	10		Forb (FG)	No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	0.5	5		Grass & grasslike (GG)	No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.2	20	*		No		
dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac	0.1	1		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.5	50	*		No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.2	10	*		No		
junc fili	*Juncus filicaulis*		Juncaceae	0.1	1		Grass & grasslike (GG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	1	*		No		
cras colo	*Crassula colorata*	Dense Stonecrop	Crassulaceae	0.1	10		Forb (FG)	No		
caps burs	*Capsella bursa-pastoris*	Shepherd's Purse	Brassicaceae	0.1	10	*		No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.5	50	*		No		
cype	*Cyperus spp.*		Cyperaceae	0.1	1		Grass & grasslike (GG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W17	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				270	
Recorders	MP BT		**PCT:**	Cultivated				
GPS Easting	776121	**GPS Northing**	6408961		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W17

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	11
	Grass & grasslike (GG)	5
	Fern (EG)	0
	Other (OG)	0
	TOTAL	16

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	2.9
	Grass & grasslike (GG)	6.2
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	9.1
	TOTAL 'HTE'	40

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	4%	2.00%	
	15m	2%		
	25m	2%		
	35m	1%		
	45m	1%		
Bare ground cover	5m	35%	15%	
	15m	15%		
	25m	10%		
	35m	15%		
	45m	2%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W17								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	5		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	40		*		HTE		
trif repe	*Trifolium repens*	White Clover	Fabaceae (Fa	1		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	2		*		No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.5			Grass & grasslike (GG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.2		*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.5			Grass & grasslike (GG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5			Forb (FG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.1		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5		*		No		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae	0.1			Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.2		*		No		
vitt muel	*Vittadinia muelleri*	A Fuzzweed	Asteraceae	0.2			Forb (FG)	No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.1		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	0.5		*		No		
sile	*Silene spp.*		Caryophyllace	0.5		*		No		
tolp barb	*Tolpis barbata*	Yellow Hawkweed	Asteraceae	0.1		*		No		
cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	0.5		*		No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1		*		No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1			Forb (FG)	No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	5		*		No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	5		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1			Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1			Forb (FG)	No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1		*		No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.2		*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.2		*		No		
plan hisp	*Plantago hispida*		Plantaginacea	0.1			Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.5			Forb (FG)	No		
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	0.5		*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1			Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1			Forb (FG)	No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.2		*		No		
plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginacea	0.1		*		No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.1			Grass & grasslike (GG)	No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	0.1			Grass & grasslike (GG)	No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1		*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W18	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**					
Recorders	MP BT		**PCT:**	Cultivated				
GPS Easting	776641	**GPS Northing**	6410164		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W18

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	1
	Forb (FG)	2
	Grass & grasslike (GG)	1
	Fern (EG)	0
	Other (OG)	0
	TOTAL	4

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0.5
	Forb (FG)	0.2
	Grass & grasslike (GG)	2
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	2.7
	TOTAL 'HTE'	1

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	0.80%	
	15m	1%		
	25m	0%		
	35m	2%		
	45m	0%		
Bare ground cover	5m	65%	57%	
	15m	60%		
	25m	60%		
	35m	50%		
	45m	50%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for	W18									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
bras	*Brassica spp.*	Brassica	Brassicaceae	5		*		No		
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	50		*		No		
sile	*Silene spp.*		Caryophyllace	0.1	5	*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	10		*		No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	2		Forb (FG)	No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	0.1	10	*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	1		*		HTE		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	1		*		No		
phal aqua	*Phalaris aquatica*	Phalaris	Poaceae	5		*		No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1	10	*		No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	2			Grass & grasslike (GG)	No		
sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae	0.5	3		Shrub (SG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	1	*		No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.1	1	*		No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	20		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	1		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.1	1	*		No		

BAM Site Field Survey

Project:	18-012 Wollar Solarfarm	**Plot Identifier**	Plot 6, W6	**Pic 20x20**	GIS pro	**Pic 20x50**	GIS pro	
Survey date:	24/05/2018		**Compass Orientation (head of 20x20 plot)**					
Recorders	G Young		**PCT:**					
GPS Easting	774969	**GPS Northing**	6410290		**Datum**	UTS	**Zone**	55

Landform			**Soils**			**Drainage & Slope**		
Morphology	Lower slope		**Soil Texture**		Sandy	**Slope**	4 degrees	
Land Element	Lower slope		**Soil Colour**		Cream Orange	**Aspect**	East	
Landform	Bottom		**Soil Depth**		>1m	**Drainage**	Well draine	
Microrelief	None		**Geology**		Sandstone	**Watercourses**	40m north	

Plot Disturbance

	Severity	**Age**	**Observational Evidence**
Clearing	2	O	
Cultivation	0		
Soil erosion	0		
Firewood	1	O	
Grazing	3	O	
Fire Damage	2		Charred tree trunk
Storm Damage	0		
Weediness	2		Urtica
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information

Current land use

Grazing by cattle

Age class, condition,disturbance (inc. dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)

Mixed aged trees young and old, some hollow observed outside plot, heavily grazed and very dry sandy soil

High Threat Weeds

Significant and threatened species and communities (if present, note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

Plot 6, W6

BAM Attribute (20x20m plot)		
Count of Native Richness	Stratum	Sum
	Tree (TG)	2
	Shrub (SG)	0
	Forb (FG)	18
	Grass/Sedge (GG)	11
	Fern (EG)	0
	Other (OG)	0
	TOTAL	31

BAM Attribute (20x20m plot)		
Count of cover abundance (native vascular plants)	Stratum	Sum
	Tree (TG)	25.1
	Shrub (SG)	0
	Forb (FG)	7.2
	Grass/Sedge (GG)	15.8
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	48.1
	TOTAL 'HT'	3

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	1	0
50-79	0	0	0
30-49	1	0	0
20-29	1	0	0
10-19	0	0	0
5-9	2	0	N/A
<5	22	0	N/A
Length of logs (m)		0	

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	5%	19%	6336
	15m	40%		6337
	25m	10%		6338
	35m	15%		6339
	45m	25%		6340
Bare	5m	90%	32%	6336
	15m	3%		6337
	25m	30%		6338
	35m	15%		6339
	45m	20%		6340
Cryptogam cover	5m	0%	0%	6336
	15m	0%		6337
	25m	0%		6338
	35m	0%		6339
	45m	0%		6340
Rock Cover	5m	0%	0%	6336
	15m	0%		6337
	25m	0%		6338
	35m	0%		6339
	45m	0%		6340

Species recorded for		Plot 6, W6							
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**Exotic**	**% Cover**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**BCA Status**
TREE (TG)									
Ango flor	*Angophora floribunda*	Rough-barked Apple	Myrtaceae		25	1	N		
Brac popu	*Brachychiton populneus*	Kurrajong	Malvaceae		0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac		5	1000	N		
Gera	*Geranium spp.*		Geraniaceae	*	0.1	5	E		
Glyc taba	*Glycine tabacina*	Variable Glycine	Fabaceae (Fa		0.2	100	N		
Poly tetr	*Polycarpon tetraphyllum*	Four-leaved Allseed	Caryophyllac	*	0.1	10	E		
Eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac		0.2	25	N		
Cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	*	0.1	2	E		
Cony bona	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae	*	0.1	3	E		
Modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	*	0.3	100	E		
Dich repe	*Dichondra repens*	Kidney Weed	Convolvulace		0.1	20	N		
Cotu aust	*Cotula australis*	Common Cotula	Asteraceae		0.1	1	N		
Paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllac	*	0.1	10	E		
Sola nigr	*Solanum nigrum*	Black-berry Nightshad	Solanaceae	*	0.1	3	E		
Cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae		0.1	2	N		
Xant spin	*Xanthium spinosum*	Bathurst Burr	Asteraceae	*	0.2	10	E		
Sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	*	0.1	20	HT		
Plan hisp	*Plantago hispida*		Plantaginace		0.1	1	N		
Hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	*	0.2	30	E		
Cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	*	0.1	10	HT		
Arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	*	0.1	5	E		
Conv angu	*Convolvulus angustissim*		Convolvulace		0.1	20	N		
Erod crin	*Erodium crinitum*	Blue Crowfoot	Geraniaceae		0.1	2	N		
Chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	*	0.2	30	E		
Sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae		0.1	1	N		

Desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa		0.1	10	N		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae		0.1	10	N		
Wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace		0.1	6	N		
Sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae		0.1	15	N		
Sige	*Sigesbeckia spp.*		Asteraceae		0.1	1	N		
Erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	*	0.2	50	E		
Hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	*	0.1	5	HT		
Lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	*	0.1	1	E		
Tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	*	0.1	10	E		
Urti inci	*Urtica incisa*	Stinging Nettle	Urticaceae		0.4	12	N		
Verb virg	*Verbascum virgatum*	Twiggy Mullein	Scrophularia	*	0.1	1	E		
Oxal thom	*Oxalis thompsoniae*		Oxalidaceae	*	0.1	2	E		
Dich sp.	*Dichondra sp. A*	Kidney Weed	Convolvulace		0.1	5	N		
Malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	*	0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
GRASS/SEDGE (G	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae		0.2	30	N		
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gras	Poaceae		0.1	2	N		
Micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae		5	150	N		
Aust scab	*Austrostipa scabra*	Speargrass	Poaceae		3	200	N		
Erag lept	*Eragrostis leptostycha*	Paddock Lovegrass	Poaceae		0.1	10	N		
Ryti caes	*Rytidosperma caespitosu*	Ringed Wallaby Grass	Poaceae		0.1	10	N		
Both macr	*Bothriochloa macra*	Red Grass	Poaceae		5	300	N		
Erag lacu	*Eragrostis lacunaria*	Purple Lovegrass	Poaceae		2	350	N		
Digi	*Digitaria spp.*	A Finger Grass	Poaceae	*	0.1	1	E		
Pani simi	*Panicum simile*	Two-colour Panic	Poaceae		0.1	2	N		
Chlo vent	*Chloris ventricosa*	Tall Chloris	Poaceae		0.1	1	N		
Chlo trun	*Chloris truncata*	Windmill Grass	Poaceae		0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W19	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				0	
Recorders	MP BT		**PCT:**	281 Good				
GPS Easting	775209	**GPS Northing**	6410425		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W19

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	1
	Shrub (SG)	2
	Forb (FG)	22
	Grass & grasslike (GG)	5
	Fern (EG)	0
	Other (OG)	4
	TOTAL	34

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	25
	Shrub (SG)	0.3
	Forb (FG)	16.4
	Grass & grasslike (GG)	15.2
	Fern (EG)	0
	Other (OG)	1.9
	TOTAL Native	58.8
	TOTAL 'HTE'	10

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49	1		
20-29	4		
10-19	7		
5-9	2		
<5	3		N/A
Length of logs (m)		4	

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	8%	25.40%	
	15m	50%		
	25m	40%		
	35m	9%		
	45m	20%		
Bare ground cover	5m	40%	26%	
	15m	2%		
	25m	10%		
	35m	70%		
	45m	7%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	1%		
	45m	1%		

COMPOSITION & STRUCTURE

Species recorded for W19

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	0.2	50		Forb (FG)	No		
euca blak	*Eucalyptus blakelyi*	Blakely's Red Gum	Myrtaceae	25			Tree (TG)	No		
pime lini	*Pimelea linifolia*	Slender Rice Flower	Thymelaeace	0.2	5		Shrub (SG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.2	50		Forb (FG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	1		*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.5	20		Other (OG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	5		*		No		
care inve	*Carex inversa*	Knob Sedge	Cyperaceae	5			Grass & grasslike (GG)	No		
good hede	*Goodenia hederacea*	Ivy Goodenia	Goodeniacea	0.5			Forb (FG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	1		*		No		
glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.2	5		Other (OG)	No		
cype grac	*Cyperus gracilis*	Slender Flat-sedge	Cyperaceae	0.1	1		Grass & grasslike (GG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	1			Forb (FG)	No		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae	0.2	10		Forb (FG)	No		
clem aris	*Clematis aristata*	Old Man's Beard	Ranunculacea	1			Other (OG)	No		
cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae	0.5	5		Forb (FG)	No		
micr parv	*Microtis parviflora*	Slender Onion Orchid	Orchidaceae	0.1	5		Forb (FG)	No		P
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	0.1	5		Grass & grasslike (GG)	No		
elym scab	*Elymus scaber*	Common Wheatgrass	Poaceae	5			Grass & grasslike (GG)	No		
arth mill	*Arthropodium millefloru*	Pale Vanilla-lily	Anthericacea	0.5	20		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac	0.5	5		Forb (FG)	No		
conv erub	*Convolvulus erubescens*	Pink Bindweed	Convolvulace	0.2	10		Other (OG)	No		
acae ovin	*Acaena ovina*	Acaena	Rosaceae	5			Forb (FG)	No		
micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae	5			Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	10		*		HTE		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	5			Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	0.5	10	*		No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.2	5		Forb (FG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	1		Forb (FG)	No		
linu	*Linum spp.*		Linaceae	0.1	1	*		No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.2	5		Forb (FG)	No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	20	*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	1		*		No		
plan hisp	*Plantago hispida*		Plantaginacea	0.1	1		Forb (FG)	No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.2	5		Forb (FG)	No		
hydr laxi	*Hydrocotyle laxiflora*	Stinking Pennywort	Apiaceae	0.1	1		Forb (FG)	No		
phyl hirt	*Phyllanthus hirtellus*	Thyme Spurge	Phyllanthacea	0.1	1		Shrub (SG)	No		

cyno echi	*Cynosurus echinatus*	Rough Dog's Tail	Poaceae	0.1	5	*		No		
sole	*Solenogyne spp.*		Asteraceae	0.1	1		Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.1	5			No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	0.1	5	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	2		Forb (FG)	No		
pter muti	*Pterostylis mutica*	Midget Greenhood	Orchidaceae	0.1	1		Forb (FG)	No		P
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	1		Forb (FG)	No		
rost pumi	*Rostraria pumila*	Roughtail	Poaceae	0.5	20	*		No		
dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac	0.1	1			No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W20	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				185	
Recorders	MP BT		**PCT:**	281 good				
GPS Easting	774824	**GPS Northing**	6409137		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W20

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	1
	Shrub (SG)	1
	Forb (FG)	10
	Grass & grasslike (GG)	4
	Fern (EG)	0
	Other (OG)	2
	TOTAL	18

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	20
	Shrub (SG)	0.2
	Forb (FG)	5.3
	Grass & grasslike (GG)	10.3
	Fern (EG)	0
	Other (OG)	2.1
	TOTAL Native	37.9
	TOTAL 'HTE'	0

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79	4		1
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		7	

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	20.00%	
	15m	3%		
	25m	80%		
	35m	10%		
	45m	5%		
Bare ground cover	5m	90%	60%	
	15m	93%		
	25m	20%		
	35m	20%		
	45m	75%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W20								
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	2			Other (OG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	5		*		No		
calo cune	*Calotis cuneata*	Mountain Burr-Daisy	Asteraceae	0.2	10		Forb (FG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	10			Grass & grasslike (GG)	No		
eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac	2			Forb (FG)	No		
eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac	1			Forb (FG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.5	20		Forb (FG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.5			Forb (FG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	5		*		No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	2		Forb (FG)	No		
euca albe	*Eucalyptus albens*	White Box	Myrtaceae	20			Tree (TG)	No		
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	0.1	1		Grass & grasslike (GG)	No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	5		*		No		
urti inci	*Urtica incisa*	Stinging Nettle	Urticaceae	0.5	5		Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.2	50		Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	2		Forb (FG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.2	10		Forb (FG)	No		
sola cine	*Solanum cinereum*	Narrawa Burr	Solanaceae	0.2	1		Shrub (SG)	No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	2		*		No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.1	5		Grass & grasslike (GG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.2	50	*		No		
erag parv	*Eragrostis parviflora*	Weeping Lovegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.1	2		Other (OG)	No		

BAM Site Field Survey

Project:	18-012 Wollar Solarfarm	**Plot Identifier**	Plot 5	**Pic 20x20**	GIS pro	**Pic 20x50**	GIS pro	
Survey date:	24/05/2018		**Compass Orientation (head of 20x20 plot)**				185	
Recorders	G Young		**PCT:**					
GPS Easting	775463	**GPS Northing**	6409932		**Datum**	UTS	**Zone**	55

Landform			**Soils**			**Drainage & Slope**		
Morphology	Flat		**Soil Texture**		Sand	**Slope**	1-2 degrees	
Land Element	Lower slope		**Soil Colour**		Light Grey	**Aspect**	Flat	
Landform	Bottom		**Soil Depth**		>1m	**Drainage**	Moderate	
Microrelief	None		**Geology**		Sandstone	**Watercourses**	120m east	

Plot Disturbance

	Severity	**Age**	**Observational Evidence**
Clearing	3	O	
Cultivation	2	O	
Soil erosion	0		
Firewood	0		
Grazing	2		Cattle observ d
Fire Damage	0		
Storm Damage	0		
Weediness	2		Carthamnus l natus
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information

Current land use

Grazing by cattle

Age class, condition,disturbance (inc. dbh, hollows, fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)

Rabbit scats, burr ws 100m away. History of cultivation/farming.

High Threat Weeds

Carthamnus lanat s

Significant and threatened species and communities (if present, note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	Nothing observed

Plot 5

	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	15
	Grass/Sedge (GG)	11
	Fern (EG)	0
	Other (OG)	0
	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.7
	Grass/Sedge (GG)	16.8
	Fern (EG)	0
	Other (OG)	0
	TOTAL 'HT'	1

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	15%	22%	6331
	15m	20%		6332
	25m	25%		6333
	35m	15%		6334
	45m	35%		6335
Bare	5m	1%	5%	6331
	15m	5%		6332
	25m	7%		6333
	35m	5%		6334
	45m	7%		6335
Cryptogam cover	5m	0%	0%	6331
	15m	0%		6332
	25m	0%		6333
	35m	0%		6334
	45m	0%		6335
Rock Cover	5m	0%	0%	6331
	15m	0%		6332
	25m	0%		6333
	35m	0%		6334
	45m	0%		6335

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	N/A
<5	0	0	N/A
Length of logs (m)		0	

Species recorded for	Plot 5								
N:Native	E:Exotic	HT: High Threat Exotic							
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**Exotic**	**% Cover**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**BCA Status**
TREE (TG)									
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
SHRUB (SG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FORB (FG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
Chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	*	2	300	E		
Cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	*	5	1000	HT		
Hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	*	0.2	100	E		
Erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	*	0.3	500	E		
Dich sp.	*Dichondra sp. A*	Kidney Weed	Convolvulace		0.1	10	N		
Glyc taba	*Glycine tabacina*	Variable Glycine	Fabaceae (Fa		0.1	20	N		
Modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	*	0.1	10	E		
Trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	*	0.2	100	E		
Sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae		0.1	20	N		
Wahl comm	*Wahlenbergia communis*	Tufted Bluebell	Campanulace		0.1	10	N		
Gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae		0.1	1	N		
Dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac		0.1	50	N		
Alte nana	*Alternanthera nana*	Hairy Joyweed	Amaranthac		0.1	2	N		
Hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	*	0.2	50	E		
Cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiace		0.1	1	N		
Calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae		0.1	1	N		
Cony bona	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae	*	0.1	5	E		
Erod crin	*Erodium crinitum*	Blue Crowfoot	Geraniaceae		0.3	100	N		
Conv gram	*Convolvulus graminetinu*		Convolvulace		0.1	1	N		
Rume brow	*Rumex brownii*	Swamp Dock	Polygonacea		0.1	10	N		
Oxal pere	*Oxalis perennans*		Oxalidaceae		0.1	1	N		
Port oler	*Portulaca oleracea*	Pigweed	Portulacacea		0.1	3	N		
Dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac		0.1	30	N		

GRASS/SEDGE (G	*Scientific Name*	Common Name	Family	Exotic	Cover%	Abundance	N, E or 'HT'	EPBC Stat	TSC Status
Ryti caes	*Rytidosperma caespitosu*	Ringed Wallaby Grass	Poaceae		0.2	50	N		
Erag lept	*Eragrostis leptostachya*	Paddock Lovegrass	Poaceae		0.1	20	N		
Erag cili	*Eragrostis cilianensis*	Stinkgrass	Poaceae	*	0.1	10	E		
Both macr	*Bothriochloa macra*	Red Grass	Poaceae		3	300	N		
Digi brow	*Digitaria brownii*	Cotton Panic Grass	Poaceae		2	200	N		
Pani simi	*Panicum simile*	Two-colour Panic	Poaceae		0.1	20	N		
Aris pers	*Aristida personata*		Poaceae		1	35	N		
Micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae		10	1000	N		
Chlo trun	*Chloris truncata*	Windmill Grass	Poaceae		0.1	20	N		
Spor creb	*Sporobolus creber*	Slender Rat's Tail Gras	Poaceae		0.1	10	N		
Cyno dact	*Cynodon dactylon*	Common Couch	Poaceae		0.1	10	N		
Digi	*Digitaria spp.*	A Finger Grass	Poaceae	*	0.1	1	E		
Pasp crin	*Paspalidium criniforme*		Poaceae		0.1	1	N		
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
FERN (EG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
Other (OG)	***Scientific Name***	**Common Name**	**Family**	**Exotic**	**Cover%**	**Abundance**	**N, E or 'HT'**	**EPBC Stat**	**TSC Status**
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A
	#N/A	#N/A	#N/A	#N/A				#N/A	#N/A

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W21	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				260	
Recorders	MP BT		**PCT:**	281 DGL				
GPS Easting	775798	**GPS Northing**	6410678		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W21

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	12
	Grass & grasslike (GG)	5
	Fern (EG)	0
	Other (OG)	2
	TOTAL	19

