

Appendix B

Biodiversity Development Assessment Report

Broken Hill Battery Energy Storage System Project

Biodiversity Development Assessment Report


Prepared for AGL Energy Limited | 19 May 2021



Project number	Client	Project manager	LGA
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Declaration

This Biodiversity Development Assessment Report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as certified by BAM Accredited Assessor: Simon Tweed (BAAS 18088)



Version	Author	Review	Status	Date
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Executive summary

Context

AECOM Australia Pty Ltd (AECOM) has been engaged by AGL Energy Limited (AGL) to prepare an Environmental Impact Statement (EIS) to assist with obtaining development consent to construct, operate and maintain a battery energy storage system (BESS) facility with a capacity of approximately 50 megawatts (MW) and up to 100 megawatt-hour (MWh) at Broken Hill (hereafter referred to as ‘the Project’), NSW.

AECOM commissioned Niche Environment and Heritage Pty Ltd (Niche) to prepare a Biodiversity Development Assessment Report (BDAR) for the Project.

The Project is located at 74 to 80 Pinnacles Place, Broken Hill NSW 2880 and encompasses Lots 57 and 58 of DP285288, part of Lot 7302 of DP1181129 (for the transmission line corridor), and part of Lot 2 DP1102040 (for the connection of the transmission line to the substation). These locations are collectively referred to as the ‘Project Area’.

This report describes the ecological values within the Project Area as per the Biodiversity Assessment Methodology (BAM) (OEH 2017), and determines whether the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 22 October 2020, a new version of the BAM came into force. Clause 6.31 of the *Biodiversity Conservation Regulation 2017* (NSW) provides that, where the BAM is changed, a biodiversity assessment report in respect of a State significant development may, within 12 months of the change, be prepared on the basis of the BAM in force before the change, where the report states that it has been prepared on that basis. Accordingly, this BDAR has been prepared on the basis of the BAM 2017.

The ecological assessment, undertaken in accordance with the BAM, included the following:

- Project Area walkover to map type and extent of native vegetation and determine habitat for threatened biodiversity.
- Collection of floristic and habitat data from 4 BAM plots and 1 Rapid Data Point (RDP).
- Targeted surveys for threatened flora species.

Targeted fauna survey was not undertaken due to lack of potential habitat in the Project Area.

Results

One plant community type (PCT) was mapped within the Project Area:

- PCT 155 *Bluebush shrubland on stony rises and downs in the arid and semi-arid zones*

The PCT recorded does not align to a Threatened Ecological Community (TEC) listed in the BC Act or EPBC Act. Therefore, the Project would not impact on any TECs listed in the BC Act or EPBC Act.

No threatened flora was recorded within the Project Area, and no threatened flora is considered to have a moderate or higher likelihood of occurrence in the Project Area.

No threatened fauna species were recorded within the area. Eight threatened fauna species are considered to have a moderate likelihood of occurrence in the Project Area, mostly because they are highly mobile or wide-ranging species.

Impact assessment

The Project would result in the following:

- Direct removal of 0.82 ha of low condition native vegetation (largest possible clearing extent)
- Removal of 0.82 ha of fauna habitat (i.e. native vegetation)

Avoid/mitigate impacts

Measures to reduce the impact of the Project on local flora and fauna are detailed in the report and include siting of the Project within a low impact area, staff training, erosion and sediment controls, weed control measures, and management and removal of waste related to the Project.

Credit calculations and offsetting

A total of eight (8) ecosystem credits (PCT 155) and nine (9) species credits (Australian Bustard) are required to offset impacts to native vegetation as a result of the Project.

Glossary and list of abbreviations

Term or abbreviation	Definition
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Credit Calculator
BC Act	<i>NSW Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
cm	Centimetre/s
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry and Environment (formerly DECCW, DECC, DEC, OEH)
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	Hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre/s
LEP	Local Environment Plan
LGA	Local Government Area
Locality	The study area and surrounds, nominally a 30 km radius from the study area
m	Metre/s
MNES	Matters of National Environmental Significance (from the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>).
PCT	Plant Community Type
RDP	Rapid Data Point
SAIL	Serious and Irreversible Impacts
TEC	Threatened Ecological Community
VI	Vegetation Integrity as calculated by the BAM Calculator

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1. Introduction

1.1 Context

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by AECOM Australia Pty Ltd (AECOM) to assess the ecological values and impacts associated with the Broken Hill Battery Energy Storage System (BESS) (the Project) as part of the Environmental Impact Statement (EIS). AGL Energy Ltd have commissioned AECOM to prepare the EIS. The Project will be assessed as State-significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project is located on the outskirts of Broken Hill in the immediate vicinity of the existing TransGrid Broken Hill Substation. The Project Area consists of Lots 57 and 58 of DP285288 for the BESS (located at 74 to 80 Pinnacles Place, Broken Hill 2880 hereafter referred to as ‘the Site’), as well as a transmission line corridor crossing Lot 7302 DP1181129 and Lot 2 DP1102040. The location of the Project Area consists of the locations identified in Table 1 and is shown in Figure 1. The study area consists of the Project Area and a 1500 m buffer as identified in Figure 2.

Table 1 Subject land address and lot details

Project Area	Lot/DP	Address
The Site	Lots 57 and 58/DP285288	74-80 Pinnacles Place, Broken Hill
Transmission line corridor	Part Lot 2/DP1102040 Part Lot 7302/DP1181129	76 Pinnacles Road, Broken Hill

A preliminary biodiversity assessment for the Project was prepared by Niche in December 2019 to assess the biodiversity constraints associated with three different siting options, and to allow AGL to make an informed decision based on those constraints. The BAM plots undertaken as part of that preliminary assessment have been used in preparation of this BDAR.

The primary objective of this Biodiversity Development Assessment Report (BDAR) is to use the Biodiversity Assessment Methodology (BAM) (OEH 2017) to describe and assess the ecological values within the Project Area and surrounds, determine whether the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and identify and quantify any associated biodiversity offsetting requirements.

On 22 October 2020, a new version of the BAM came into force. Clause 6.31 of the *Biodiversity Conservation Regulation 2017* (NSW) provides that, where the BAM is changed, a biodiversity assessment report in respect of a State significant development may, within 12 months of the change, be prepared on the basis of the BAM in force before the change, where the report states that it has been prepared on that basis. This BDAR was finalised in May 2021, which is within the 12 month transitional arrangements period; pursuant to clause 6.3.1 of the *Biodiversity Conservation Regulations 2017*. As such, reliance on the BAM 2017 is considered suitable to inform this BDAR.

The Project comprises a BESS with a capacity of approximately 50 MW and up to 100 MWh. Key features of the Project include:

- Construction and operation of a BESS; and
- Connection of the BESS facility to the nearby TransGrid substation via a 22 kV powerline connecting through a 22 kV busbar at the substation.

The Project would be generally comprised of the following components:

- Battery enclosures
- Inverters
- Medium voltage transformers up to 22 kV
- Cabling and collector units
- Control and office building, workshop and equipment storage area
- 22 kV electrical switchyard
- Security fencing and lighting
- Access, internal roads and car parking
- Drainage and stormwater management
- Transmission connection infrastructure
- Minor works to connect the BESS to transformer compound or TransGrid switchyard
- Temporary site office/s, laydown and construction compound
- Other ancillary infrastructure.

It is currently anticipated that construction of the Project would take up to 12 months, starting in 2021