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	4.1
	Grass & grasslike (GG)	2.5
	Fern (EG)	0
	Other (OG)	0.6
	TOTAL Native	7.2
	TOTAL 'HTE'	40

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	1.20%	
	15m	1%		
	25m	1%		
	35m	1%		
	45m	1%		
Bare ground cover	5m	5%	13%	
	15m	10%		
	25m	15%		
	35m	25%		
	45m	10%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	1%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W21								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	40		*		HTE		
oxal pere	*Oxalis perennans*		Oxalidaceae	1			Forb (FG)	No		
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	1			Forb (FG)	No		
elym scab	*Elymus scaber*	Common Wheatgrass	Poaceae	1			Grass & grasslike (GG)	No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.2	10		Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	1			Grass & grasslike (GG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	5		Forb (FG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	2		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.2	20	*		No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.1	5		Forb (FG)	No		
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	1		*		No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	1		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	10		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.1	5		Forb (FG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.2	10	*		No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1	1	*		No		
cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae	0.1	1		Forb (FG)	No		
micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae	0.2	20		Grass & grasslike (GG)	No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	0.2	10	*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.5	20		Other (OG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.2	4		Forb (FG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
arth minu	*Arthropodium minus*	Small Vanilla Lily	Anthericacea	0.2	20		Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	1		Forb (FG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	1		Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	1	100		Forb (FG)	No		
conv erub	*Convolvulus erubescens*	Pink Bindweed	Convolvulace	0.1	2		Other (OG)	No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	0.5	50	*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W22	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				260	
Recorders	MP BT		**PCT:**	281 DGL				
GPS Easting	775954	**GPS Northing**	6410219		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W22

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	13
	Grass & grasslike (GG)	6
	Fern (EG)	0
	Other (OG)	0
	TOTAL	19

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	3.7
	Grass & grasslike (GG)	12.2
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	15.9
	TOTAL 'HTE'	20.1

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	1.40%	
	15m	2%		
	25m	1%		
	35m	1%		
	45m	1%		
Bare ground cover	5m	30%	33%	
	15m	25%		
	25m	35%		
	35m	25%		
	45m	50%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for W22

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	20		*		HTE		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	1		*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.2	10		Forb (FG)	No		
xant spin	*Xanthium spinosum*	Bathurst Burr	Asteraceae	0.1	1	*		HTE		
cent sols	*Centaurea solstitialis*	St Barnabys Thistle	Asteraceae	0.1	2	*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1			Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	1			Grass & grasslike (GG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	5		*		No		
brom cath	*Bromus catharticus*	Praire Grass	Poaceae	10		*		No		
plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginacea	5		*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	5		*		No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	5			Grass & grasslike (GG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.5	20		Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	1			Forb (FG)	No		
boer domi	*Boerhavia dominii*	Tarvine	Nyctaginacea	0.1	3		Forb (FG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.1	5		Forb (FG)	No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.2	10	*		No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1	20	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	5		Forb (FG)	No		
erod botr	*Erodium botrys*	Long Storksbill	Geraniaceae	2		*		No		
sonc oler	*Sonchus oleraceus*	Common Sowthistle	Asteraceae	0.1	1	*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.2	5		Forb (FG)	No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	5			Grass & grasslike (GG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.1	5		Grass & grasslike (GG)	No		
eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac	0.1	1		Forb (FG)	No		
plan debi	*Plantago debilis*	Shade Plantain	Plantaginacea	0.1	1		Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	1		*		No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	5	*		No		
uroc pani	*Urochloa panicoides*	Urochloa Grass	Poaceae	0.1	1	*		No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.1	1	*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	1		Forb (FG)	No		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	1		Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.5	1	*		No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	1		Forb (FG)	No		
eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	0.1	10	*		No		
verb bona	*Verbena bonariensis*	Purpletop	Verbenaceae	0.1	1	*		No		
aris vaga	*Aristida vagans*	Threeawn Speargrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		

hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	10		*		No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W23	**Pic 20x20**		**Pic 20x50**		
Survey date:	25/10/2018		**Compass Orientation (head of 20x20 plot)**				20	
Recorders	MP BT		**PCT:**	281 DGL				
GPS Easting	777984	**GPS Northing**	6408353		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W23

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	9
	Grass & grasslike (GG)	7
	Fern (EG)	0
	Other (OG)	1
	TOTAL	17

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	4.7
	Grass & grasslike (GG)	31
	Fern (EG)	0
	Other (OG)	0.2
	TOTAL Native	35.9
	TOTAL 'HTE'	1

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	2.40%	
	15m	3%		
	25m	2%		
	35m	2%		
	45m	3%		
Bare ground cover	5m	15%	18%	
	15m	20%		
	25m	10%		
	35m	20%		
	45m	23%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for		W23								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
brom cath	*Bromus catharticus*	Praire Grass	Poaceae	0.5		*		No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	25		*		No		
paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllace	0.5		*		No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	2		*		No		
aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae	20			Grass & grasslike (GG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	10			Grass & grasslike (GG)	No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1		*		No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.5			Forb (FG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.2			Other (OG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5			Forb (FG)	No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	10		*		No		
linu	*Linum spp.*		Linaceae	0.1		*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	1		*		No		
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	0.1		*		No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.2		*		No		
boer domi	*Boerhavia dominii*	Tarvine	Nyctaginacea	0.1			Forb (FG)	No		
schk pinn abro	*Schkuhria pinnata var. a*	Dwarf Marigold	Asteraceae	0.1		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	2		*		No		
eina nuta	*Einadia nutans*	Climbing Saltbush	Chenopodiac	0.2			Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1			Forb (FG)	No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.2		*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.1		*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	5		*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	0.5			Grass & grasslike (GG)	No		
wahl	*Wahlenbergia spp.*	Bluebell	Campanulace	2			Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.1			Grass & grasslike (GG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	1			Forb (FG)	No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1			Forb (FG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.2		*		No		
aris vaga	*Aristida vagans*	Threeawn Speargrass	Poaceae	0.2			Grass & grasslike (GG)	No		
erag lept	*Eragrostis leptocarpa*	Drooping Lovegrass	Poaceae	0.1			Grass & grasslike (GG)	No		
verb bona	*Verbena bonariensis*	Purpletop	Verbenaceae	0.2		*		No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.1			Grass & grasslike (GG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.2			Forb (FG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	1		*		HTE		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W28	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				255	
Recorders	MP BT		**PCT:**	281 DGL				
GPS Easting	775475	**GPS Northing**	6410571		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W28

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	13
	Grass & grasslike (GG)	7
	Fern (EG)	0
	Other (OG)	2
	TOTAL	22

BAM Attribute (20x20m plot)		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	15.6
	Grass & grasslike (GG)	18.3
	Fern (EG)	0
	Other (OG)	1.1
	TOTAL Native	35
	TOTAL 'HTE'	15

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)				
	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	1.60%	
	15m	2%		
	25m	1%		
	35m	1%		
	45m	2%		
Bare ground cover	5m	5%	17%	
	15m	35%		
	25m	10%		
	35m	30%		
	45m	5%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for	W28

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	15		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	10		*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
cirs	*Cirsium spp.*		Asteraceae	5		*		No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	10		Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	15		*		HTE		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	10			Grass & grasslike (GG)	No		
wahl grac	*Wahlenbergia gracilenta*	Annual Bluebell	Campanulace	0.1	5		Forb (FG)	No		
arth minu	*Arthropodium minus*	Small Vanilla Lily	Anthericacea	0.2	10		Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	2		Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	5		*		No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	1			Grass & grasslike (GG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.3	20	*		No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	2		Forb (FG)	No		
plan hisp	*Plantago hispida*		Plantaginacea	2			Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	10			Forb (FG)	No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	5		*		No		
gera sola	*Geranium solanderi*	Native Geranium	Geraniaceae	0.1	10		Forb (FG)	No		
swai	*Swainsona spp.*		Fabaceae (Fa	0.1	5		Forb (FG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	1			Other (OG)	No		
trif camp	*Trifolium campestre*	Hop Clover	Fabaceae (Fa	1		*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.2	5		Forb (FG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.1	2	*		No		
micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Elym scab	*Elymus scaber*	Common Wheatgrass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.1	5	*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.5	10	*		No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	2			Grass & grasslike (GG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	2			Forb (FG)	No		
Glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.1	2		Other (OG)	No		
desm gunn	*Desmodium gunnii*	Slender Tick-trefoil	Fabaceae (Fa	0.1	1		Forb (FG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	10		Forb (FG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W30	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				300	
Recorders	MP and BT		**PCT:**	281 DGL				
GPS Easting	775122	**GPS Northing**	6409100		**Datum**	Gda 94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W30

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	8
	Grass & grasslike (GG)	8
	Fern (EG)	0
	Other (OG)	1
	TOTAL	17

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.6
	Grass & grasslike (GG)	12.9
	Fern (EG)	0
	Other (OG)	0.5
	TOTAL Native	15
	TOTAL 'HTE'	15.2

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	5%	10.00%	
	15m	1%		
	25m	3%		
	35m	1%		
	45m	40%		
Bare ground cover	5m	17%	23%	
	15m	14%		
	25m	35%		
	35m	38%		
	45m	11%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m			

COMPOSITION & STRUCTURE

Species recorded for W30

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
xant	*Xanthium spp.*		Asteraceae	0.1	1	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	20		*		No		
plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginacea	1		*		No		
sile	*Silene spp.*		Caryophyllace	0.1	10	*		No		
pani simi	*Panicum simile*	Two-colour Panic	Poaceae	0.1	5		Grass & grasslike (GG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	15		*		HTE		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	10			Grass & grasslike (GG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.5	20		Other (OG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5	50		Forb (FG)	No		
aust vert	*Austrostipa verticillata*	Slender Bamboo Gras	Poaceae	0.5	5		Grass & grasslike (GG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	1		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	0.1	5	*		No		
care inve	*Carex inversa*	Knob Sedge	Cyperaceae	0.1	5		Grass & grasslike (GG)	No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	5		*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	20	*		No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1	5	*		No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	1		*		No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	1		*		No		
cirs vulg	*Cirsium vulgare*	Spear Thistle	Asteraceae	1		*		No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.5	20		Forb (FG)	No		
acet vulg	*Acetosella vulgaris*	Sheep Sorrel	Polygonaceae	0.1	5	*		HTE		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.1	1		Forb (FG)	No		
Echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	0.5	10	*		No		
junc fili	*Juncus filicaulis*		Juncaceae	0.1	1		Grass & grasslike (GG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1	1	*		No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.1	2	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	1		Forb (FG)	No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	0.2	10	*		No		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	0.1	2	*		HTE		
aspe conf	*Asperula conferta*	Common Woodruff	Rubiaceae	0.1	10		Forb (FG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	1		Forb (FG)	No		
lepi afri	*Lepidium africanum*	Common Peppercres	Brassicaceae	0.1	20	*		No		
ryti caes	*Rytidosperma caespitos*	Ringed Wallaby Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	0.5	20	*		No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	1	10		Grass & grasslike (GG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	1	5		Grass & grasslike (GG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.5	50	*		No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	0.5	50	*		No		

wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	2		Forb (FG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W24	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				120	
Recorders			**PCT:**	Exotic				
GPS Easting	775725	**GPS Northing**	6410100		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W24

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	3
	Grass & grasslike (GG)	1
	Fern (EG)	0
	Other (OG)	0
	TOTAL	4

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	0.3
	Grass & grasslike (GG)	0.5
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	0.8
	TOTAL 'HTE'	0.1

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	10%	4.00%	
	15m	3%		
	25m	2%		
	35m	3%		
	45m	2%		
Bare ground cover	5m	5%	45%	
	15m	55%		
	25m	50%		
	35m	55%		
	45m	60%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for	W24									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
aven fatu	*Avena fatua*	Wild Oats	Poaceae	50		*		No		
loli pere	*Lolium perenne*	Perennial Ryegrass	Poaceae	20		*		No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	0.5	10		Grass & grasslike (GG)	No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	1		*		No		
brom cath	*Bromus catharticus*	Praire Grass	Poaceae	0.5	20	*		No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	10		*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	5	*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	10	*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	1		Forb (FG)	No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	0.1	5	*		No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.2	20	*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.1	5	*		No		
eina hast	*Einadia hastata*	Berry Saltbush	Chenopodiac	0.1	1		Forb (FG)	No		
cham drum	*Chamaesyce drummondi*	Caustic Weed	Euphorbiacea	0.1	2		Forb (FG)	No		
onop	*Onopordum spp.*		Asteraceae	0.1	1	*		No		
uroc pani	*Urochloa panicoides*	Urochloa Grass	Poaceae	0.1	5	*		No		
bras	*Brassica spp.*	Brassica	Brassicaceae	0.1	5	*		No		
eleu tris	*Eleusine tristachya*	Goose Grass	Poaceae	0.1	5	*		No		
poa annu	*Poa annua*	Winter Grass	Poaceae	0.1	1	*		No		
plan lanc	*Plantago lanceolata*	Lamb's Tongues	Plantaginacea	0.1	10	*		No		
xant spin	*Xanthium spinosum*	Bathurst Burr	Asteraceae	0.1	1	*		HTE		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W25	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2018		**Compass Orientation (head of 20x20 plot)**				290	
Recorders	MP BT		**PCT:**	1610 low				
GPS Easting	775756	**GPS Northing**	6408327		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W25

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	6
	Grass & grasslike (GG)	3
	Fern (EG)	1
	Other (OG)	2
	TOTAL	12

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	2.6
	Grass & grasslike (GG)	6.1
	Fern (EG)	0.5
	Other (OG)	0.3
	TOTAL Native	9.5
	TOTAL 'HTE'	20

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	2.40%	
	15m	5%		
	25m	1%		
	35m	4%		
	45m	1%		
Bare ground cover	5m	13%	15%	
	15m	35%		
	25m	12%		
	35m	9%		
	45m	7%		
Cryptogam cover	5m	2%	2%	
	15m	2%		
	25m	2%		
	35m	3%		
	45m	2%		
Rock Cover	5m	1%	1%	
	15m	4%		
	25m	0%		
	35m	0%		
	45m	2%		

COMPOSITION & STRUCTURE

Species recorded for	W25									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
pter muti	*Pterostylis mutica*	Midget Greenhood	Orchidaceae	0.5	20		Forb (FG)	No		P
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	10		*		HTE		
wahl comm	*Wahlenbergia communi*	Tufted Bluebell	Campanulace	0.2	10		Forb (FG)	No		
schk pinn abro	*Schkuhria pinnata var. a*	Dwarf Marigold	Asteraceae	0.5	50	*		No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.2	10		Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	1			Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	5		*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	5		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	10		*		HTE		
cham drum	*Chamaesyce drummond*	Caustic Weed	Euphorbiacea	1			Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	5		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	1		*		No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.2	10		Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.5	30		Fern (EG)	No		
sile	*Silene spp.*		Caryophyllace	0.2	50	*		No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.5	20	*		No		
glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.1	1		Other (OG)	No		
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	1		*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.5	20		Forb (FG)	No		
hord lepo	*Hordeum leporinum*	Barley Grass	Poaceae	1		*		No		
UNK forb	*#N/A*	#N/A	#N/A	0.1	1	#N/A		FALSE	#N/A	#N/A
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.2	10		Other (OG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W27	**Pic 20x20**		**Pic 20x50**		
Survey date:	22/10/2018		**Compass Orientation (head of 20x20 plot)**				89	
Recorders	MP BT		**PCT:**	1610 Low				
GPS Easting	776121	**GPS Northing**	6408177		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W27

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	6
	Grass & grasslike (GG)	8
	Fern (EG)	0
	Other (OG)	0
	TOTAL	14

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.9
	Grass & grasslike (GG)	12.6
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	14.5
	TOTAL 'HTE'	10.1

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	2%	3.20%	
	15m	2%		
	25m	4%		
	35m	3%		
	45m	5%		
Bare ground cover	5m	3%	10%	
	15m	2%		
	25m	4%		
	35m	25%		
	45m	17%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	1%	1%	
	15m	3%		
	25m	3%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for W27

Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	10		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	10		*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.5	20	*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	10			Grass & grasslike (GG)	No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	2			Grass & grasslike (GG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	1			Forb (FG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	10		*		HTE		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	5		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	1		*		No		
care inve	*Carex inversa*	Knob Sedge	Cyperaceae	0.1	10		Grass & grasslike (GG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	1		Forb (FG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	0.5	50	*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.2	50	*		No		
cent meli	*Centaurea melitensis*	Maltese Cockspur	Asteraceae	0.1	10	*		No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	10		Forb (FG)	No		
salv verb	*Salvia verbenaca*	Vervain	Lamiaceae	1		*		No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.5	50		Forb (FG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	5	*		No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	0.1	5		Forb (FG)	No		
briz mino	*Briza minor*	Shivery Grass	Poaceae	0.1	1	*		No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1	5	*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
arct cale	*Arctotheca calendula*	Capeweed	Asteraceae	0.1	2	*		No		
sile	*Silene spp.*		Caryophyllace	0.5	100	*		No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.1	20		Grass & grasslike (GG)	No		
erag alve	*Eragrostis alveiformis*		Poaceae	0.1	2		Grass & grasslike (GG)	No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	0.1	20	*		No		
cycl lept	*Cyclospermum leptophyl*	Slender Celery	Apiaceae	0.1	5	*		No		
cyno dact	*Cynodon dactylon*	Common Couch	Poaceae	0.1	2		Grass & grasslike (GG)	No		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	0.1	1	*		HTE		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W31	**Pic 20x20**		**Pic 20x50**		
Survey date:	22/10/2016		**Compass Orientation (head of 20x20 plot)**				0N	
Recorders	MP BT		**PCT:**	1610 Low				
GPS Easting	775979	**GPS Northing**	6408008		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W31

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	11
	Grass & grasslike (GG)	4
	Fern (EG)	1
	Other (OG)	0
	TOTAL	16

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	6.6
	Grass & grasslike (GG)	5.4
	Fern (EG)	0.1
	Other (OG)	0
	TOTAL Native	12.1
	TOTAL 'HTE'	5

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	2.00%	
	15m	2%		
	25m	2%		
	35m	3%		
	45m	2%		
Bare ground cover	5m	2%	2%	
	15m	3%		
	25m	1%		
	35m	4%		
	45m	2%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	7%	2%	
	15m	1%		
	25m	3%		
	35m	0%		
	45m	1%		

COMPOSITION & STRUCTURE

Species recorded for	W31									
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	20		*		No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	10		*		No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	1		*		No		
briz mino	*Briza minor*	Shivery Grass	Poaceae	0.1	5	*		No		
paro bras	*Paronychia brasiliana*	Chilean Whitlow Wor	Caryophyllace	0.2	20	*		No		
care inve	*Carex inversa*	Knob Sedge	Cyperaceae	0.2	20		Grass & grasslike (GG)	No		
salv verb	*Salvia verbenaca*	Vervain	Lamiaceae	0.2	20	*		No		
sile	*Silene spp.*		Caryophyllace	10		*		No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
oxal pere	*Oxalis perennans*		Oxalidaceae	5			Forb (FG)	No		
chon junc	*Chondrilla juncea*	Skeleton Weed	Asteraceae	0.1	2	*		No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.1	5		Forb (FG)	No		
rost pumi	*Rostraria pumila*	Roughtail	Poaceae	1	20	*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	0.5	50	*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.5	10	*		No		
cirs	*Cirsium spp.*		Asteraceae	0.2	20	*		No		
acae ovin	*Acaena ovina*	Acaena	Rosaceae	0.1	5		Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.1	2		Fern (EG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac	0.2	5		Forb (FG)	No		
eina nuta	*Einadia nutans*	Climbing Saltbush	Chenopodiac	0.1	1		Forb (FG)	No		
dysp pumi	*Dysphania pumilio*	Small Crumbweed	Chenopodiac	0.5			Forb (FG)	No		
trif camp	*Trifolium campestre*	Hop Clover	Fabaceae (Fa	1		*		No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.1	10		Forb (FG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	1		Forb (FG)	No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	2		Forb (FG)	No		
trif subt	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Fa	5		*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	5		*		No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	5		*		HTE		
cotu aust	*Cotula australis*	Common Cotula	Asteraceae	0.1	2		Forb (FG)	No		
malv parv	*Malva parviflora*	Small-flowered Mallo	Malvaceae	0.1	2	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	15		*		No		
tara offi	*Taraxacum officinale*	Dandelion	Asteraceae	0.1	5	*		No		
verb	*Verbascum spp.*		Scrophulariac	0.1	1	*		No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.2	100		Forb (FG)	No		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	0.1	2		Grass & grasslike (GG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W32	**Pic 20x20**		**Pic 20x50**		
Survey date:	24/10/2018		**Compass Orientation (head of 20x20 plot)**				15	
Recorders	MP BT		**PCT:**	1610 low				
GPS Easting	776521	**GPS Northing**	6407941		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W32

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	11
	Grass & grasslike (GG)	4
	Fern (EG)	1
	Other (OG)	1
	TOTAL	17

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	0
	Forb (FG)	1.8
	Grass & grasslike (GG)	0.9
	Fern (EG)	0.1
	Other (OG)	0.2
	TOTAL Native	3
	TOTAL 'HTE'	80

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	3%	8.40%	
	15m	6%		
	25m	8%		
	35m	13%		
	45m	12%		
Bare ground cover	5m	9%	10%	
	15m	8%		
	25m	16%		
	35m	9%		
	45m	7%		
Cryptogam cover	5m	2%	1%	
	15m	0%		
	25m	1%		
	35m	1%		
	45m	0%		
Rock Cover	5m	1%	1%	
	15m	0%		
	25m	2%		
	35m	1%		
	45m	3%		

COMPOSITION & STRUCTURE

Species recorded for		W32								
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	60		*		HTE		
hype perf	*Hypericum perforatum*	St. Johns Wort	Clusiaceae	20		*		HTE		
arth minu	*Arthropodium minus*	Small Vanilla Lily	Anthericacea	0.1	2		Forb (FG)	No		
trif arve	*Trifolium arvense*	Haresfoot Clover	Fabaceae (Fa	5		*		No		
trif dubi	*Trifolium dubium*	Yellow Suckling Clove	Fabaceae (Fa	2		*		No		
swai gale	*Swainsona galegifolia*	Smooth Darling Pea	Fabaceae (Fa	0.2	5		Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.1	5		Forb (FG)	No		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.2	5			No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.2	10		Forb (FG)	No		
euch spha	*Euchiton sphaericus*	Star Cudweed	Asteraceae	0.1	1		Forb (FG)	No		
erod cicu	*Erodium cicutarium*	Common Crowfoot	Geraniaceae	0.1	5	*		No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	0.5	20	*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.5	50		Forb (FG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	0.1	5		Forb (FG)	No		
brom hord	*Bromus hordeaceus*	Soft Brome	Poaceae	1		*		No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.1	10	*		No		
salv verb	*Salvia verbenaca*	Vervain	Lamiaceae	0.1	20	*		No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.2	5		Other (OG)	No		
linu	*Linum spp.*		Linaceae	0.1	20	*		No		
hypo radi	*Hypochaeris radicata*	Catsear	Asteraceae	0.2	20	*		No		
sile	*Silene spp.*		Caryophyllace	0.1	1	*		No		
desm gunn	*Desmodium gunnii*	Slender Tick-trefoil	Fabaceae (Fa	0.1	5		Forb (FG)	No		
elym scab	*Elymus scaber*	Common Wheatgrass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
cymb laws	*Cymbonotus lawsonianu*	Bear's Ear	Asteraceae	0.1	2		Forb (FG)	No		
loma mult mult	*Lomandra multiflora sub*	Many-flowered Mat-	Lomandracea	0.1	1		Grass & grasslike (GG)	No		
medi sati	*Medicago sativa*	Lucerne	Fabaceae (Fa	0.1	2	*		No		
rume brow	*Rumex brownii*	Swamp Dock	Polygonaceae	0.1	5		Forb (FG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.2	20		Grass & grasslike (GG)	No		
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	0.2	5		Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	0.1	5		Fern (EG)	No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	0.5	50		Grass & grasslike (GG)	No		

BAM Site Field Survey								
Project:	Wollar SF	**Plot Identifier**	W26	**Pic 20x20**		**Pic 20x50**		
Survey date:	23/10/2016		**Compass Orientation (head of 20x20 plot)**				10	
Recorders	MP BT		**PCT:**	1610 good				
GPS Easting	775228	**GPS Northing**	6408435		**Datum**	94	**Zone**	55
Landform			**Soils**			**Drainage & Slope**		
Morphology			**Soil Texture**			**Slope**		
LandF Element			**Soil Colour**			**Aspect**		
LandF Pattern			**Soil Depth**			**Drainage**		
Microrelief			**Geology**			**Watercourses**		

Plot Disturbance			
	Severity	**Age**	**Observational Evidence**
Clearing			
Cultivation			
Soil erosion			
Firewood			
Grazing			
Fire Damage			
Storm Damage			
Weediness			
Other			

Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe **Age:** R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Additional information
Current land use
Age class of trees (DBH range) , Condition of Vegetation, Hollows
10 - 100cm DBH
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)

Dominant Species outside Plot	

FUNCTION

Function attributes for	W26

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of Native Richness	Tree (TG)	0
	Shrub (SG)	3
	Forb (FG)	13
	Grass & grasslike (GG)	10
	Fern (EG)	1
	Other (OG)	3
	TOTAL	30

BAM Attribute (20x20m plot)

	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	0
	Shrub (SG)	15.6
	Forb (FG)	22.9
	Grass & grasslike (GG)	18.5
	Fern (EG)	1
	Other (OG)	1.3
	TOTAL Native	59.3
	TOTAL 'HTE'	10

BAM Attribute (20 x 50m plot) Tree Stem Counts

DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9		10	
<5		5	N/A
Length of logs (m)			

BAM Attributes (1 x 1m Plots)

	Tape length	% cover	Average %	Photos
Litter Cover	5m	1%	1.20%	
	15m	1%		
	25m	1%		
	35m	1%		
	45m	2%		
Bare ground cover	5m	50%	42%	
	15m	30%		
	25m	70%		
	35m	40%		
	45m	20%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	1%	1%	
	15m	2%		
	25m	1%		
	35m	1%		
	45m	1%		

COMPOSITION & STRUCTURE

Species recorded for		W26								
Abbreviation	**Scientific Name**	**Common Name**	**Family**	**% Cover**	**Abundance**	**Exotic**	**Growth Form**	**High Threat?**	**EPBC Status**	**BCA Status**
sida corr	*Sida corrugata*	Corrugated Sida	Malvaceae	5			Forb (FG)	No		
zorn dyct dyct	*Zornia dyctiocarpa var. d*	Zornia	Fabaceae (Fa	1			Forb (FG)	No		
desm vari	*Desmodium varians*	Slender Tick-trefoil	Fabaceae (Fa	0.2	10		Other (OG)	No		
chlo trun	*Chloris truncata*	Windmill Grass	Poaceae	0.5	20		Grass & grasslike (GG)	No		
both macr	*Bothriochloa macra*	Red Grass	Poaceae	10			Grass & grasslike (GG)	No		
calo lapp	*Calotis lappulacea*	Yellow Burr-daisy	Asteraceae	5			Forb (FG)	No		
vitt cune	*Vittadinia cuneata*	A Fuzzweed	Asteraceae	10			Forb (FG)	No		
chei sieb	*Cheilanthes sieberi*	Rock Fern	Pteridaceae	1			Fern (EG)	No		
wahl stri	*Wahlenbergia stricta*	Tall Bluebell	Campanulace	0.5	20		Forb (FG)	No		
dich repe	*Dichondra repens*	Kidney Weed	Convolvulace	0.5	100		Forb (FG)	No		
acac ixio	*Acacia ixiophylla*		Fabaceae (Mi	15			Shrub (SG)	FALSE		
aris ramo	*Aristida ramosa*	Purple Wiregrass	Poaceae	1			Grass & grasslike (GG)	No		
aris pers	*Aristida personata*		Poaceae	0.1	2		Grass & grasslike (GG)	No		
gono tetr	*Gonocarpus tetragynus*	Poverty Raspwort	Haloragaceae	0.1	5		Forb (FG)	No		
ryti tenu	*Rytidosperma tenuius*	A Wallaby Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
loma fili	*Lomandra filiformis*	Wattle Matt-rush	Lomandracea	0.2	10		Grass & grasslike (GG)	No		
trif glom	*Trifolium glomeratum*	Clustered Clover	Fabaceae (Fa	0.5	10	*		No		
lysi arve	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae	1		*		No		
conv erub	*Convolvulus erubescens*	Pink Bindweed	Convolvulace	1	1		Other (OG)	No		
cart lana	*Carthamus lanatus*	Saffron Thistle	Asteraceae	10		*		HTE		
ryti race	*Rytidosperma racemosu*	Wallaby Grass	Poaceae	0.5	20		Grass & grasslike (GG)	No		
glyc clan	*Glycine clandestina*	Twining glycine	Fabaceae (Fa	0.1	5		Other (OG)	No		
schk pinn abro	*Schkuhria pinnata var. a*	Dwarf Marigold	Asteraceae	0.5	50	*		No		
micr stip	*Microlaena stipoides*	Weeping Grass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
pter muti	*Pterostylis mutica*	Midget Greenhood	Orchidaceae	0.1	2		Forb (FG)	No		P
aspe conf	*Asperula conferta*	Common Woodruff	Rubiaceae	0.1	50		Forb (FG)	No		
burs spin	*Bursaria spinosa*	Native Blackthorn	Pittosporacea	0.1	1		Shrub (SG)	No		
echi crus	*Echinochloa crus-galli*	Barnyard Grass	Poaceae	1		*		No		
sile	*Silene spp.*		Caryophyllace	0.2	50	*		No		
spor creb	*Sporobolus creber*	Slender Rat's Tail Gra	Poaceae	1			Grass & grasslike (GG)	No		
petr nant	*Petrorhagia nanteuilii*	Proliferous Pink	Caryophyllace	0.1	1	*		No		
oxal pere	*Oxalis perennans*		Oxalidaceae	0.1	5		Forb (FG)	No		
good pinn	*Goodenia pinnatifida*	Scrambles Eggs	Goodeniacea	0.2	20		Forb (FG)	No		
eina poly	*Einadia polygonoides*	Knotweed Goosefoot	Chenopodiac	0.2	10		Forb (FG)	No		
aust scab	*Austrostipa scabra*	Speargrass	Poaceae	5			Grass & grasslike (GG)	No		
plan hisp	*Plantago hispida*		Plantaginacea	0.1	1		Forb (FG)	No		
modi caro	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae	0.5	10	*		No		
davi geni	*Daviesia genistifolia*	Broom Bitter Pea	Fabaceae (Fa	0.5	2		Shrub (SG)	No		
UNK Forb	*#N/A*	#N/A	#N/A	0.5		#N/A		FALSE	#N/A	#N/A

COMPOSITION & STRUCTURE

poly avic	*Polygonum aviculare*	Wireweed	Polygonaceae	0.2	50	*		No		

FAUNA SPECIES LIST

August Survey

Scientific name	Common name	BC Act	EPBC Act	Nocturnal Survey				Diurnal Survey			Opportunistic
				FS 1	FS 2	FS 3	FS 7	FS 4	FS 5	FS 6	
BIRDS											
Acanthiza nana	Yellow Thornbill					x					x
Acanthorhynchus tenuirostris	Eastern Spinebill					x		x			x
Aegotheles cristatus	Owlet Nightjar				x						
Anthus novaeseelandiae	Australian Pipit					x					x
Aquila audax	Wedge-tailed Eagle					x				x	x
Artamus cyanopterus	**Dusky Woodswallow**	**V**						**x**		**x**	
Cacatua sanguinea	Corella					x		x	x		x
Chenonetta jubata	Australia Wooduck					x					x
Cheramoeca leucosterna	White-backed Swallow					x				x	x
Climacteris picumnus	**Brown Treecreeper**	**V**								**x**	
Colluricincla harmonica	Grey-shrike Thrush					x				x	x
Corcorax melanorhamphos	White-winged Chough					x			x		x
Corvus coronoides	Australian Raven					x					x
Cracticus nigrogularis	Pied Butcherbird					x					x
Cracticus-tibicen	Australian Magpie					x		x			x

Scientific name	Common name	BC Act	EPBC Act	Nocturnal Survey				Diurnal Survey			Opportunistic
Dacelo novaeguineae	Kookaburra					x					x
Elanus axillaris	Black-shouldered Kite					x					x
Eolophus roseicapilla	Galah							x			
Eopsaltria australis	Eastern Yellow Robin					x				x	x
Falco cenchroides	Australian Kestrel					x		x			x
Grallina cyanoleuca	Magpie Lark					x		x		x	x
Hirundo neoxena	Welcome Swallow					x		x			x
Lichenostomus melanops	Yellow-tufted Honeyeater									x	
Malurus cyaneus	Superb Fairy Wren					x		x	x	x	x
Manorina melanocephala	Noisy Miner					x			x		x
Microeca fascinans	Jacky Winter					x		x	x	x	x
Mirafra javanica	Horsfields Bushlark					x					x
Neochmia temporalis	Red-browed Finch					x				x	x
Nesoptilotis leucotis	White-eared Honeyeater									x	
Ocyphaps lophotes	Crested Pigeon					x			x		x
Pardalotus punctatus	Spotted Pardalote					x		x	x	x	x
Platycercus elegans	Crimson Rosella					x			x		x
Platycercus eximius	Eastern Rosella							x	x		
Podargus strigoides	Tawny Frogmouth					x					x
Pomatostomus temporalis	**Grey-crowned Babbler**	**V**								**x**	
Psephotus haematonotus	Red-rumped Parrot					x		x	x		x
Ptilotula fusca	Fuscous Honeyeater					x					x

Scientific name	Common name	BC Act	EPBC Act	Nocturnal Survey				Diurnal Survey			Opportunistic
Pyrrholaemus sagittatus	**Speckled Warbler**	**V**								**x**	
Rhipidura albiscapa	Grey Fantail					x		x			x
Rhipidura leucophrys	Willie Wagtail					x				x	x
Stagonopleura guttata	**Diamond Firetail**	**V**							**x**	**x**	
Strepera graculina	Currawong					x			x		x
Sturnus vulgaris	Starling*					x					x
Tyto alba	Barn Owl					x					x
MACROPODS											
Macropus giganteus	Eastern Grey Kangaroo				x	x					
Vombatus ursinus	Common Wombat			x			x				
Macropus robustus	Wallaroo				x	x					
Macropus refogriseus	Red-necked Wallaby				x	x					

APPENDIX B EPBC REQUIREMENTS

NSW GOVERNMENT | Planning & Environment

Planning Services
Resource & Energy Assessments
Contact: Anthony Ko
Phone: (02) 8217 2022
Email: anthony.ko@planning.nsw.gov.au

Rhyson Li
Wollar Solar Development Pty Ltd
52 Dalton Road
ST IVES NSW 2075

Dear Mr Li

Wollar Solar (SSD 9254)
Supplement to Environmental Assessment Requirements

I refer to the Secretary's Environmental Assessment Requirements (SEARs) issued for the Springdale Solar project on 3 October 2018.

As you are aware, the project was determined to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 1 May 2018, for likely impacts on listed threatened species and communities. Therefore, in accordance with Schedule 2, clause 3(5) of the NSW *Environmental Planning & Assessment Regulation 2000*, I have enclosed the Commonwealth's requirements for the assessment.

I can also confirm that the administrative procedures in relation to the accredited assessment process will apply to the assessment of this project under the EPBC Act, so that the Department can undertake an environmental impact assessment of the project to satisfy the requirements of both NSW and Commonwealth legislation.

You must ensure that the Environmental Impact Statement adequately addresses the SEARs issued on 3 October 2018, and the supplementary requirements attached to this letter.

If you have any enquiries about these requirements, please do not hesitate to contact Anthony Ko on the above contact details.

Yours sincerely

1/11/18

Clay Preshaw
Director
Resource & Energy Assessments
as nominee of the Secretary

Department of Planning and Environment
320 Pitt Street Sydney NSW 2000 | GPO Box 39 Sydney NSW 2001 | planning.nsw.gov.au

Checklist of Supplementary SEARs, demonstrating where each matter has been addressed.

Requirement	Addressed:
Assessment documentation prepared for the purposes of approval under the EPBC Act must address the statutory requirements outlined in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) (EPBC Regulations).	Consultation with DoEE occurred on 13 June 2018 regarding the requirement for lodgement of an EPBC referral. Specific matters required by Schedule 4 were included in the EPBC referral which was publicly exhibited: EPBC 2018/SSD 9254. On October 3, the project was deemed a controlled action.
The EIS must include an assessment of all protected matters that may be impacted by the proposed action under the controlling provision identified in paragraph 1, noting that: • **Protected matters that the Department considers are likely to be significantly impacted by the proposed action are listed at Attachment A.** • **This list is not exhaustive, and it is the proponent's responsibility to ensure any relevant protected matters under this controlling provision are adequately assessed for the Commonwealth decision-maker's consideration.**	Protected matters are addressed in the BDAR. Specifically: • Sections 5.1 to 5.4 set out relevant matters to be considered under the Act. • Section 7.4 examines MNES impacts in detail, with reference to the additional surveys undertaken in October 2018 to address additional MNES requirements of the Supplementary SEARs. • Section 7.4 is supported by Appendix D EPBC Habitat Assessment Evaluations. This evaluation considers all entities returned in the MNES search and included in the Supplementary SEARs. In consideration of entity habitat requirements, the surveys undertaken onsite, the habitat that is available onsite and the likelihood of occurrence, the potential for impact is determined in this table. • Where entities are deemed to have less than a low risk of impact, an EPBC Assessment of Significant Impact is undertaken, Appendix E. The assessments also assist to target mitigation strategies as required. • Only for those entities where significant impact is evaluated likely to occur, are Commonwealth offsets required. Appendix F sets out the quantification of offsets for relevant entities. • Section 10.1.4 provides an offset strategy for relevant entities, as determined above.
Project description • **The title of the action, background to the development and current status.** • **The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES.** • **How the action relates to any other**	The project description is provided in detail in Section 4 of the EIS.

Requirement	Addressed:
actions that have been, or are being taken, in the region affected by the action.	
Identification of threatened species and communities • **The EIS must identify each EPBC Act-listed species and community likely to be significantly impacted by the proposed action and provide evidence as to why other EPBC Act-listed species and communities likely to be located in the project area or in the vicinity are unlikely to be impacted.** • **For each of the relevant EPBC Act-listed species and communities likely to be impacted, the EIS must provide:** ○ **A description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans; and** ○ **Details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Commonwealth guidelines and policy statements.** • **The EIS must include a comprehensive assessment of impacts on any relevant EPBC Act-listed species and communities. The assessment must address the nature, geographic extent, magnitude, timing and duration of any likely direct, indirect and consequential impacts. The description of impacts must have regard to the full national extent of the species or community's range (i.e. not just NSW).**	As above, threatened species and communities are addressed in Section 7.4 of this BDAR. Relevant species and communities considered likely to be impacted we determined to be: • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC). • Regent Honeyeater • Large-eared pied bat • Pink-tailed worm lizard Appendix E contains the Assessments of significance for these entities, which set out habitat requirements and how these are met onsite, references relevant policies and plans, and concludes with a determination of the significance of the impacts proposed. Impacts on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC) were deemed likely to be significant. Survey methodology is included in Section 4.3.
Avoidance and mitigation • **For each of the EPBC Act-listed species and communities that are likely to be impacted by the development, the EIS must provide information on proposed**	Proposed avoidance and mitigation measures to deal with the potential impacts of the proposal are addressed in Section 7.1 and the BDAR. Indirect impacts are included in Section 7.2.

Requirement	Addressed:
avoidance and mitigation measures to deal with the impacts of the action, and a description of the predicted effectiveness and outcomes that the avoidance and mitigation measures will achieve.	All impacts and measures are relevant to: • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC). • Regent Honeyeater • Large-eared pied bat • Pink-tailed worm lizard
Offsets • **Where a significant residual adverse impact to EPBC Act-listed species or communities is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy, how offsets will be secured, and timing of protection.** • **For each EPBC Act-listed species and community likely to be significantly impacted by the action, the EIS must provide reference to, and consideration of, relevant approved conservation advice or recovery plan for the species or community.**	An offset strategy for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC) is provided in Section 10.1.4.
Environmental Record of the person proposing to take action • **Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.**	Information about the proponent is provided in Section 1.3 of the EIS and the EPBC referral which was publicly exhibited: EPBC 2018/SSD 9254.
Information sources • **For information given in the EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.**	Information sources are provided in the references list of the BDAR and Section 11 of this EIS. Reference citation makes clear published from non-published (i.e. website) sources. Areas of uncertainty, specifically around the impacts of shading, are stated clearly and conservative assumptions made in place of reliable data.

APPENDIX C EPBC PROTECTED MATTERS SEARCH

Australian Government
Department of the Environment and Energy

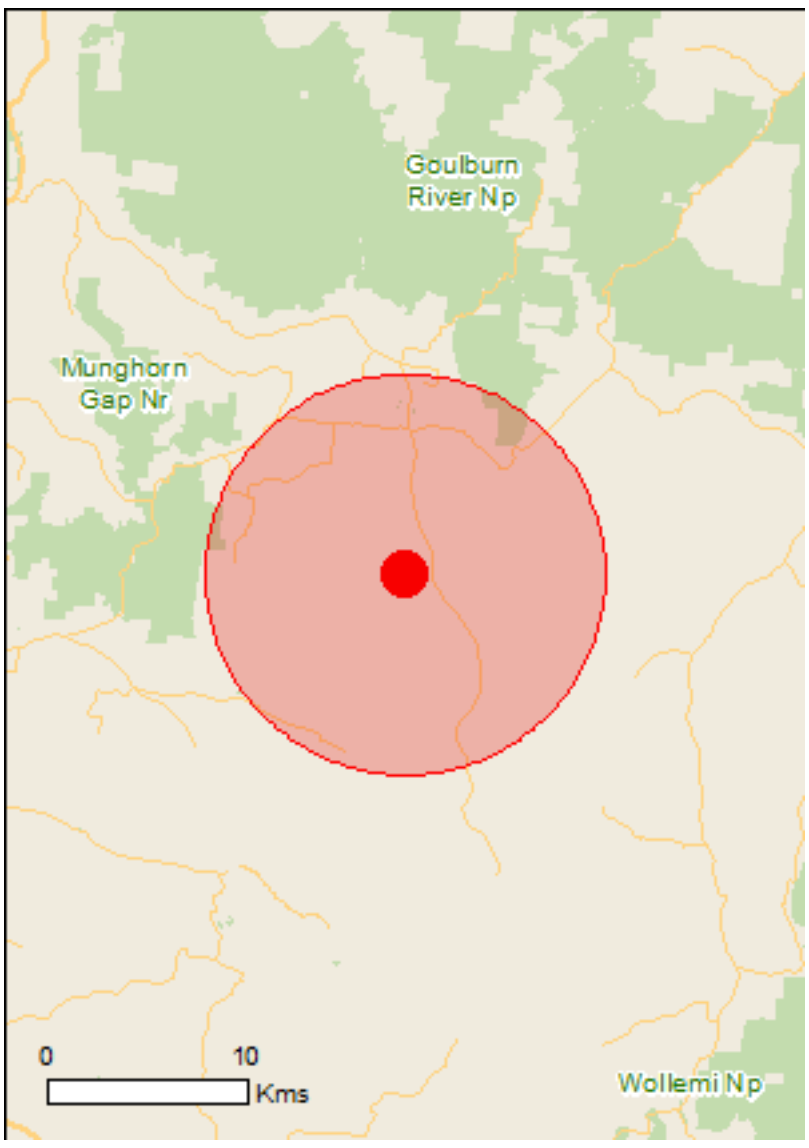
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

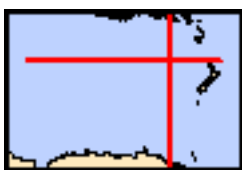
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/01/18 10:00:50



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	5
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	33
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	900 - 1000km upstream
Hunter estuary wetlands	150 - 200km upstream
Riverland	800 - 900km upstream
The coorong, and lakes alexandrina and albert wetland	1000 - 1100km
The macquarie marshes	200 - 300km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Fish		
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Homoranthus darwinioides [12974]	Vulnerable	Species or species habitat known to occur within area
Leucochrysum albicans var. tricolor Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Ozothamnus tesselatus [56203]	Vulnerable	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Philotheca ericifolia [64942]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]	Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Delma impar Striped Legless Lizard [1649]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lathamus discolor		
Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Goulburn River	NSW
Munghorn Gap	NSW

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis		
Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.41826 149.94788

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX D EPBC HABITAT ASSESSMENT EVALUATION TABLE

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
FAUNA				
Anthochaera phrygia Regent Honeyeater	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Occurs in woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Present - Non optimal habitat occurs within the development site. More suitable vegetation occurs on *E. albens* dominated lower slopes outside of development site boundary.	Possible - Mapped important areas occur within the development site (OEH) however is considered not optimal. May occur on occasion in better condition vegetation outside of the development site with more complex structure. Not detected during surveys	**YES – Assessment of Significance undertaken**
Curlew Sandpiper *Calidris ferruginea*	Intertidal mudflats in both fresh and brackish waters in sheltered coastal areas, such as estuaries, bays, inlets, and lagoons. Also recorded inland, including around ephemeral and permanent lakes, dams, and waterholes, usually with bare edges of mud or sand	Absent - no intertidal mudflats	Unlikely	No – Unlikely to occur on site
Painted Honeyeater *Grantiella picta*	Boree/Weeping Myall, Brigalow, and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes.	Marginal - Scattered paddock trees of box-gum woodland. Minimal mistletoes present.	Unlikely – not detected during site surveys.	No – Unlikely to occur on site
Swift Parrot *Lathamus discolor*	On the coast and southwest slopes in areas with abundant flowering eucalypts or lerp. Feed	Present	Unlikely – outside mapped important areas	No – Unlikely to occur on site

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box and Lerp infested trees such as Grey Box and Black Butt.		(OEH). Not detected during surveys	
Mallee Fowl *Leipoa ocellata*	Semi-arid to arid shrublands and low woodlands, especially those dominated by Mallee and/or Acacia which are tall, dense, and floristically rich. A sandy to sandy-loam substrate and abundance of leaf litter are required for breeding.	Absent	Unlikely	No – Unlikely to occur on site
Eastern Curlew *Numenius madagascariensis*	Large intertidal mudflats often with seagrass beds along sheltered coasts including in estuaries, bays, harbours, inlets, lagoons, and among saltmarshes and mangroves.	Absent	Unlikely	No – Unlikely to occur on site
Superb Parrot *Polytelis swainsonii*	Box-Gum, Box-Cypress, and Boree Woodlands and River Red Gum Forests. They nest in hollows of large trees in tall open forest or woodland.	Marginal - Outside of normal habitat range.	Unlikely – No detected during surveys	No – Unlikely to occur on site
Australian Painted Snipe *Rostratula australis*	Shallow terrestrial freshwater or occasionally brackish wetlands, including temporary and permanent lakes, swamps, and claypans, as well as inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms, and bore drains. Fringes of swamps, dams, and nearby marshy areas with cover of grasses, lignum, low scrub, or open timber. Shallow wetlands with areas of bare wet mud.	Absent	Unlikely	No – Unlikely to occur on site
Booroolong Frog *Litoria booroolongensis*	Permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Requires cobble banks, riffles and other rock structures within stream margins.	Absent	Unlikely	No – Unlikely to occur on site
Large-eared Pied Bat	Caves (near their entrances), crevices in cliffs, old mine	Present – Large shallow	Present – No breeding habitat	**YES – Assessment of**

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
Chalinolobus dwyeri	workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	sandstone caves and crevices in ridges surrounding development site. Fairy martins recorded within southern end of development site	observed within development site however may be used for foraging with potential breeding habitat within 2km. Recorded via ultrasonic detection in ridgelines outside of development site.	**Significance undertaken**
Spotted-tail Quoll *Dasyurus maculatus*	Variety of vegetation types including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Present	Unlikely – May occur on a transient basis. No evidence of presence detected during survey	No – Unlikely to occur on site
Corben's Long-eared Bat *Nyctophilus corbei*	Variety of vegetation types, most commonly Mallee, Bulloke, and Box-dominated communities, but most common in vegetation with distinct canopy and dense understorey. Roost in tree hollows, crevices, and under loose bark.	Marginal	Unlikely	No – Unlikely to occur on site
Greater Glider *Petauroides volans*	Tall, montane, moist eucalypt forests with relatively old trees and abundant hollows and a high diversity of eucalypts	Absent	Unlikely	No – Unlikely to occur on site
Brush-tailed Rock-wallaby *Petrogale penicillata*	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north	Present – North facing sandstone rock outcrop on ridges at the southern end of development site	Unlikely – Unlikely to venture outside of optimal habitat in ridges to the south of the development site. No evidence off presence detected during site surveys	No – No direct or indirect impacts on optimal habitat

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
Koala *Phascolarctos cinereus*	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species that are particularly abundant on fertile clay soils.	Present	Unlikely – no evidence of presence detected during site surveys	No – Unlikely to occur on site
Pseudomys novaehollandiae New Holland Mouse,	Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	Absent	Unlikely	No – Unlikely to occur on site
Grey-headed Flying-fox *Pteropus poliocephalus*	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water, including lakes, rivers, and coastlines.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Pink-tailed Worm-lizard *Aprasia parapulchella*	Inhabits sloping open woodland areas with predominantly native grassy ground layers. Commonly found beneath small, partially-embedded rock.	Present - Majority of potential habitat within the development site considered no-optimal due to embedded rock and lack of native grass cover however one area of optimal habitat does occur.	Possible – Optimal habitat occurs with DNG to the north east of the development site with partially embedded/loose rock and good grass cover. No evidence of presence detected during site surveys	**YES – Assessment of Significance undertaken**
Striped legless lizard *Delma impar*	Inhabits grassland dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa spp*. and Poa tussocks *Poa spp*., and occasionally wallaby grasses *Rhytidosperma spp* and exotic components.	Marginal - Groundcover dominated by exotic flora	Unlikely– development site outside known distribution	No – Unlikely to occur on site
FLORA				
Commersonia procumbens	Endemic to NSW, mainly confined to the Dubbo-	Marginal	Unlikely – not detected during	No – Unlikely to occur on site

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and Callitris area. Also, in *Eucalyptus fibrosa subsp. nubila, Eucalyptus dealbata, Eucalyptus albens* and *Callitris glaucophylla* woodlands north of Dubbo.		site surveys	
Cryptostylis hunteriana	Typically occurs in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata)* and the Tartan Tongue Orchid (*C. erecta*)	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Dichanthium setosum	Associated with heavy basaltic black soils and red-brown loams with clay subsoils in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Euphrasia arguta	Eucalypt forest with a mixed grass and shrub understorey in an open disturbed area and along the roadside.	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Homoranthus darwinioides	Grows in in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	south-facing slopes, and a slight depression on a roadside with loamy sand.			
Leucochrysum albicans var. tricolor	Variety of grassland, woodland and forest habitats, generally on relatively heavy soils	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Ozothamnus tesselatus	Grows in eucalypt woodland.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Pelargonium sp. Striatellum (G.W. Carr 10345)	High-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Philotheca ericifolia	Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops.	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Prasophyllum petilum	Open sites within Natural Temperate Grassland	Absent	Unlikely	No – Unlikely to occur on site
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	Perennial orchid, appearing as a single leaf over winter and spring in open eucalypt woodland and grassland	Marginal - Groundcover dominated by exotic flora	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Prostanthera discolor	Restricted to only a few localities from Bylong to the Baerami Valley within the Rylstone and Muswellbrook local government areas. Grows in dry sclerophyll forest in the side gullies of main creek lines, often on rocky or well-drained alluvial substrates.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Prostanthera stricta	Occurs from Mt Vincent to Genowlan Mountain in the Capertee Valley. Prostanthera aff. stricta is found at Dingo Creek and the Widden and Baerami Valleys in the Upper Hunter. Is often a locally dominant undershrub in heath or scrub communities along cliff	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	edges, or as an understorey species within a range of open forest or tall open forest types, or in adjacent transitional communities. Associated vegetation includes *Eucalyptus blaxlandii, Eucalyptus cannonii and Eucalyptus viminalis* with *Acacia implexa* and *Goodenia ovata*. Other associated species recorded at sites include *Angophora floribunda, Eucalyptus punctata, Brachychiton populneus, Acacia parvipinnula, Beyeria viscosa, Microlaena stipoides and Cheilanthes species*.			
Swainsona recta	Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils.	Marginal - Groundcover dominated by exotic flora. Outside of known distribution.	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Tylophora linearis	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of Eucalyptus fibrosa, *Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii.*	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Thesium australe	Coastal headlands or grassland and grassy woodland away from the coast in association with Kangaroo Grass (*Themeda triandra*)	Marginal - Groundcover dominated by exotic flora	Unlikely – not detected during site surveys	No – Unlikely to occur on site
TEC				
Central Hunter Valley eucalypt forest and woodland	The Central Hunter Valley eucalypt forest and woodland ecological community is an open forest or woodland—typically with a tree canopy dominated by eucalypt species; an open to sparse mid-layer of shrubs; and a ground layer of native grasses, forbs and small shrubs. Typically	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from finer grained sedimentary rocks. The woodland or forest canopy is dominated by one or more of the following four eucalypt species: – narrow-leaved ironbark (*Eucalyptus crebra*), spotted gum (*Corymbia maculata (syn. Eucalyptus maculata*), slaty gum (*Eucalyptus dawsonii*) and grey box (*Eucalyptus moluccana*).			
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	The Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion are generally tall open eucalypt forests found on igneous rock (predominately Tertiary basalt and microsyenite) in, or adjacent to, the Sydney Basin Bioregion. The ecological community occurs in areas of high rainfall, generally ranging from 950 to 1600 mm/year. Dominant canopy species are most often *Eucalyptus fastigata* (brown barrel), *E. viminalis* (ribbon gum) and *E. radiata subsp. radiata* (narrow-leaved peppermint). *Eucalyptus obliqua* (messmate stringybark), *E. elata* (river peppermint), *E. quadrangulata* (white-topped box) and *E. smithii* (ironbark peppermint) are also common components.	Absent	Unlikely – not detected during site surveys	No – Unlikely to occur on site
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and Blakely's Red Gum *E.*	Present	Present – Recorded onsite	**YES – Assessment of Significance undertaken**

Name	Habitat	Habitat Present	Likelihood of occurrence	Potential for impact?
	blakelyi. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs.			

APPENDIX E EPBC ASSESSMENT OF SIGNIFICANT IMPACT

The EPBC specifies factors which are considered in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species, listed at the Commonwealth level. The following is an assessment of the likely impacts associated with:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC).
- Regent Honeyeater
- Large-eared pied bat
- Pink-tailed worm lizard

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (Referred to as 'BGW') and Derived Native Grasslands (referred to as 'DNG') which is listed as a Critically Endangered Ecological Community (CEEC).

Significant impact criteria a) to g) as specified in the EPBC Significant Impact Guidelines (v1.1 2013) have been assessed below within Table 1. For the purposes of the assessment in within Table 1, the definition of 'extent' is provided below. Extent has been defined in terms of:

- An upper estimate of extent – that which could potentially occur within and outside the development site
- A lower estimate of extent – that which is known and likely to occur within and outside the development site

Upper estimate of extent

An upper extent of BGW and DNG outside of the development site can be viewed on Figure 5-1 and is assumed based on the following evidence;

- Observing vegetation along and immediately adjacent to Wollar Road, Barigan Rd and Maree road during field work in late May 2018. These roads traverse through the Wollar valley which is similar in landscape setting to that of the Wollar Solar Farm impact area.
- Aerial photo interpretation undertaken of surrounding properties using Google Earth imagery. This involved observing aerial photography of the Wollar Solar farm property and comparing this to adjoining grasslands and woodlands with similar topographic setting and landscape position.

This patch of BGW/DNG is approximately 5,947ha and comprises most of the Wollar Valley flats and foot slopes. The occurrence of BGW and DNG in the areas outside of the Wollar Solar Farm site has not been field validated through quantitative surveys.

Lower estimate of extent

For the purposes of this assessment a 'worst case scenario' of extent is given to assess the 'worst case' potential impact on BGW/DNG that could occur as a result of the Wollar Solar Farm development. For this

assessment, it is assumed all groundcover where trees are greater than 75m apart[7] are not 'DNG' and do not form part of the patch for the purpose of this assessment.

An illustration of this patch (only containing BGW within the development site) is provided in Attachment B. DNG within the Wollar Solar Farm property are included within this patch due to confirmation with limited BAM survey during the site inspection in late May. The smaller estimate of the patch of BGW/DNG is 463ha.

Limitations

Without field verification, the assumed extent of BGW/DNG cannot be confirmed outside of the surveyed areas of the Wollar Solar Farm site.

Table 1 – Significant Impact Criteria to assess impacts on a CEEC

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:
a) Will the action reduce the 'extent' of a community?
The action will reduce the extent of the community by approximately 228 hectares (worst case scenario) when assuming that solar panels will destroy all components of BGW/DNG where solar panels are to be established. *Upper assumed extent* There is 25 ha of BGW and 205 ha of DNG directly impacted which adjoins onto a patch that is estimated to be around 5497ha in area (inclusive of powerlines and dirt roads running through Wollar valley). The area of CEEC directly impacted comprises around about 4% of the overall adjoining patch, (assuming that surrounding grasslands and woodlands contain similar vegetation). A reduction of 4% of this patch of BGW/DNG is a reduction in the extent but is not likely to be a reduction that would affect the ongoing survival of the overall patch of BGW/DNG over the Wollar Valley considering the large areas (>5,500ha) that would remain. However, a loss of 204 ha of the patch is still substantial and could be deemed a significant loss of the CEEC. *Lower known extent* There is 25 ha of BGW and 205 ha of DNG directly impacted which adjoins onto a patch that is estimated to be around 210 ha in area. The area of CEEC directly impacted is estimated to comprise 55% of the overall adjoining patch (when only assuming connection with wooded vegetation off the Wollar Solar Farm site). A reduction of 55% is a major reduction in the extent of this community and may affect the ongoing survival of this patch of BGW/DNG.
b) Will the action fragment or increase fragmentation of the community, for example by clearing vegetation for roads or transmission lines?
Upper assumed extent The proposal occurs within a much larger patch of BGW/DNG within the Wollar Valley. At present, this patch is bordered to the north (extending 11km from the subject site), to the south west and west (extending approximately 500m from the subject site) and to the east (extending approximately 2km), by vegetated mountains not defined or likely to constitute BGW/DNG. The location of the area of direct impact will isolate a portion of BGW/DNG directly south-west of the subject site. This patch is estimated to be 210 ha in area which would become separated from the existing patch of BGW/DNG. It is estimated that the proposal would isolate around 4% of the current patch of BGW/DNG (not including the 4% to be removed for solar panels). *Smallest extent* The development footprint contains the majority of the patch of BGW/DNG where the remaining extent (45%) extends off the property to the south west. The proposal will not result in fragmentation of this patch however it will

[7] As defined in accordance with the White Box – Yellow Box – Blakley's Red Gum grassy woodlands and derived native grasslands EPBC Act Policy Statement and Appendix 2 of the National Recovery Plan (DEH 2012).

substantially reduce its extent as outlined in a).

c) Will the action adversely affect habitat critical to the survival of an ecological community which consists of, or includes, fauna species?

The National Recovery Plan for the CEEC identifies habitat critical to the survival of Box-Gum Grassy Woodland as:

The moderate to highly fertile soils of the western slopes of NSW and Queensland, the northern slopes of Victoria, and the tablelands of the Great Dividing Range from southern Queensland through NSW and the ACT. Given the currently highly fragmented and degraded state of this ecological community, all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria… should be considered critical to the survival of this ecological community. In addition, degraded woodland areas not considered part of the listed ecological community may also be essential to the long-term conservation of Box-Gum Grassy Woodland, by virtue of their landscape setting (e.g. providing connectivity) or remaining flora/fauna habitat features (e.g. occurrence of rare or threatened species, tree hollows), and should also be considered as potential habitat critical to the survival of this ecological community.

Vegetation zones 1, 2, 5, 6 within the development footprint meet the condition criteria for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands and would be considered critical habitat. As such the proposal will adversely affect habitat critical to the survival of the community.

d) Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

It is predicted that the proposal could have impacts on,

- surface water flows across the ground, this would be limited as minimal excavation is proposed and panels would be mounted above the ground,
- change in light levels reaching the ground due to shading of panels, mitigated by spacing between panels,
- to ground moisture levels where solar panels may block or concentrate rain over certain areas.

The proposal could potentially benefit the BGW/DNG by;

- Removing disturbances caused by farming activities such as application of fertilisers and overgrazing by stock.

There is little scientific information on the effects of solar farms on these factors. Until sufficient monitoring of Solar farms is carried out, it is largely unknown whether solar farms are likely to have a detrimental impact on abiotic factors. A 'worst case' assumption would be that alterations to sunlight reaching the ground and changes to surface water flows due to the large surface area of solar panels over the ground, could modify abiotic factors necessary for survival of the CEEC.

A review of Table 4, proposed actions within the National Recovery Plan for BGW/DNG, indicates that;

- Altered hydrological regimes may lead to impacts,
- Prolonged shading may lead to impacts and
- Mowing and slashing associated with managing grasslands may lead to impacts

To address the uncertainty, it is therefore assumed that this proposal may lead to modification and destruction of important abiotic factors for preserving the integrity of this CEEC onsite.

e) Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The proposal may cause a change in species composition of DNG onsite, as solar panels will block sunlight to the ground. At present the DNG receives full sun so changing to full or partial shade is likely to influence what species may grow onsite. As stated above, scientific data in this regard is not available and a 'worst case' assumption would be that functionally important species could decline or be lost.

The majority of CEEC to be impacted consists of degraded DNG (i.e. 89% of the total area of CEEC impacted). The DNGs are subjected to annual weed invasion, trampling by stock, past cultivation and past application of fertilisers which have all impacted on groundcover structure and diversity. The current impacts encountered reduce the severity of impacts that will be caused by the solar farm. With active management of weeds, it may be that DNGs may improve in floristics and composition without grazing and pasture improvement, but it is largely unknown. In relation to the box-gum woodland containing trees, these areas have also been subjected to ongoing disturbances similar to the derived

native grasslands. Firewood collection is an added impact within these areas where at the time of assessment during May the landholder was collecting firewood from fallen timber onsite. With existing impacts of agricultural practises onsite, the impacts of establishing a solar farm may reduce impacts to Box-gum woodland and derived native grassland but it largely unknown.

f) Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: - assisting invasive species, that are harmful to the listed ecological community, to become established; and - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

There are existing impacts currently affecting the integrity of the BGW/DNG that include activities associated with farming. This has resulted in the introduction of Saffron Thistle, a high threat weed which has high cover abundance readings within some of the vegetation integrity plots conducted onsite. Farming activities have also removed a lot of BGW converting it into a DNG. The existing remnants of BGW which contain sparse fallen timber resources which are still being subjected to firewood collection as observed during survey in May. The use of fertilisers and herbicides is very likely to have occurred in the past as part of the farming practises onsite. All these farming practises contribute to a decline in species diversity.

Installing a solar farm may benefit the DNG by removing stock and stopping the future cultivation of the land, both of which are likely to contribute to the spread of existing weeds onsite. The solar farm is unlikely to require any fertilisers although managed application may be needed to maintain groundcovers within certain areas.

The proposal is unlikely to result in further assisting invasive flora species to become established with the implementation of appropriate weed management. Any herbicide applications would be conducted in accordance with recommended guidelines. Increases in invasive fauna species are unlikely given that these species are already present, and the proposal would not introduce any factors that would increase the populations.

Considering the above, the proposal is unlikely to cause a substantial reduction in quality or integrity as a result of assisting invasive species, or causing regular mobilisation of fertilisers, herbicides, chemicals or pollutants.

g) Will the action interfere with the recovery of an ecological community?

The National Recovery Plan for the CEEC (DEH 2012) specifies the following criteria as indicators of CEEC recovery;

1. An increase in the area of listed CEEC,
2. An increase in areas meeting minimum condition criteria,
3. Maintenance of floristics, structure, ecological function across its distribution,
4. Improved landscape connectivity and
5. Improved overall condition in BGW/DNG

The proposal is inconsistent with the recovery criteria as it will:

- Decrease the area of CEEC.
- Potentially further degrade the CEEC which may lead to certain areas of this CEEC not fitting the 'minimum condition criteria',
- Modify the floristics (by removing trees), 'structure' (by removal of canopy cover) and 'ecological function' through modifying key habitat resources such as hollow bearing trees and fallen timber as a result of tree removal.
- Result in a decline in landscape connectivity in further distancing patches of BGW onsite and a general decline in overall condition of the BGW/DNG onsite.

The effects of a solar farm on the recovery of DNG is uncertain. Construction of the solar farm is unlikely to introduce negative impacts in addition to those that are currently associated with farming, for example, new invasive weeds that contribute to reduced condition of BGW/DNG onsite. Strict weed hygiene and control protocols would be implemented as part of the proposal managing this risk.

Table 4 (Current Best Practice Site Management Practices) of the National Recovery Plan stipulates that;

- Altered hydrological regimes (e.g. diversion of rainfall caused by solar panels)
- Prolonged shading (e.g. caused by solar panels) and
- Regular mowing and slashing (e.g. maintenance around solar panels)

are actions that should be avoided in managing CEECs sustainably. Shading may lead to a reduction in groundcover

floristics and may also lead to some areas of CEEC DNG not meeting the minimum condition criteria. Altered hydrological regimes may result in some areas receiving more ground moisture and other areas becoming drier. This may affect groundcover composition and diversity.

Conclusion

The proposal is likely to impact on the existing extent of BGW/DNG within the Wollar Valley. Assuming all areas under infrastructure (including panel arrays) are permanently removed, the lower value of impact is estimated to be around 4% of the existing patch of BGW/DNG assuming that adjoining properties contain 'like for like' groundcover to that found on the Wollar Solar Farm site (See Figure 5-1). The upper-value impact scenario could lead to a 55% reduction in the patch of existing BGW/DNG within the Wollar Valley (See Figure 5-2).

All habitat to be impacted is considered to be or is potentially habitat critical to the survival of the EEC. The loss of 55% of the patch is likely to be significant. Similarly, even the loss of 4% could be determined to be a significant impact on the CEEC

Fragmentation of the existing patch, when assuming the upper extent, would result in the isolation of 210ha of BGW/DNG directly southwest of the Wollar Solar Farm property.

The removal of BGW/DNG from the site may reduce foraging habitat for many birds of prey and habitat for various reptiles, however these microhabitats are likely to be present in adjoining farmland within Wollar Valley which is around 6000ha.

There may be potential impacts to abiotic factors affecting DNG onsite. Impacts in relation to shading changes to ground moisture may lead to altered groundcover composition and floristics. Some areas are likely to receive more or less rainfall depending on the diversion of rainfall onsite. The potential effects of this are unknown.

This assessment has taken a conservative approach in assuming all native vegetation within the development footprint would be removed. On this basis, the assessment has concluded that there is a potential for a significant impact.

Regent Honeyeater

a) Will the action lead to a long-term decrease in the size of a population of a species?

Regent Honeyeater

Potential foraging habitat for Regent Honeyeater occurs within the development site. OEH mapping determines that mapped areas of critical habitat occur on the lower slopes within and surrounding the development site. The development footprint has been defined to avoid these areas.

Numerous diurnal avifauna surveys and call play back surveys were undertaken and did not detect these species. Following a habitat assessment of the broader subject land, it was determined that areas surrounding the development site that contain a more complex vegetative structure on the lower slopes contains potential habitat that may be used on occasion by these nomadic species. These areas, although recovering from a major bushfire in the last 2 years, had a high abundance of woodland birds' species present. However, vegetation within development footprint is considered non-optimal for the regent honeyeater due to low canopy cover, dominance of aggressive native fauna i.e. noisy miner and noisy friarbird as well as general poor health of the species present. This could be attributed to recover from the recent bushfire as well the trees subjected to more frequent indirect fertilisers use. Only one preferred forage species, *E. melliodora*, was observed in flowering over the many survey periods, at the most southern point of the subject land, well outside of the development site and development footprint.

The proposal would involve the removal of around 25ha of woody vegetation of which most of it is largely fragmented and isolated remnant vegetation. There would also be some disturbance associated with construction, including noise, vibration, light, and risk of introduction or spread of weeds, pests, and pathogens.

The quality of potential habitat impacted for these species is low, being largely cleared, with few mature or hollow-bearing trees, and highly disturbed by agriculture. Given the amount of non-optimal habitat to be removed, the amount of higher quality habitat on the lower slopes of the ridgelines surrounding the development site that would not be impacted and with the recommended mitigation measures, the likelihood of the proposal leading to a long-term decrease in the size of a population of this species is minimal.

b) Will the action reduce the area of occupancy of the species?

Regent Honeyeater

The proposal would involve the removal of around 25 ha of woody but non-optimal habitat. No critical habitat for the regent honeyeater mapped by the OEH would be affected.

The quality of potential habitat for this species is low within the development site. Large areas surrounding the development site on the lower slopes of the ridgelines contain better quality and more suitable habitat, that if present on occasion, would be utilised in preference to the poorer quality, sparse non-optimal habitat impacted.

c) Will the action fragment an existing population into two or more populations?

Regent Honeyeater

There would also be some disturbance associated with construction. The development site is not considered known habitat and the likelihood of occurrence of these species is low within the development site.

The proposal would not fragment an existing population of these species into two or more populations.

d) Will the action adversely affect habitat critical to the survival of a species?

Regent Honeyeater

The Register of Critical Habitat established under the EPBC Act does not list any critical habitat for these species.

e) Will the action disrupt the breeding cycle of a population?

Regent Honeyeater

Regent Honeyeaters breed in specific breeding areas, with the development site being within the Mudgee-Wollar key breeding area. However, considering the non-optimal habitat impacted, and better quality habitat being avoided, the likelihood of the action disrupting the breeding cycle of a population of these species is minimal.

f) Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Regent Honeyeater

The proposal would not remove any important mapped habitat. There would also be some disturbance associated with construction, which could decrease the quality of some habitat temporarily.

The quality of habitat impacted is low, and the area of habitat to be removed is relatively small and would not disrupt habitat connectivity for canopy species. With the implementation of the recommended mitigation measures, the likelihood of the action modifying, destroying, removing, isolating, or decreasing the availability or quality of habitat to the extent that these species would be likely to decline is minimal.

g) Will the action result in invasive species that are harmful to a critically endangered or endangered/vulnerable species becoming established in the endangered / critically endangered /vulnerable species habitat?

Regent Honeyeater

The proposal has the potential to contribute to the spread of invasive species in the subject land through the transfer and introduction of plant material and soil on machinery. Mitigation measures have been recommended to prevent the spread of weeds on site. Currently, field surveys and observations noted a high abundance of aggressive native avifauna such as noisy miner and noisy friarbird in the vegetation to be impacted, however these species became less abundant in the better quality vegetation outside of the development site were more complex vegetative structure and connected vegetation occurs, as noted by the higher abundance of other woodland avifauna including a number of state listed threatened species. The proposal is therefore unlikely to result in invasive species, native or exotic, that are harmful ore restrictive to the Regent Honeyeater becoming established in future.

h) Will the action introduce disease that may cause the species to decline?

Regent Honeyeater

There is a risk that diseases could be introduced to the development site via machinery, vehicles, and materials during construction and operation. With the implementation of the recommended mitigation measures, the proposal is therefore unlikely to result in the introduction of any disease that may cause these species to decline.

i) Will the action interfere with the recovery of the species?

Regent Honeyeater

The National Recovery Plan for the Regent Honeyeater lists the following objectives:

1. Reverse the long-term population trend of decline and increase the numbers of Regent Honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years.
2. Enhance the condition of habitat across the Regent Honeyeater range to maximise survival and reproductive success and provide refugia during periods of extreme environmental fluctuation.

The proposal would not interfere with any of these objectives.

Conclusion

The proposal will result in the loss of around 25 ha of woody but non-optimal Regent Honeyeater habitat. Areas impacted are isolated patches or paddock trees with low to moderate canopy cover, lacking complex vegetative structure, and subjected to regular occurrence of aggressive native species such as the noisy miner. Better quality vegetation occurs outside of the development site that would not be impacted. It is unlikely that the proposal would significantly impact on the existence of the Regent Honeyeater and therefore, referral to the Commonwealth Department of Environment is not required.

Large-eared pied bat/Pink-tailed worm lizard

a) Will the action lead to a long-term decrease in the size of an important population of a species?

Large-eared Pied Bat

Fringing foraging habitat for the Large-eared Pied Bat occurs within the development site however would not be directly impacted by the proposal. Vegetated ridgelines surrounding the development contains significant sandstone caves, crevices and overhangs caves which is suitable roosting sites for Large-eared Pied Bats in the subject land.

The Large-eared Pied Bat was detected via ultrasonic detection during surveys approximately 400m south of the development site in the sandstone ridgeline. Areas containing suitable roosting habits will not be impacted. Surveys did not detect these species within the development site however it is considered that this species may utilise fringing vegetation within the lower slopes surrounding the development site. No suitable foraging habitat or roosting habitat occurs within the development footprint or will be impacted. Linear rocky outcrops that are within the development site largely contain embedded rock with shallow crevices. No observations or evidence of their use was observed during the field surveys in these areas.

The Large-eared Pied Bat is a sub canopy forager preferring to forage along the edges of vegetation and sandstone escarpments and are not known to utilises open grasslands or small area vegetated areas for foraging. The proposal is not located in a known important population of these species. In this context, the proposal would not lead to a long-term decrease in the size of an important population of these species.

Pink-tailed worm-lizard

Suitable and potential foraging and breeding habitat for the Pink-tailed worm-lizard occurs within the development site and would be removed by the proposal. Surveys did not detect this species and so the development site is not considered known habitat.

There is approximately 0.9 ha of suitable habitat within the development site, of which 0.1 ha of partially embedded and loose rock surrounded native grass species including *Themeda triandra* may be impacted. Additionally, there approximately 4.9 ha of rocky outcrop through the development site considered potential habitat of which 3.2 ha may be impacted during construction. The quality of potential habitat for this species is low, being largely embedded rock and subject to persistent grazing and dominated by predominately exotic grasses. With the implementation of the recommended mitigation measures, the proposal would not lead to a long-term decrease in the size of an important population of this species.

b) Will the action reduce the area of occupancy of an important population of a species?

Large-eared Pied Bat

The proposal would not directly impact upon suitable roosting or foraging habit for this species. Indirect impacts such as noise, dust and light spill may occur during construction but would be short term and temporary. It is not considered

that the proposal would reduce the area of occupancy for this species.

Pink-tailed worm-lizard

The proposal would involve the removal of around 0.1 ha of potential habitat. These areas were surveyed, and the species was not detected. Areas of rocky outcrop were assessed and surveyed by two ecologists on the 24th and 25th October 2018 for approximately 30 minutes at each site within and surrounding the development site. This included traversing the rocky outcrop area and randomly turning and inspecting loose rocks and partially embedded rock that occurred before being placed back into their original position. Where practicable, between 100-150 rock were turned and inspected at each surveyed area.

If assumed to occur, there would be some disturbance associated with construction. The quality of potential habitat for this species is low, and the area of habitat to be removed is relatively small. In this context, while removal of this habitat could reduce the area of occupancy, it would not have a significant impact on an important population of this species.

c) Will the action fragment an existing important population into two or more populations?

Large-eared Pied Bat

The proposal would not impact upon suitable roosting or foraging habit for this species and therefore the proposal would not fragment an existing important population of these species into two or more populations.

Pink-tailed worm-lizard

The proposal would involve the removal of around 0.1 ha of potential habitat. There would also be some disturbance associated with construction. The quality of potential habitat is low, and the area of habitat to be removed is relatively small. The proposal would not fragment an existing important population of this species into two or more populations.

d) Will the action adversely affect habitat critical to the survival of a species?

Large-eared Pied Bat

The Register of Critical Habitat established under the EPBC Act does not list any critical habitat for these species.

Pink-tailed worm-lizard

The Register of Critical Habitat established under the EPBC Act does not list any critical habitat for this species.

e) Will the action disrupt the breeding cycle of an important population?

Large-eared Pied Bat

There is no suitable breeding habitat for these species in the development site. The proposal would not disrupt the breeding cycle of an important population of these species.

Pink-tailed worm-lizard

The proposal would involve the removal of around 0.1 ha of potential habitat. There would also be some disturbance associated with construction. The quality of potential habitat is low, and the area of habitat to be removed is relatively small. The proposal would not disrupt the breeding cycle of an important population of this species.

f) Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Large-eared Pied Bat

The proposal would not impact upon suitable roosting or foraging habit for this species. Suitable habitat does occur in the vegetated lower slopes and sandstone ridgelines, but these areas would not be directly impacted. Indirect impacts such as noise, dust and light spill may occur during construction but would be short term and temporary.

With the implementation of the recommended mitigation measures, the proposal would not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that an important population of these species would be likely to decline.

Pink-tailed worm-lizard

The proposal would involve the removal of around 0.1 ha of suitable habitat, including some areas of grassland. There

would also be some disturbance associated with construction. The quality of potential habitat is low, and the area of habitat to be removed is relatively small and would not disrupt habitat significantly. With the implementation of the recommended mitigation measures, the proposal would not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that an important population of these species would be likely to decline.

g) Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Large-eared Pied Bat and Pink-tailed worm-lizard

The proposal has the potential to contribute to the spread of invasive species in the subject land through the transfer and introduction of plant material and soil on machinery. Mitigation measures have been recommended to prevent the spread of weeds on site. The proposal is therefore unlikely to result in invasive species that are harmful to these vulnerable species becoming established in potential habitat.

h) Will the action introduce disease that may cause the species to decline?

Large-eared Pied Bat and Pink-tailed worm-lizard

There is a risk that diseases could be introduced to the development site via machinery, vehicles, and materials during construction and operation. With the implementation of the recommended mitigation measures, the proposal is therefore unlikely to result in the introduction of any disease that may cause these species to decline.

i) Will the action interfere substantially with the recovery of the species?

Large-eared Pied Bat

The National Recovery Plan for the Large-eared Pied Bat lists the following specific objectives:

1. Identify priority roost and maternity sites for protection.
2. Implement conservation and management strategies for priority sites.
3. Educate the community and industry to understand and participate in the conservation of the Large-eared Pied Bat.
4. Research the Large-eared Pied Bat to augment biological and ecological data to enable conservation management.
5. Determine the meta-population dynamics throughout the distribution of the Large-eared Pied Bat.

The proposal would not interfere with any of these objectives.

Pink-tailed worm-lizard

There is no National Recovery Plan for Pink-tailed worm-lizard at this time, however conservation actions include

1. Identify priority sites for protection
2. Ensure appropriate grazing regimes
3. Educate the community and industry to understand and participate in the conservation of the Pink-tailed worm-lizard.
4. Information and research priorities.
5. Survey and monitoring priorities

Conclusion

Pink-tailed worm-lizard

The proposal will result in the loss of 0.1 ha of potential habitat for the Pink-tailed worm-lizard. Approximately 0.8 ha would remain and not be impacted. Areas of rocky outcrop were assessed and surveyed by two ecologists; between 100-150 rock were turned and inspected at each surveyed area. No individuals were observed during field surveys.

Large-eared Pied Bat

Although detected in close proximity to the development site in suitable sandstone ridgelines containing appropriate foraging habitat, only suboptimal roosting or foraging habitat for the Large-eared Pied Bat would be impacted.

It is highly unlikely that the proposal would significantly impact on the existence of the Large-eared Pied Bat or Pink-tailed worm-lizard.

APPENDIX F EPBC OFFSET CALCULATIONS

COMMONWEALTH OFFSETTING REQUIREMENTS

The EPBC Act Environmental Offsets Policy (EOP) outlines the Australian Government's approach to the use of environmental offsets ('offsets') under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This policy relates to all matters protected under the EPBC Act. Offsets are required where a significant impact is anticipated. For the proposed Wollar Solar Farm, this could include:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (henceforth, Box-Gum Woodland).

No other entities are considered likely to have a significant impact. Commonwealth offset requirement calculations are detailed below for this entity.

COMMONWEALTH OFFSET METHODOLOGY

The Offsets Assessment Guide (OAG) was run according to the information contained in the document titled 'How to use the Offsets Assessment Guide' (which is published on the DoEE's EPBC Act environmental offsets policy web page). In running the OAG, the user is required to enter a number of variables which require a quantitative assessment of the condition of the vegetation at the development and offset site and also factors such as the time until the ecological benefit of the offset is realised, the risk of the loss of the offset and the level of confidence in these results. The reasoning used in reaching these values is discussed individually for each below.

F.1.1 Box Gum Woodland

Conservation listing

The *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (aka Box Gum Woodland, BGW) is listed as Critically Endangered.

Area of impacted community

A total of 229.9 ha will be impacted, of this:

- 24.8 ha are structural woodland and contain 64 hollow-bearing trees.
- 205.1 ha are relatively degraded secondary grasslands, modified by agriculture.

It is noted for the solar farm area, the majority of the development footprint, that the impacts of the project in derived grasslands do not involve total removal of vegetation. The vast majority of impact will be from shading by panel modules which may not lead to substantive composition or structural changes. For the purpose of this assessment however, 100% removal is assumed.

Habitat quality

The overall habitat quality score (0-10) was determined by considering the following factors (as outlined in the 'How to use the Offsets Assessment Guide') individually:

- Site condition. Including vegetation condition, structure and species diversity;
- Site context. The biodiversity importance of the site in terms of its landscape position;
- Species stocking rate. The number of individual populations at the site.

The contribution of these factors was noted according to their level of importance. The results of this analysis are provided in the below table. As potential offset sites are within the project boundary or immediate area, the start quality of both areas was considered to be the same.

Table 1 Overall habitat quality score for Box Gum Woodland / Derived Native Grassland CEEC

Factor	Score	Importance Ranking	Reasoning
Site condition	6 (BGW treed) 1 (BGW grassland)	1	Where BGW CEEC occurs with tree cover within the solar farm it was classified as being in moderate condition. A total of 30.5 ha is considered to support high diversity and nine hollow-bearing trees. **A condition rating of 6 has been given to the grassland areas based on the floristics analysis presented in Table 7-5 against EPBC criteria.** Where BGW occurs as a derived grassland it is primarily of low condition. A total of 205 ha is degraded. **A condition rating of 1 has been given to the grassland areas based on the floristics analysis presented in Table 7-5 against EPBC criteria.**
Site context	6 (BGW treed) 2 (BGW grassland)	2	Aerial imagery demonstrates the site itself varies between cleared and sparsely treed areas of vegetation. The site comprises mostly paddocks within flatter land or foot slopes, which have been cleared for agricultural purposes. There are no significant connectivity features within the development site itself. At a local scale the project area supports some small patches of treed BGW directly south of the site, but this only provides some minor connectivity value. The value of the treed BGW within the site is therefore important locally given the prior clearance and fragmented nature of the woodland within the project area. **A score of 6 has been given to the treed BGW habitat as its importance value is assumed higher than the grassland areas.** The Wollar Valley has a patchy distribution of both exotic and native pastures. The proposed solar farm is not expected to disrupt connectivity of native grasslands when consideration is given the large area of native grasslands surrounding the development site that exist within Wollar Valley (~8000ha). At a regional scale, the project area can be seen to be located within cleared agricultural land, with woodland outside the development zone to the west and south. As treed vegetation is primarily non-existent or patchy within the project area, it does not facilitate direct linkages to the woodland located outside the project area. **A score of 1 has been given to the BGW grassland habitat as its importance value is lower than the treed BGW and it is more abundant in the landscape.**
Species stocking rate	N/A	N/A	N/A
Overall quality score	**6 (BGW treed)** **1 (BGW grassland)**		

Quantum of impact

For treed BGW the quantum of impact (adjusted hectares), based on the habitat quality score of six is: 14.88 ha.

For BGW grassland the quantum of impact (adjusted hectares), based on the habitat quality score of one is: 20.51 ha.

Offset description

An offset site has not been identified at the time of writing; however, it is proposed to offset impacts within the local area under one offset site, protecting the better-quality residual areas within the project area. There is good potential to offset the south western portion of the project area where Box Gum Woodland (BGW) is not impacted to preserve and enhance CEEC habitat onsite. These areas are in better condition and have better connectivity values due to the more mature/hollow bearing trees. There is scope to improve connectivity values within this area.

The Wollar Valley comprises largely of BGW and Derived Native Grassland (DNG) habitat on the valley flats and foot slopes. It is estimated around 5497ha of BGW/DNG in area (inclusive of powerlines and dirt roads running through Wollar valley) is present within the wider area (i.e. outside the project area). This figure has been assumed from aerial photography, knowledge of the landscape, and observation of vegetation within the landscape during field surveys. The occurrence of BGW/DNG however, has not been validated through quantitative field surveys.

Time horizon

The risk-related time horizon has been set at the maximum forecast term of 20 years as the offset site would be legally secured and managed in perpetuity under a NSW BC Act Stewardship agreement.

The time until ecological benefit was entered as 5 years, as the offset package would not expect to be finalised until after construction of the solar farm so that all impacts can be accurately accounted for.

Start area and quality

The start area required to achieve 90% offset for impact to 24.8 ha of treed BGW in moderate condition is 195 ha.

The start area required to achieve 90% offset for impact to 205.1 ha of BGW grassland in low condition is 190 ha.

It is assumed this total number of ha to offset the impact can be achieved in the local area if the assumption that approximately 5497 ha of BGW/DNG is present within the Wollar Valley, as described above.

Offset quality has been given the condition rank of 6 (from ten), as the surrounding vegetation within the landscape is considered to represent 'moderate' quality habitat.

Future area and quality without offset

RISK OF LOSS

An estimate of 45% risk of loss without offset has been applied to the treed BGW and 70% risk of loss without offset to the grassland BGW as the site is unprotected and subject to agricultural activities. The sites are currently utilised for agriculture and are situated in an area where this is the dominant land use. A widespread fire is likely to have stimulated the seed bank and is reflected in current plot data composition however, the ground cover amount shows impacts of drought and grazing and is unlikely to improve, in consideration of land use alone. The land is privately owned and not protected by any conservation agreements or reservation schemes. There are no known pending mining leases or development applications that apply to the candidate offset sites. As stated in the 'How to use the Offsets Assessment Guide', degradation to the quality of the site due to current management practices and use should not be incorporated into the risk of loss as these factors are incorporated in the quality score. However, it is considered reasonable that future land management practices be considered. These may include broad scale spraying and cropping.

QUALITY

The future quality of the treed BGW without offset has been entered as four, as degradation over time would be expected to reduce habitat and vegetation condition and quality.

The future quality of the BGW grassland without offset has been entered as two, as the land is already heavily degraded and further degradation above that already occurring is not expected.

Future area and quality with offset

RISK OF LOSS

The Stewardship agreement for the offset site would be a formal, legal protection mechanism for BGW/DNG. However, there may still be some natural attrition and the intentions of landowners are unknown. Therefore, the future risk of loss with offset has been set at 5%.

With 5% risk of loss, the offset calculator shows the adjusted hectares of an offset site as 194.8 ha for the treed BGW.

With 5% risk of loss, the offset calculator shows the adjusted hectares of an offset site as 197.6 ha for the BGW grassland.

QUALITY

Management of offset sites would include managing grazing for conservation, minimising clearing as well as weed and erosion control. With these measures in place, over time it is expected that the quality of the vegetation on site would improve to 'moderate-good'. A quality factor of eight has been entered for the treed BGW area and a quality factor of seven has been entered for the BGW grassland areas.

Gain from offset

RAW GAIN

For the treed BGW offsetting is expected to bring about a raw gain of 78 ha and a quality score increase of 4. This assumes active management.

For the BGW grassland offsetting is expected to bring about a raw gain of 123.5 ha and a quality score increase of 5. This assumes active management such as planting overstorey species appropriate to the community.

CONFIDENCE IN RESULT

The estimated values for risk of loss are based on factors outside the control of the Wollar Solar Farm, but are considered reasonable, given the known land use history. An 80% confidence in these results has been applied.

ADJUSTED GAIN

Considering an 80% confidence, the potential adjusted gain from offsetting the impact is 62.4 ha for the treed BGW and 98.8 ha for the BGW grassland.

NET PRESENT VALUE

The net present value (adjusted hectares) is 13.39 ha for treed BGW.

The net present value (adjusted hectares) is 18.55 ha for BGW grassland.

Results

PERCENTAGE OF IMPACT OFFSET

The minimum direct offset requirement (90% direct offset required) equates to:

- 195 ha for treed BGW.

- 190 ha for BGW grassland.
- **385 ha in total.**

REQUIRED AREA OF LIKE-FOR-LIKE

It is noted that the Wollar Valley comprises largely of BGW and Derived Native Grassland (DNG) habitat on the valley flats and foot slopes. It is estimated around 5497ha of BGW/DNG in area (inclusive of powerlines and dirt roads running through Wollar valley) is present within the wider area (i.e. outside the project area). This figure has been assumed from aerial photography, knowledge of the landscape, and observation of vegetation within the landscape during field surveys. The occurrence of BGW/DNG however, has not been validated through quantitative field surveys.

Within the project boundaries, in areas that would not be impacted by the development, around 217 ha of CEEC is available for protection under an offset agreement. Based on available mapping, though not subject to detailed survey, it is estimated that an additional 258 ha remains within the property boundary, that would not be impacted by the development and may provide suitable direct offsets. If suitable, this exceeds the required amount by 90 ha.

APPENDIX G BAM CALCULATOR CREDIT REPORT

NSW GOVERNMENT

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011361//18/00012396	Wollar Solar Farm BDAR Major Project BDAR Ver 3_TotalDevtFP	05/05/2020
Assessor Name	**Report Created**	**BAM Data version ***
Mitch Palmer	28/05/2020	26
Assessor Number	**BAM Case Status**	**Date Finalised**
17051	Open	To be finalised
Assessment Revision	**Assessment Type**	
5	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion								
4	281_BGW_Zone5	59.6	8.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	238
5	281_DNG_Zone6	11.9	102.8	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
							Subtotal	**238**
White Box - Black Cypress Pine shrubby woodland of the Western Slopes								
6	1610_Good_Zone8	27.0	0.1	0.25	High Sensitivity to Potential Gain	1.75		2
7	1610_Degraded_Zone9	2.3	27.1	0.25	High Sensitivity to Potential Gain	1.75		0
							Subtotal	**2**
White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion								
1	1303_BGW_Zone1	56.8	16.8	0.25	High Sensitivity to Potential Gain	2.00	TRUE	478
2	1303_DNG_Zone2	9.4	102.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
3	1303_Cultivated_Low_Zone3	11.4	110.7	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
							Subtotal	**478**
							Total	**718**

Species credits for threatened species

BAM Credit Summary Report

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Acacia ausfeldii / Ausfeld's Wattle (Flora)						
281_BGW_Zone5	59.6	1.06	0.25	2	False	32
1610_Good_Zone8	27.0	0.14	0.25	2	False	2
					Subtotal	**34**
Burhinus grallarius / Bush Stone-curlew (Fauna)						
281_BGW_Zone5	59.6	1.06	0.25	2	False	32
1610_Good_Zone8	27.0	0.14	0.25	2	False	2
					Subtotal	**34**
Callocephalon fimbriatum / Gang-gang Cockatoo (Fauna)						
281_BGW_Zone5	59.6	2.03	0.25	2	False	61
281_DNG_Zone6	11.9	0.73	0.25	2	False	4
1610_Good_Zone8	27.0	0.12	0.25	2	False	2
1610_Degraded_Zone9	2.3	0.19	0.25	2	False	0
					Subtotal	**67**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
281_BGW_Zone5	59.6	1.06	0.25	3	True	47
1610_Good_Zone8	27.0	0.14	0.25	3	True	3
					Subtotal	**50**
Commersonia procumbens / Commersonia procumbens (Flora)						
1610_Good_Zone8	27.0	0.14	0.25	2	False	2

1610_Degraded_Zone9	2.3	0.21	0.25	2	False	0
					Subtotal	**2**
Monotaxis macrophylla / Large-leafed Monotaxis (Flora)						
281_BGW_Zone5	59.6	1.06	0.25	2	False	32
1610_Good_Zone8	27.0	0.14	0.25	2	False	2
					Subtotal	**34**
Ninox connivens / Barking Owl (Fauna)						
281_BGW_Zone5	59.6	0.52	0.25	2	False	16
281_DNG_Zone6	11.9	0.01	0.25	2	False	0
1610_Degraded_Zone9	2.3	0.08	0.25	2	False	0
					Subtotal	**16**
Ninox strenua / Powerful Owl (Fauna)						
281_BGW_Zone5	59.6	0.52	0.25	2	False	16
281_DNG_Zone6	11.9	0.01	0.25	2	False	0
					Subtotal	**16**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
281_BGW_Zone5	59.6	1.06	0.25	2	False	32
1610_Good_Zone8	27.0	0.14	0.25	2	False	2
					Subtotal	**34**

Phascogale tapoatafa / Brush-tailed Phascogale (Fauna)						
281_BGW_Zone5	59.6	0.38	0.25	2	False	11
281_DNG_Zone6	11.9	0.18	0.25	2	False	1
1610_Good_Zone8	27.0	0.06	0.25	2	False	1
1610_Degraded_Zone9	2.3	0.08	0.25	2	False	0
					Subtotal	**13**
Phascolarctos cinereus / Koala (Fauna)						
281_BGW_Zone5	59.6	1.06	0.25	2	False	32
1610_Good_Zone8	27.0	0.14	0.25	2	False	2
					Subtotal	**34**
Tyto novaehollandiae / Masked Owl (Fauna)						
281_BGW_Zone5	59.6	0.52	0.25	2	False	16
281_DNG_Zone6	11.9	0.01	0.25	2	False	0
					Subtotal	**16**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
1303_BGW_Zone1	56.8	0	0.25	3	True	0
281_BGW_Zone5	59.6	0	0.25	3	True	0
					Subtotal	**0**

APPENDIX H ASSESSMENT PERSONNEL

Name	Title	Qualifications	Roles
Brooke Marshall	Project Director	• Certified Environmental Practitioner (CEnvP) • BAM Accredited Assessor • B. Nat Res (First Class Honours)	Review and approval of BDAR – all versions. Commonwealth offset tool requirement.
Dave Maynard	Principal Ecologist	• BAM Accredited Assessor • B Science (Ecology, First Class Honours)	Direction in BAM assessment and BDAR V1 and 2. Preliminary review.
Gillian Young	Senior Ecologist	• BAM Accredited Assessor • B. Nat Res (Second Class Honours)	Field work including PCT identification, vegetation mapping, vegetation plots and threatened flora surveys. Main author and assessor of the BDAR report. Author of BAM Calculator report. MNES assessment for EPBC listed CEECs onsite.
Colin Bower	Field ecologist	• BAM Accredited Assessor • Bachelor of Science (Hons) and Ph.D. Entomology	Field work including stratifying vegetation and collection of VI Plot data.
Zoe Quaas	Field ecologist	• B. Env. Sc. and Mgmt (First Class Honours)	Field work including threatened fauna surveys. Writing parts of the BDAR report. GIS Mapping
Mitch Palmer	Field ecologist and co author	• BAM Accredited Assessor • B. Science	Field work including threatened flora/fauna surveys. MNES assessment of EPBC listed fauna species.
Lauren Byrne	Field ecologist	• B. Science	Assistant to field work including threatened flora/fauna surveys.
Brendon True	Field ecologist	• BAM Accredited Assessor • Master of Conservation Biology • Bachelor of Science (Ecology and Biodiversity)	Field work including habitat trees survey and PCT mapping alongside Barigan Road.

Name	Title	Qualifications	Roles
Clancy Bowman	Environmental Consultant Mapping coordinator	• Bachelor of Science (Resource & Environmental Management)	GIS updates including areas calculations used in BDAR Version 3.

Appendix D **ABORIGINAL HERITAGE ITEMS**

Table 1: Aboriginal heritage items – avoid impacts

*Item**	
Wollar SF AFT 6	Wollar SF IF25
Wollar SF IF8	Wollar SF GDG 1
Wollar SF IF9	Wollar SF ST 1
Wollar SF IF10	Wollar SF ST 2
Wollar SF IF11	Wollar SF Cultural Site 1
Wollar SF IF12	Wollar Creek 1
Wollar SF IF14	Wollar Creek 2
Wollar SF IF21	-

** Refer to the Figure in this Appendix to identify items*

Table 2: Aboriginal heritage items – surface collection salvage

Item	
Wollar SF AFT 1	Wollar SF IF15
Wollar SF AFT 2	Wollar SF IF16
Wollar SF AFT 3	Wollar SF IF17
Wollar SF AFT 4	Wollar SF IF18
Wollar SF AFT 5	Wollar SF IF19
Wollar SF AFT 7	Wollar SF IF20
Wollar SF AFT 8	Wollar SF IF22
Wollar SF AFT 9	Wollar SF IF23
Wollar SF AFT 10	Wollar SF IF24
Wollar SF AFT 11	Wollar SF IF26
Wollar SF AFT 12	NGH Barigan AFT 1
Wollar SF IF1	NGH Barigan AFT 2
Wollar SF IF2	NGH Barigan AFT 3
Wollar SF IF3	NGH Barigan AFT 4
Wollar SF IF4	NGH Barigan IF 1
Wollar SF IF5	NGH Barigan IF 2
Wollar SF IF6	NGH Barigan IF 3
Wollar SF IF7	NGH Barigan IF 4
Wollar SF IF13	NGH Barigan IF 5

Appendix E **COUNCIL NOTIFICATION**

21 May 2020

Mr Brad Cam
The General Manager
Mid-Western Regional Council
PO Box 156
MUDGEE NSW 2820

Email: council@midwestern.nsw.gov.au
Cc: Julie.robertson@midwestern.nsw.gov.au

Attention: Julie Robinson – Director Development

Dear Mr Cam,

RE: PROPOSED MODIFICATION TO A STATE SIGNIFICANT DEVELOPMENT (WOLLAR SOLAR FARM - SSD 9254)

We are writing on behalf of Wollar Solar Farm Development Pty Ltd, the proponent for the Wollar Solar Farm. The Wollar Solar Farm is a State Significant Development. Development consent was issued by the Executive Director, Department of Planning, Industry and Environment (DPIE) on February 24, 2020 (Application Number: SSD 9254), under Section 4.38 of the *Environmental Planning and Environment Act. 1979.*

The Wollar Solar Farm is located on the western side of Barigan Road, approximately 7km south of Wollar village, in the Mid-Western Regional Local Government Area (LGA).

The development consent permits the construction, operation, and decommissioning of a 290 Megawatt (MW AC) photovoltaic (PV) solar farm and associated infrastructure including:

- An onsite 330kV substation to connect to the national electricity grid via the existing 330kV transmission line onsite,
- Underground power cabling to connect solar panels, combiner boxes and power conversion units (PCUs),
- An energy storage facility with a capacity of up to 30 MWh,
- Access tracks, staff amenities, car parking, laydown area and security fencing.

The Environmental Impact Statement (EIS) was completed by NGH in 2019. Given further detailed design and investigation, a Modification Application is now being prepared to address proposed changes to the approved development. The proposed modifications include:

- Subdivision of land within the solar farm development site for TransGrid internal substation and electrical connection infrastructure, that will be placed into the ownership of the authority,
- Relocation of a section of the main site access route, which traverses the proposed lot for the internal substation, and
- Inclusion of an allotment that was omitted from Appendix 2 Schedule of Land of the development consent due to an administrative error.

Figure 1 indicates the subject land and location of the proposed subdivision with respect to the development footprint. Figure 2 below shows the proposed new allotment comprising an area of approximately 2.58ha and indicative 10m wide right of carriageway (ROC) from the public road.

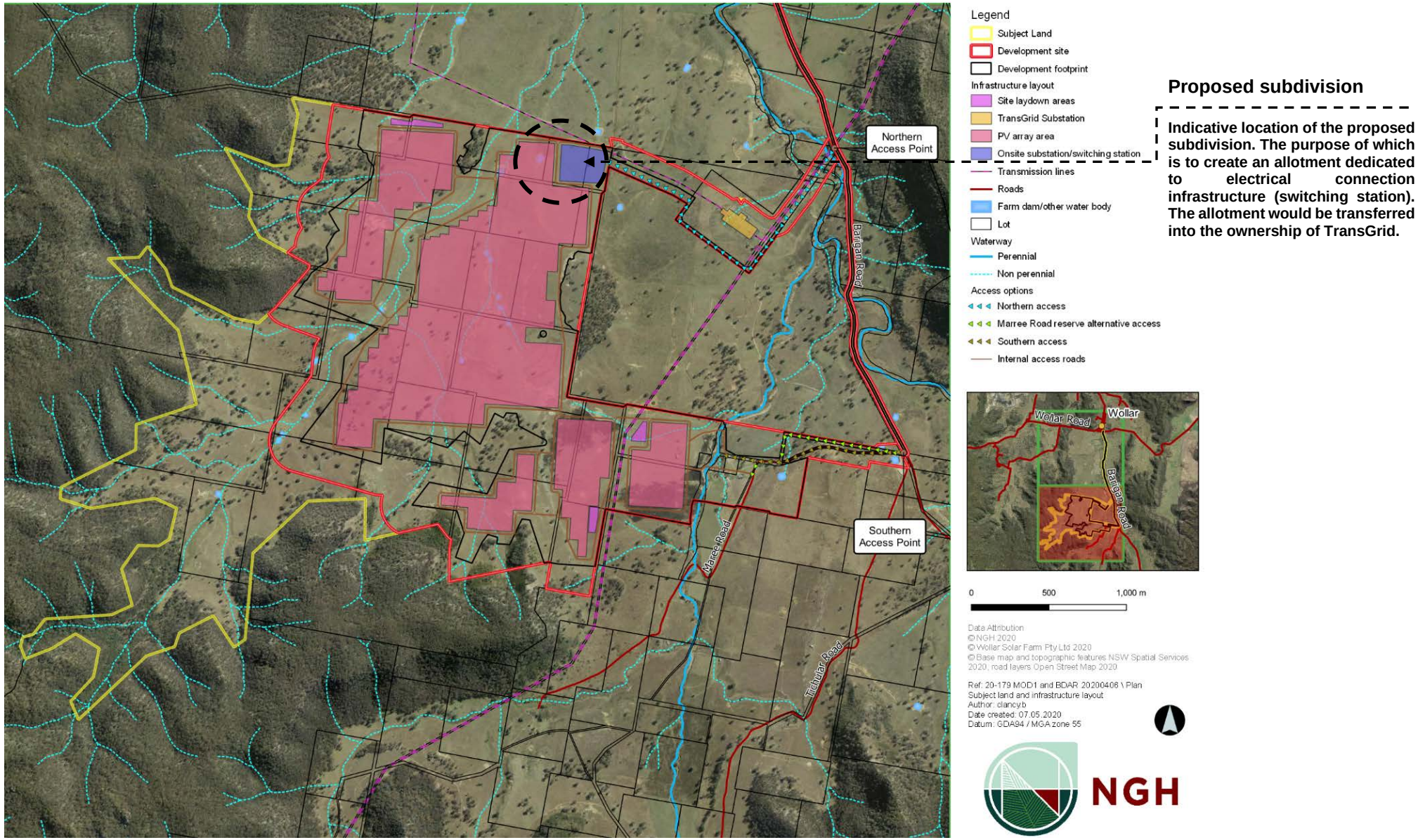

Figure 1: Subject land, development layout and location of proposed subdivision and access (Source: NGH)

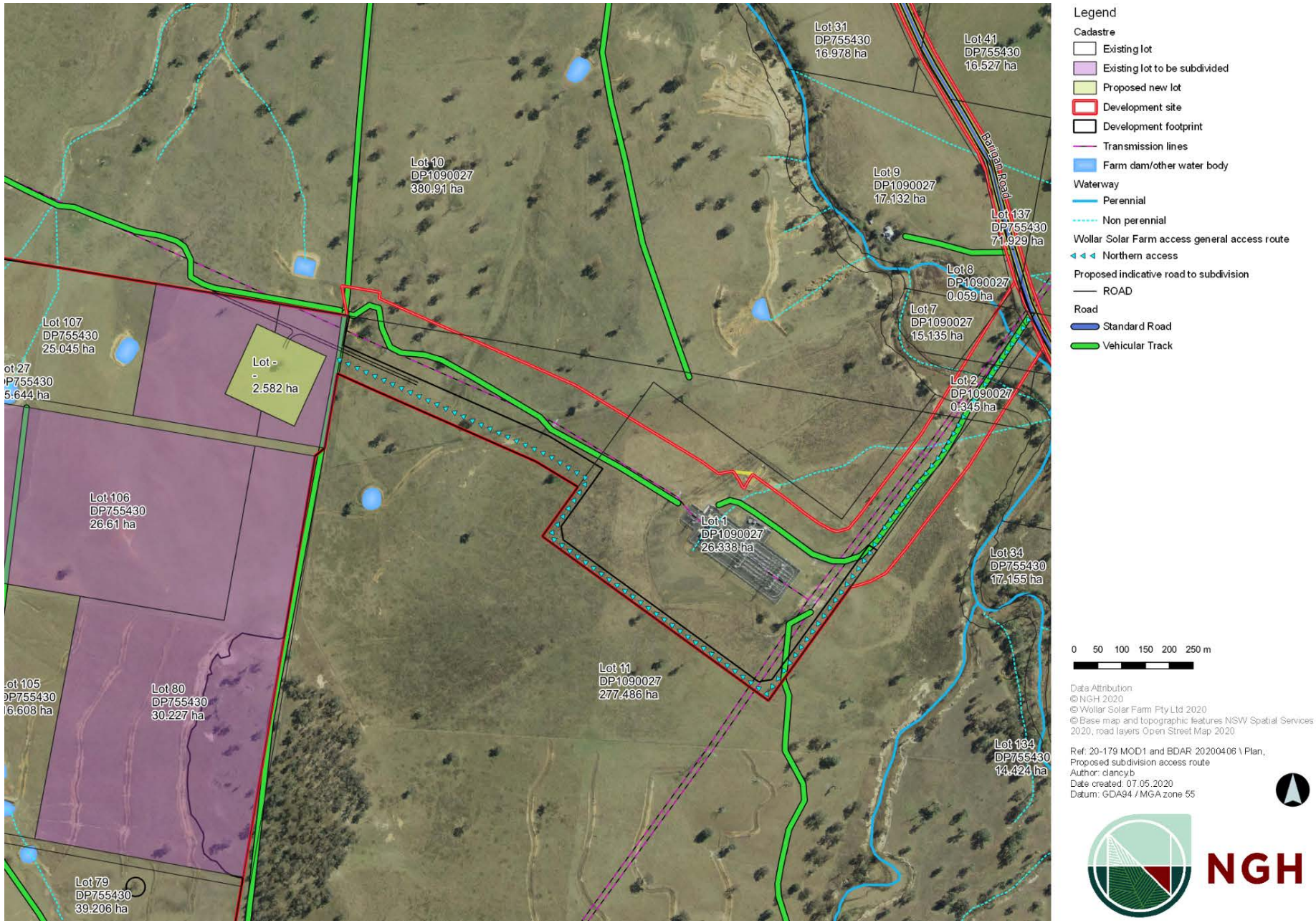

Figure 2: Location of proposed new allotment, indicating proposed access from public road (Source: NGH)

The proposed subdivision would involve Lots 80 and 106 DP 755430. It would excise an area of approximately 2.58 ha to create one additional lot.

The newly created allotment would incorporate the TransGrid internal substation components and facilitate the electrical connection of the approved solar farm on the subject land. In this regard, TransGrid has confirmed that it requires the right to own the land containing the substation. This allows TransGrid to meet the network control and protection requirements under the National Electricity Rules.

The subject land is zoned RU1 Primary Production under the provisions of the Mid-Western Regional Local Environmental Plan 2012. The land is subject to a minimum subdivision lot size of 100ha as shown on the Lot Size Map in relation to that land. The two existing lots are less than 100ha. The proposed subdivision would result in the creation of an allotment that would be less than the minimum lot size shown on the Lot Size Map.

Previously when dealing with solar farm developments DPIE, has directed applications for associated land subdivision to the local authority for determination. However, these applications have been problematic given the absence of provisions within local planning instruments to enable the creation of allotments under the minimum lot size, as is the case in this instance.

In consultation with DPIE it was advised that approval for land subdivision could be included in the overall assessment of the SSD proposal. However, to ensure the approval path is seamless, DPIE requests formal correspondence be provided by Council advising no objection is likely to be raised to the proposed subdivision during the notification period.

State Environmental Planning Policy (State and Regional Development) 2011

Despite the provisions of the Mid-Western RLEP2012, the provisions of the *Environmental Planning and Assessment Act 1979* provide that the subdivision may be approved by the consent authority, given that the subdivision forms part of a State Significant Development (SSD).

According to clause 8(2) of the State Environmental Planning Policy (State and Regional Development) 2011, where a development application comprises development that is only partly SSD, the remainder of the development is also declared to be SSD.

Furthermore, clause 4.38(3) of the *Environmental Planning and Assessment Act 1979* states “development consent may be granted despite the development being partly prohibited by an environmental planning instrument.” Consultation with DPIE confirms that this allows the consent authority to approve aspects of an SSD that are prohibited under an environmental planning instrument. DPIE advises that consent may be granted to a proposed subdivision, as part of SSD, despite prohibitive provisions in an applicable LEP.

Mid-Western Regional Local Environmental Plan (MWRLEP) 2012

General aims

Under section 1, the aims of the MWRLEP 2012 are:

> *(a) to promote growth and provide for a range of living opportunities throughout Mid-Western Regional,*
>
> *(b) to encourage the proper management, development and conservation of resources within Mid-Western Regional by protecting, enhancing and conserving—*
>
> > *(i) land of significance to agricultural production, and*
> >
> > *(ii) soil, water, minerals and other natural resources, and*
> >
> > *(iii) native plants and animals, and*
> >
> > *(iv) places and buildings of heritage significance, and*
> >
> > *(v) scenic values,*
>
> *(c) to provide a secure future for agriculture through the protection of agricultural land capability and by maximising opportunities for sustainable rural and primary production pursuits,*
>
> *(d) to foster a sustainable and vibrant economy that supports and celebrates the Mid-Western Regional’s rural, natural and heritage attributes,*

(e) to protect the settings of Mudgee, Gulgong, Kandos and Rylstone by—

(i) managing the urban and rural interface, and

(ii) preserving land that has been identified for future long- term urban development, and

(iii) promoting urban and rural uses that minimise land use conflict and adverse impacts on amenity, and

(iv) conserving the significant visual elements that contribute to the character of the towns, such as elevated land and the rural character of the main entry corridors into the towns,

(f) to match residential development opportunities with the availability of, and equity of access to, urban and community services and infrastructure,

(g) to promote development that minimises the impact of salinity on infrastructure, buildings and the landscape.

It is considered that the proposed development is not inconsistent with the aims of the MWLEP2012. The proposed subdivision would facilitate an approved State Significant Development that will encourage economic growth and provide a range of opportunities to the region. Additionally, the development will promote development consistent with the principles of ecologically sustainable development and management of climate change, promote sustainability of natural attributes and co-ordinate development with the provision of public infrastructure and services.

Objectives of the RU1 Primary Production zone

The subject land is zoned RU1 Primary Production under the provisions of the MWLEP2012.

The objectives of the RU1 Primary Production zone are as follows:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.*
- *To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.*

The proposed subdivision, as a critical component of the approved solar farm, is not inconsistent with the objectives of the RU1 zone. The solar farm meets the objective of the zone to encourage diversity in primary industry enterprises and systems appropriate for the area. From a land use planning perspective, solar farms are compatible with agricultural land use given the only practical location that large-scale solar farms can be located is within a non-urban area. Solar farms are not susceptible to adverse amenity impacts that are problematic and constrain agricultural uses (such as dwellings), as they do not result in the generation of new dwellings, thus avoiding the fragmentation of land.

The introduction of renewable energy would contribute to a more diverse local industry, thereby supporting the local economy and community. The construction phase would support direct and indirect jobs, which would create further economic stimulus in the local region. Once constructed the solar farm would employ full time staff during operation. Other economic benefits will accrue to the local economy.

As indicated above, in consultation with DPIE it was determined that the subdivision may be approved by the consent authority, given it forms part of a State Significant Development (SSD). However, to ensure the approval path is seamless, DPIE requests formal correspondence be provided by Council advising no objection is likely to be raised to the proposed subdivision during the notification period.

We respectfully request that Council consider their position and provide a formal response at its earliest convenience.

Should you have any questions please do not hesitate to contact me on 0412 403499 or alternatively email me at lizzie.oj@nghenvironmental.com.au.

Yours sincerely,

Lizzie Olesen-Jensen
Principle Town Planner
0412 403499
NGH

From:	David Webster
To:	Robbie Williamson
Cc:	Garry Hemsworth; Andrew Kearins
Subject:	SSD9254 Wollar Solar - Comment regarding Traffic Management Plan
Date:	Friday, 19 June 2020 4:16:16 PM
Attachments:	20-070 Wollar TMP Final 1.0 updated June 2020 cover.pdf

Robbie,

I refer to the TMP and other documentation submitted to Council for review, (See attached extract / cover).

I wish to advise that the documentation has been reviewed and is considered to be satisfactory. Please be advised that Council will not generally approve TMP documents.

However, it is considered sufficient to meet the requirements detailed in Condition 10 of Schedule 3 Environmental Condition – General of the above referenced State Approval.

Should you have any queries please do not hesitate to contact me further.

Regards,

David

David Webster
Manager Development Engineering, Operations
Mid-Western Regional Council
t 02 6378 2925 | f 02 6378 2815 | m [redacted]
e david.webster@midwestern.nsw.gov.au
a 86 Market Street | PO Box 156 Mudgee NSW 2850
w www.midwestern.nsw.gov.au
facebook | twitter | youtube

Appendix F **LANDOWNERS CONSENT**

Consultation and consent to lodge the modification application has been obtained from:

- Transgrid
- Crown Lands
- Peabody Pastoral
- Mid-Western Regional Shire (stating consent is not required)
- Private landowners

From: Julie Robertson
To: Brooke Marshall
Cc: Robbie Williamson; Clancy Bowman
Subject: Re: Involved landowners: Wollar Solar Farm modification application
Date: Wednesday, 5 August 2020 10:10:48 AM
Attachments: image001.png

Hi Brooke
I acknowledge receipt of your email. Thanks for the update.

Kind regards
Julie

Get Outlook for iOS

From: Brooke Marshall <brooke.m@nghconsulting.com.au>
Sent: Wednesday, August 5, 2020 9:56:31 AM
To: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Cc: Robbie Williamson <robbie.williamson@bjceaustralia.com>; Clancy Bowman <clancy.b@nghconsulting.com.au>
Subject: RE: Involved landowners: Wollar Solar Farm modification application

Caution: This email originated from outside the organisation.

Hi Julie, sorry to bother you but could you please confirm you received the email below?
I just need to know it got to you. No further action requires.
Thanks, Brooke.

BROOKE MARSHALL
MANAGER – NSW SE & ACT
Certified Environmental Practitioner
Please note I do not work Wednesdays
T. 02 6492 8303 **M.** 0437 700 915
E. brooke.m@nghconsulting.com.au
Suite 11, 89-91 Auckland St
(PO Box 470) Bega NSW 2550

BEGA · BRISBANE · CANBERRA · GOLD COAST · NEWCASTLE · SYDNEY · WAGGA WAGGA
WWW.NGHCONSULTING.COM.AU

From: Brooke Marshall
Sent: Tuesday, 28 July 2020 5:56 PM
To: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Subject: Involved landowners: Wollar Solar Farm modification application

Hi Julie

Earlier this year, we sought your consent (as an involved landowner) to lodge a Modification Application for the Wollar Solar Farm to:

1. Move an section of access track within the Transgrid substation lot
2. Include subdivision of an additional Transgrid lot for the new substation

We acknowledge that you do not believe this is required but provide this update regarding the project.

The lodgement of the Modification was on hold while the project focussed on preparing management plans to allow the Stage 1 works to commence (Barigan Road upgrades; unaffected by the Modification) and while the Commonwealth approval was pending. We are now ready to lodge the Modification and intend to include one additional change:

3. Increase the number of over-dimensional vehicles required for the development from 2 to 5.

This requirement has been identified now that TransGrid have progress their detailed methodology for the new substation will be constructed. In addition to the two electrical transformer deliveries originally anticipated, there are three more over-dimensional deliveries of large equipment required for the substation.

We consider this to be a minor change which does not affect the conclusions or mitigation required for traffic impacts associated with the development. Can you please respond to this email confirming that you have received this notification?

Please find below the previous record of our correspondence of this matter for ease of reference.

Best regards
Brooke

BROOKE MARSHALL
MANAGER – NSW SE & ACT
Certified Environmental Practitioner
Please note I do not work Wednesdays
T. 02 6492 8303 **M.** 0437 700 915
E. brooke.m@nghconsulting.com.au
Suite 11, 89-91 Auckland St
(PO Box 470) Bega NSW 2550

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WWW.NGHCONSULTING.COM.AU

From: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Sent: Monday, 25 May 2020 2:39 PM
To: Brooke Marshall <brooke.m@nghconsulting.com.au>
Cc: Bruce Howard <bruce.howard@wollarsolarfarm.com>; Lizzie Olesen-Jensen <lizzie.oj@nghconsulting.com.au>
Subject: RE: landowner consent Wollar Solar Farm modification application

Hi Brooke,

I have discussed this matter previously with the proponent. As the development site is not on

Council owned land, my view is that owner's consent is not required by Council. I have confirmed our position with the Department.

I note that this is a highly unusual request – we have numerous state significant developments in the Mid-Western Region, all utilising public roads and we have never once been asked to provide owner's consent to lodge a development application.

If you disagree and still request a consent letter from Council to lodge your modification application, this would need to be a decision of the full Council. The next Council meeting is not until 18 June 2020.

Kind regards
Julie

From: Brooke Marshall <brooke.m@nghconsulting.com.au>
Sent: Friday, 15 May 2020 11:17 AM
To: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Cc: Lizzie Olesen-Jensen <lizzie.oj@nghconsulting.com.au>; Clancy Bowman <clancy.b@nghconsulting.com.au>
Subject: landowner consent Wollar Solar Farm modification application

Hi Julie,
In relation to the proposed subdivision Lizzie Olesen-Jensen has raised with you, I am seeking all involved landowners' consents to lodge the modification (the same as we did for lodgement of the EIS).
In this case, none of the Council owned land (Barigan Road) would be impacted by the modification. The affected lots and extent of the Modification are shown in the attached letter.
I would be pleased to discuss this with you further and hope you may be able to provide Council's consent to lodge or in principle support for the Modification as soon as practical.
Please let me know if you need anything further.
Kind regards, Brooke

BROOKE MARSHALL
MANAGER – NSW SE & ACT
Certified Environmental Practitioner
Please note I do not work Wednesdays
T. 02 6492 8303 **M.** 0437 700 915
E. brooke.m@nghconsulting.com.au
Suite 11, 89-91 Auckland St
(PO Box 470) Bega NSW 2550

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WWW.NGHCONSULTING.COM.AU

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Planning, Industry & Environment

Letter to Applicant (consent granted)

File Ref: 19/00676
Account No: 602718

Jason Jones
Phone: (02) 6883 5426
jason.jones@crownland.nsw.gov.au

Wollar Solar Development Pty Ltd
PO Box K1053
HAYMARKET NSW 1240

13 May 2020

Dear Sir/Madam

Landowner's Consent for Lodgement of a Modification Application relating to development comprising: Development, construction and operation of Wollar solar PV electricity generation facility which traverses numerous Crown unformed roads and Part reserve 755430. on Crown land: Part: Lot 7303 DP 1139558 Parish Fitzgerald County Phillip

Consent is granted by the Minister for Water, Property and Housing to the lodging of a Modification Application under section 4.55(1A) of the *Environmental Planning and Assessment Act 1979* (minor biodiversity and heritage impacts result, making 1A applicable, and other associated applications required under other legislation, for the development proposal described above.

This consent is subject to the following:

(1) This consent is given without prejudice so that consideration of the proposed development may proceed under the *Environmental Planning and Assessment Act 1979* and any other relevant legislation.

(2) This consent does not imply the concurrence of the Minister for Water, Property & Housing for the proposed development, or the issue of any necessary lease, licence or other required approval under the *Crown Lands Act 1989*; and does not prevent the Department of Planning, Industry & Environment - Crown Lands (Department of Planning, Industry & Environment - Crown Lands) from making any submission commenting on.

(3) This consent will expire after a period of 24 months from the date of this letter if not acted on within that time. Extensions of this consent can be sought.

(4) The Minister reserves the right to issue landowner's consent for the lodgement of applications for any other development proposals on the subject land concurrent with this landowner's consent.

This letter should be submitted to the relevant consent or approval authority in conjunction with the development application and/or any other application.

You are required to forward to Department of Planning, Industry & Environment - Crown Lands a copy of any development consent or other approval as soon as practical after that consent or approval is received.

If any modifications are made to the application (whether in the course of assessment, by conditions of consent, or otherwise), it is your responsibility to ensure the modified development remains consistent with this landowner's consent.

For further information, please contact Jason Jones via the details given in the letter head.

Yours faithfully

Jason Jones
Department of Planning, Industry & Environment - Crown Lands

Jim Betts
The Secretary
NSW Department of Planning, Industry & Environment
GPO Box 39
SYDNEY, NSW 2001

Dear Mr Betts,

Owner's Consent to Lodge Development Modification Application (SSD – 9254)
Lots 1, 2, 4, 6 and 8 In DP 1090027
Wollar Solar Development Pty Ltd - Wollar Solar Farm Project

The Electricity Transmission Ministerial Holding Corporation is the owner of land located at Wollar, NSW being Lots 1, 2, 4, 6 and 8 in DP 1090027 (**the Land**). I understand Wollar Solar Development Pty Ltd (**Proponent**) has proposed a development modification application (SSD **–** 9254) for Wollar Solar Farm which is proposed to connect into the Wollar 500KV Substation and therefore cross and impact the Land.

Please accept this letter as consent (for the purposes of clause 49 of the *Environmental Planning and Assessment Regulation* 2000) of the owner of the Land for the Proponent to lodge a development modification application (SSD **–** 9254) in relation to the Wollar Solar Farm.

Yours sincerely

24/8/2020

Angelo Kriketos
As agent for Michael Pratt, NSW Treasury Secretary
(Treasurer's delegate under delegation dated 24 November 2015)
on behalf of the Electricity Transmission Ministerial Holding Corporation

Brooke Marshall

From: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Sent: Monday, 25 May 2020 2:39 PM
To: Brooke Marshall
Cc: Bruce Howard; Lizzie Olesen-Jensen
Subject: RE: landowner consent Wollar Solar Farm modification application

Hi Brooke,

I have discussed this matter previously with the proponent. As the development site is not on Council owned land, my view is that owner's consent is not required by Council. I have confirmed our position with the Department.

I note that this is a highly unusual request – we have numerous state significant developments in the Mid-Western Region, all utilising public roads and we have never once been asked to provide owner's consent to lodge a development application.

If you disagree and still request a consent letter from Council to lodge your modification application, this would need to be a decision of the full Council. The next Council meeting is not until 18 June 2020.

Kind regards
Julie

From: Brooke Marshall <brooke.m@nghconsulting.com.au>
Sent: Friday, 15 May 2020 11:17 AM
To: Julie Robertson <Julie.Robertson@midwestern.nsw.gov.au>
Cc: Lizzie Olesen-Jensen <lizzie.oj@nghconsulting.com.au>; Clancy Bowman <clancy.b@nghconsulting.com.au>
Subject: landowner consent Wollar Solar Farm modification application

Hi Julie,
In relation to the proposed subdivision Lizzie Olesen-Jensen has raised with you, I am seeking all involved landowners' consents to lodge the modification (the same as we did for lodgement of the EIS).
In this case, none of the Council owned land (Barigan Road) would be impacted by the modification. The affected lots and extent of the Modification are shown in the attached letter.
I would be pleased to discuss this with you further and hope you may be able to provide Council's consent to lodge or in principle support for the Modification as soon as practical.
Please let me know if you need anything further.
Kind regards, Brooke

BROOKE MARSHALL
MANAGER – NSW SE & ACT
Certified Environmental Practitioner
Please note I do not work Wednesdays

T. 02 6492 8303 **M.** 0437 700 915
E. brooke.m@nghconsulting.com.au

Suite 11, 89-91 Auckland St
(PO Box 470) Bega NSW 2550

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PEABODY PASTORAL HOLDINGS PTY LTD

ABN: 30 141 206 368

100 Melbourne Street
South Brisbane Qld 4101

GPO Box 164
Brisbane Qld 4001
Australia
Tel + 61 (0) 7 3225 5500
Fax + 61 (0) 7 3225 5555

21 May 2020

Jim Betts
The Secretary
NSW Department of Planning, Industry and Environment
320 Pitt Street
Sydney NSW 2000

Dear Jim

Landowner's consent for lodgement of modification application to the state significant development (SSD) known as the Wollar Solar Farm (SSD - 9254), in relation to various land lots listed in the Appendix.

Peabody Pastoral Holdings Pty Ltd (Peabody Pastoral) is the owner of lands located along Barigan Road and Maree Road, Tichular, NSW 2850 (the Land). It is understood that Wollar Solar Development Pty Ltd (the Proponent) has proposed a modification to the state significant development (SSD) known as the Wollar Solar Farm (SSD - 9254). The project was approved in February 2020. The modification is being lodged under section 4.55(1A) of the Environmental Planning and Assessment Act 1979 (minor biodiversity and heritage impacts result, making 1A applicable) for:

- Proposed subdivision: creation of a third lot within the solar farm to house TransGrid connection infrastructure. The land lots affected are:
    - Lot 106 of DP755430
    - Lot 80 of DP755430
- Proposed road realignment: realignment of a short section of access track further south of the TransGrid substation, within the same lot. The land lot affected is:
    - Lot 1 of DP1090027

Images of the broader project and lots affected by the Modification are provided below.

Approved project showing location of proposed road realignment near Transgrid substation

Proposed subdivision lots: *creation of a third lot within the north eastern corner of the solar farm to house TransGrid connection infrastructure*

Proposed road realignment lots: Realignment of a short section of access track further south of the TransGrid substation, within the same lot

The lots affected by the Modification are not owned by Peabody Pastoral. Consent from all landowners involved in the broader project is required for the purposes of clause 49 of the Environmental Planning and Assessment Regulation 2000 (NSW).

As an involved landowner in the broader SSD, Peabody Pastoral provides this letter as consent from the owner of the Land, for the purposes of clause 49 of the Environmental Planning and Assessment Regulation 2000 (NSW), for the Proponent to lodge a Modification Application, in relation to the Wollar Solar Farm.

Your sincerely,

Sean Allen
Company Director
For and on behalf of Peabody Pastoral Holdings Pty Limited (ABN 30 141 206 368)

Appendix: Land lots owned by Peabody Pastoral in relation to this Consent

61A/755455
62/755455
136/755455
6/131083 being a parcel in Auto Consol 12882-102
29/755455 being a parcel in Auto Consol 12882-98
30/755455 being a parcel in Auto Consol 12882-98
31/755455 being a parcel within Auto Consol 12882-98
32/755455 being a parcel within Auto Consol 12882-98
33/755455 being a parcel in Auto Consol 12882-98
34/755455 being a parcel in Auto Consol 19882-98
35/755455 being a parcel in Auto Consol 19882-98
8/131083 being a parcel in Auto Consol 12882-102
40/755455 being a parcel in Auto Consol 12882-98
41/755455 being a parcel in Auto Consol 12882-98
65/755455 being a parcel in Auto Consol 11771-206
11/131083 being a parcel in Auto Consol 12882-102
13/131083 being a parcel in Auto Consol 12882-102
87/755455 being a parcel in Auto Consol 12882-98
33/755430 being a parcel in Auto Consol 12882-98
31/755430
41/755430
5/1090027
7/1090027
9/1090027
10 /1090027
11/1090027
137/755430
34/755430
46/755430
134/755430
84/755430

Mr Jim Betts
The Secretary
NSW Department of Planning, Industry and Environment
320 Pitt Street
Sydney NSW 2000

Dear Mr Betts

Landowner's consent for lodgement of modification application to the state significant development (SSD) known as the Wollar Solar Farm (SSD - 9254), in relation to various land lots listed in the Appendix.

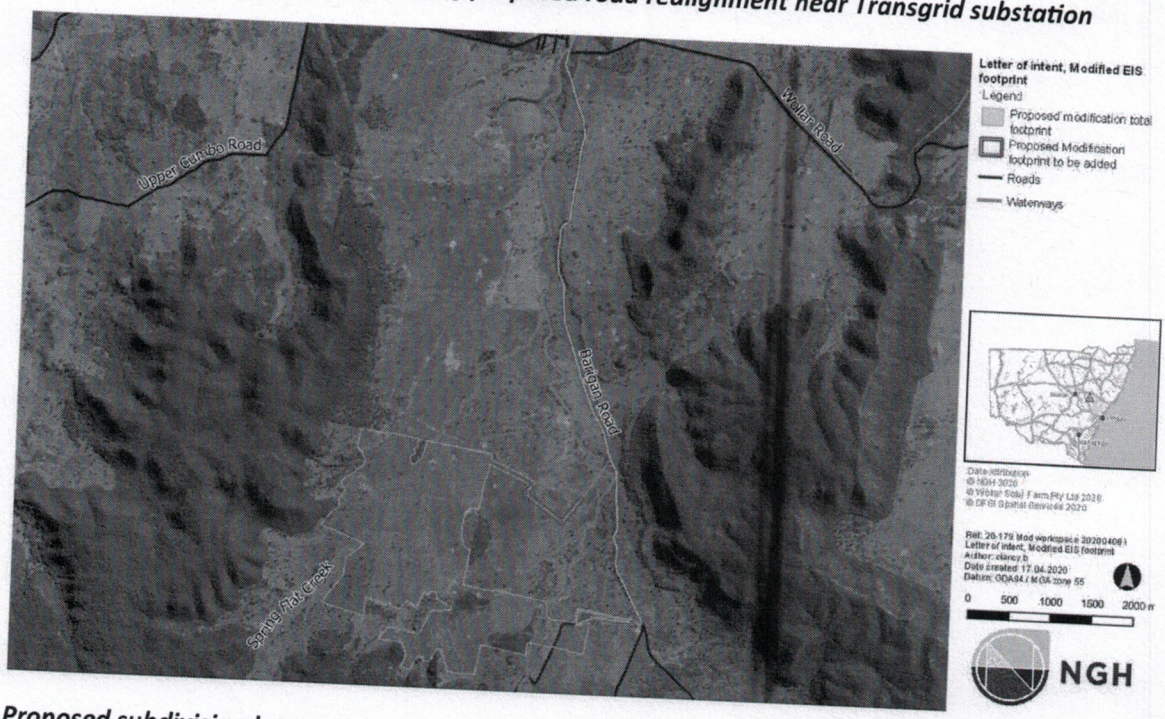
I am the owner of lands associated with 96 Maree Road, Tichular, NSW 2850 (the Land). It is understood that Wollar Solar Development Pty Ltd (the Proponent) has proposed a modification to the state significant development (SSD) known as the Wollar Solar Farm (SSD - 9254). The project was approved in February 2020. The modification is being lodged under section 4.55(1A) of the Environmental Planning and Assessment Act 1979 (minor biodiversity and heritage impacts result, making 1A applicable) for:

- Proposed subdivision: creation of a third lot within the solar farm to house the TransGrid connection infrastructure. The land lots affected are (both of which I am the owner):
    - Lot 106 of DP755430
    - Lot 80 of DP755430

- Proposed road realignment: realignment of a short section of access track further south of the TransGrid substation, within the same lot. The land lot affected is (owned by TransGrid):
    - Lot 1 of DP1090027

Images of the broader project and lots affected by the Modification are provided below.

Approved project showing location of proposed road realignment near Transgrid substation



Proposed subdivision lots: *creation of a third lot within the north easter corner of the solar farm to house TransGrid connection infrastructure*

Proposed road realignment lots: Realignment of a short section of access track further south of the TransGrid substation, within the same lot

Consent from all landowners involved in the broader project is required for the purposes of clause 49 of the Environmental Planning and Assessment Regulation 2000 (NSW).

As the existing landowner of 96 Maree Road, Tichular, NSW 2850 I provide this letter as consent from the owner of the Land, for the purposes of clause 49 of the Environmental Planning and Assessment Regulation 2000 (NSW), for the Proponent to lodge a Modification Application, in relation to the Wollar Solar Farm.

Your sincerely,

Terrence William Marskell

Landowner - 96 Maree Road, Tichular, NSW 2850

15 May 2020

Appendix: Land lots owned by Terence William Marskell

Lots 22, 23, 24, 25, 27, 30, 45, 49, 50, 51, 60, 61, 62, 63, 69 to 80, 92, 105, 106, 107, 119, 152, 153 and 154 of DP 755430 and Lot 1 of DP 650653.

Appendix G OVER-DIMENSIONAL VEHICLE INCREASE CONSULTATION WITH AMBER

From:	Robbie Williamson
To:	Robbie Williamson
Subject:	RE: Wollar Solar Farm oversize vehicle query
Date:	Thursday, 11 June 2020 5:07:56 PM
Attachments:	image001.png

From: Michael Willson <mike@amber.org.au>
Sent: Tuesday, 9 June 2020 11:36 AM
To: Louiza Romane <louiza.r@nghconsulting.com.au>
Subject: RE: Wollar Solar Farm oversize vehicle query

Hi Louiza,

This doesn't make any changes to the conclusions of my assessment. The movements are infrequent so they will not have a determinantal impact to the capacity of the road network, and they can be undertaken in a safe manner. I would think that any issues with these movements would be addressed as part of the permits that are required for the oversize/overmass movements.

I'm not sure if Council would have an issue with the increase in movements. If there is nothing specific in the permit conditions then you should be fine. The movements will just need to get the relevant permits.

Hope that helps.

Kind Regards

Mike Willson
BE (Hons) CPEng RPEQ
Director - Traffic Engineering

Ph: +61 432 022 363

From: Louiza Romane <louiza.r@nghconsulting.com.au>
Sent: Tuesday, 9 June 2020 11:01 AM
To: Michael Willson <mike@amber.org.au>
Subject: Wollar Solar Farm oversize vehicle query

Hey Mike,

Hope you're doing well!

The construction of the Wollar Solar Farm now requires 5 oversize/overmass vehicle movements (as opposed to the 2 movements that were originally assessed). I'm wondering if you can give me an idea of the implications of this in relation to your assessment. Could you tell me what additional assessment, if any you think may be required? At this stage, it is likely that 3 of the movements would occur in Q3/Q4 this year and 2 movements would occur in Q1 next year.

Cheers,

LOUIZA ROMANE
ENVIRONMENTAL CONSULTANT

BSc (Earth Science) (Hons 1)

Please note I do not work on Mondays

T. 02 6492 8352 **M.** 0415 143 295
E. louiza.r@nghconsulting.com.au
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WWW.NGHCONSULTING.COM.AU

Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

Appendix H **OVER-DIMENSIONAL VEHICLE INCREASE CONSULTATION WITH TRANSPORT FOR NSW**

From: Andrew McIntyre
To: robbie.williamson@wollarsolarfarm.com
Cc: Development Western; Angela Stewart
Subject: RE: Wollar Solar Farm TMP - TfNSW consultation
Date: Wednesday, 17 June 2020 7:28:09 PM

Dear Robbie

I have reviewed the amendments to the TMP.

NO further comment from TfNSW.

Regards

Andrew McIntyre
Manager Land Use Assessment
Community and Place
Regional and Outer Metropolitan Division
Transport for NSW
[redacted]
Level 1 51-55 Currajong Street Parkes NSW 2870

Every journey matters

From: robbie.williamson@wollarsolarfarm.com [mailto:robbie.williamson@wollarsolarfarm.com]
Sent: Monday, 15 June 2020 2:32 PM
To: Andrew McIntyre <Andrew.McIntyre@transport.nsw.gov.au>
Cc: Development Western <development.western@rms.nsw.gov.au>
Subject: RE: Wollar Solar Farm TMP - TfNSW consultation

Hi Andrew

Just following up to see if you'd lined someone up to take a look at those updates?

Best regards
Robbie

Project Development Wollar Solar Farm
robbie.williamson@wollarsolarfarm.com
[redacted]

From: robbie.williamson@wollarsolarfarm.com <robbie.williamson@wollarsolarfarm.com>

Sent: Thursday, 11 June 2020 6:10 PM
To: 'Andrew McIntyre' <Andrew.McIntyre@transport.nsw.gov.au>
Cc: 'David Webster' <David.Webster@midwestern.nsw.gov.au>; 'Development Western' <development.western@rms.nsw.gov.au>
Subject: RE: Wollar Solar Farm TMP - TfNSW consultation

Hi Andrew

Please find attached our updated TMP for Wollar Solar Farm which includes updates to address your comments as well as those of other stakeholders. The table below is a summary of our responses to your comments.

Agency Comment	**Response**
Section 4.2 – Haulage routes. I note haulage routes will not be determined until the appointment of a contractor. In this regard, the TMP will need to be updated to include haulage routes prior to approval being given by DPIE to allow haulage operations.	Section 4.2 outlines the approved access routes per Schedule 3, conditions 3 and 4. Haulage Plans will be agreed between contractors and MWRC. The haulage routes in the Haulage Plan will align with the approved access routes (per CoC Schedule 3 Conditions 3 and 4) but may include additional details of the point of origin and how vehicles will get from that point onto the approved route. Section 4.2 updated to state that *TMP will be updated to include Haulage Plans by way of an addenda and provided to DPIE at least 2 weeks prior to commencing haulage operations for the stage covered by that plan.*
Sections 5.1 & 7.6 – TMP needs to include how Wollar Solar will ensure projected/assumed use of ride sharing (Stage 1) and shuttle buses (Stages 2 & 3) will be achieved. As discussed, TfNSW experience is that unless it is mandatory for staff to arrive by bus, generally, projected and assumed take up of shuttle buses and ride sharing are significantly greater than actual take up. Details of how projected ride sharing, and shuttle bus usage will be achieved is required.	Section 7.4 updated to describe that utilisation of shuttle bus service will be required to ensure the daily light vehicle limit of 60 movement is complied with. It is noted that the utilisation rate may vary in line with the workforce number through construction. It is estimated that during peak construction when the workforce is over 300, there will need to be approximately 80% utilisation of the shuttle service. During Stages 1 and 2 the workforce number will be significantly lower and it is not anticipated the shuttle service will be required. All contractors will be contractually required to comply with this TMP and the daily traffic movement limits in Table 4-1. A Workforce Transport Plan will be developed in consultation with MWRC prior to commencing Stage 3.
Section 7.1 – Wollar Road is a classified road under the care and control of Mid Wester Regional Council. Whilst works on this road requires TfNSW concurrence, the management and control of the road sits with MWRC.	An updated description has been included in section 5.1.
Section 7.7 – This section states: "Speed limits on public roads are 50km/h. Vehicles will adhere to the sign posted speed limit". Please clarify what this means. (ie are you proposing vehicles will only travel yup to 50km/h?). Please note the rural default speed is 100km/h, however the roads you will be using to access the site are not all designed to this speed at most curves, clear zones, etc and driver awareness of the conditions and driving to those conditions is absolutely essential.	50km/h limit has been removed in Section 7.7 and replaced with *"All vehicles will adhere to the posted speed limits of the local roads and will drive at speeds appropriate to local conditions"*. Last para in Section 7.7 also amended to clarify that this will be a requirement of the Drivers Code of Conduct. Section 4.2 has been updated to reference the sections of Barigan Road for which traffic controls will be implemented during construction (per CoC Appendix 4).

In addition to the updates described above updated TMP also includes:

- Description of findings from the Road Safety Audit for the Wollar Road / Barigan Road intersection
- Description of an additional 3x over-dimensional deliveries that TransGrid have identified

they require for the project (the attached email advice from traffic consultant Amber will be added to Appendix I of the TMP)

The attached TMP has track changes to clearly show the additions from the previous version provided to you. Can you please have a look and advise if you have any further comments?

Best regards
Robbie

Project Development Wollar Solar Farm
robbie.williamson@wollarsolarfarm.com
[redacted]

From: Andrew McIntyre <Andrew.McIntyre@transport.nsw.gov.au>
Sent: Monday, 25 May 2020 1:50 PM
To: robbie.williamson@wollarsolarfarm.com
Cc: David Webster <David.Webster@midwestern.nsw.gov.au>; Development Western <development.western@rms.nsw.gov.au>
Subject: RE: Wollar Solar Farm TMP - TfNSW consultation

Dear Robbie

As requested, I have reviewed the draft TMP and provide the following comments:

- Section 4.2 – Haulage routes. I note haulage routes will not be determined until the appointment of a contractor. In this regard, the TMP will need to be updated to include haulage routes prior to approval being given by DPIE to allow haulage operations.
- Sections 5.1 & 7.6 – TMP needs to include how Wollar Solar will ensure projected/assumed use of ride sharing (Stage 1) and shuttle buses (Stages 2 & 3) will be achieved. As discussed, TfNSW experience is that unless it is mandatory for staff to arrive by bus, generally, projected and assumed take up of shuttle buses and ride sharing are significantly greater than actual take up. Details of how projected ride sharing and shuttle bus usage will be achieved is required.
- Section 7.1 – Wollar Road is a classified road under the care and control of Mid Wester Regional Council. Whilst works on this road requires TfNSW concurrence, the management and control of the road sits with MWRC.
- Section 7.7 – This section states: "Speed limits on public roads are 50km/h. Vehicles will adhere to the sign posted speed limit". Please clarify what this means. (ie are you proposing vehicles will only travel yup to 50km/h?). Please note the rural default speed is 100km/h, however the roads you will be using to access the site are not all designed to this speed at most curves, clear zones, etc and driver awareness of the conditions and driving to those conditions is absolutely essential.

Regards

Andrew McIntyre
Manager Land Use Assessment
Community and Place
Regional and Outer Metropolitan Division
Transport for NSW
[redacted]
Level 1 51-55 Currajong Street Parkes NSW 2870

Every journey matters

From: robbie.williamson@wollarsolarfarm.com [mailto:robbie.williamson@wollarsolarfarm.com]
Sent: Thursday, 21 May 2020 4:41 PM
To: Development Western <development.western@rms.nsw.gov.au>; Andrew McIntyre <Andrew.McIntyre@transport.nsw.gov.au>
Subject: RE: Wollar Solar Farm TMP - TfNSW consultation

Hi Andrew

Just following up on this. Are you able to confirm if someone if reviewing the Wollar Solar Farm TMP? We are hoping to have feedback from the consultation parties by feedback by 27th May 2020 so that we can start preparing the next version.

If you're able to give me an update that would be much appreciated.

Best regards

Robbie Williamson

Project Development Wollar Solar Farm
robbie.williamson@wollarsolarfarm.com
[redacted]

From: robbie.williamson@wollarsolarfarm.com <robbie.williamson@wollarsolarfarm.com>
Sent: Wednesday, 13 May 2020 1:04 PM
To: development.western@rms.nsw.gov.au
Cc: andrew.mcintyre@transport.nsw.gov.au
Subject: Wollar Solar Farm TMP - TfNSW consultation

Dear TfNSW / RMS Development Department

Please find attached a Traffic Management Plan prepared for the Wollar Solar Farm Development.

Schedule 3, Condition 10 of the Wollar Solar Farm Development consent requires that "*Prior to commencing the development, the Applicant must prepare a Traffic Management Plan for the development in consultation with RMS, Council, Ulan, Moolarben and Wilpinjong mines and to the satisfaction of the Secretary in writing*".

I have had some recent correspondence with Andrew McIntyre to advise that the Traffic Management Plan was being prepared and would be shared when available in order to facilitate consultation with TfNSW (formerly RMS).

Could you please arrange for review of the attached TMP and provide some feedback **by 27th May 2020** (2 weeks' time). If you are able to provide comments earlier this will be much appreciated.

I have outlined a couple of items below that I would like to draw to your attention.

Staging of Development

Section 1.2.1 describes the anticipated staging of the development. A key consideration for the project is that Stage 1 (upgrade of a ~5km length of council road near the site) needs to be completed before the subsequent stages. We are therefore targeting getting a standalone contract agreed in May for Stage 1 with a view to starting as soon as possible after that.

The TMP has been prepared to cover all stages but we would like to note that the Stage 1 works will have a considerably lower impact compared to the subsequent stages when deliveries for the solar farm components and gravel for internal tracks commence.

The project has a target of providing access to site for TransGrid to start electrical connection works (part of Stage 3) in early September. This means it's important to start the Stage 1 works as soon as possible.

We have attempted to prepare the TMP in a such a way that we may be able to request DPIE approval to commence Stage 1 prior to the other stages. As such, when raising any issues in your feedback, it would be helpful if you can give some consideration as to how that issue relates to Stage 1 specifically as well as for the subsequent stages.

If we get to a point in time where we are ready to commence Stage 1 but the TMP for the full development has not been approved, we may request TfNSW support to commence Stage 1 only whilst outstanding issues for the rest of the development are resolved.

Road Occupancy Licence

Section 7.8 discussed the requirement for an ROL. We would appreciate some feedback on whether an ROL will be required for the project and if so, which aspects of the work will require this?

Road Safety Audit

The final row of Table 2-2 discussed the requirement for an RSA for the Wollar Road / Barigan Road intersection (a request of RMS in a submission during the public exhibition stage of the project). The RSA was completed on Monday 11th of May and we will provide the associated report as soon as possible for discussion.

Shuttle Bus Service

The project has a commitment to operate a shuttle bus service for workers to cut down on traffic to the site. Andrew McIntyre mentioned that one of the things that TfNSW have requested in relation to previous projects is details around how the shuttle bus service for the construction staff will be operated (% of staff utilising the service, pick-up/drop-off locations, etc). We believe that it is best that specific details are agreed by the EPC contractor and Mid-Western Regional Council. Selection of the EPC contractor is subject to an ongoing tendering process so for now Section 7.4 contains a commitment for them to agree this information in a Workforce Transport Plan in consultation with Mid-Western Regional Council (prior to Stage 2 and 3 construction).

If you have any questions about the TMP or the Wollar Solar Farm please don't hesitate to give me a call to discuss on 0499 770 768.

Best regards

Robbie Williamson

Project Development Wollar Solar Farm

robbie.williamson@wollarsolarfarm.com

[redacted]

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From: Robbie Williamson
To: andrew.mcintyre@transport.nsw.gov.au
Cc: development.western@rms.nsw.gov.au
Subject: Wollar Solar Farm - TMP - oversize vehicle number
Attachments: image001.png

Hi Andrew

We'll be sending through an updated TMP shortly which addresses the comments you provided as well as those of other stakeholders.

Now that we're a bit further down the track discussing the construction methodology with TransGrid, they've flagged that they will actually need 5 over-dimensional deliveries (the Conditions of Consent currently have a limit of 2 for the whole project – see screenshot below). Originally it was assumed that their 2x transformers would be the over-dimensional deliveries required for the project TransGrid have now indicated that the 3x pre-fabricated buildings they will install will also be over-dimensional.

You will see in the email chain below that the traffic consultants (Amber) who did the original traffic assessment for the EIS don't believe that this increase would change the conclusions of their original assessment. They have suggested that we consult with Council to confirm this will be accepted to them (we determined we should also consult with TfNSW for feedback too).

Our intention to request agreement from the Secretary that the additional three over-dimensional vehicle movements required by TransGrid be allowed. The intention is to do this as part of the TMP (which DPIE are required to review and approve). Before we do this we'd like to get some feedback from TfNSW.

We will add a section in the TMP which describes this but I thought it was worth running past you to get your initial thoughts.

Note that Schedule 3 Condition 3 of our conditions of consent already include a requirement to obtain relevant permits for over-dimension vehicles (see screenshot below).

Best regards
Robbie

Project Manager

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From: Louiza Romane <louiza.r@nghconsulting.com.au>
Sent: Tuesday, 9 June 2020 12:13 PM
To: Brooke Marshall <brooke.m@nghconsulting.com.au>
Subject: FW: Wollar Solar Farm oversize vehicle query

Hi Brooke,

See below response from Amber re: Oversize/overmass vehicles.

Cheers,

LOUIZA ROMANE
ENVIRONMENTAL CONSULTANT
BSc (Earth Science) (Hons 1)

Please note I do not work on Mondays

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Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

From: Michael Willson <mike@amber.org.au>
Sent: Tuesday, 9 June 2020 11:36 AM
To: Louiza Romane <louiza.r@nghconsulting.com.au>
Subject: RE: Wollar Solar Farm oversize vehicle query

Hi Louiza,

This doesn't make any changes to the conclusions of my assessment. The movements are infrequent so they will not have a determinantal impact to the capacity of the road network, and they can be undertaken in a safe manner. I would think that any issues with these movements would be addressed as part of the permits that are required for the oversize/overmass movements.

I'm not sure if Council would have an issue with the increase in movements. If there is nothing specific in the permit conditions then you should be fine. The movements will just need to get the relevant permits.

Hope that helps.

Kind Regards

Mike Willson
BE (Hons) CPEng RPEQ
Director - Traffic Engineering

Ph: +61 432 022 363

From: Louiza Romane <louiza.r@nghconsulting.com.au>
Sent: Tuesday, 9 June 2020 11:01 AM
To: Michael Willson <mike@amber.org.au>
Subject: Wollar Solar Farm oversize vehicle query

Hey Mike,

Hope you're doing well!

The construction of the Wollar Solar Farm now requires 5 oversize/overmass vehicle movements (as opposed to the 2 movements that were originally assessed). I'm wondering if you can give me an idea of the implications of this in relation to your assessment. Could you tell me what additional assessment, if any you think may be required? At this stage, it is likely that 3 of the movements would occur in Q3/Q4 this year and 2 movements would occur in Q1 next year.

Cheers,

LOUIZA ROMANE
ENVIRONMENTAL CONSULTANT
BSc (Earth Science) (Hons 1)

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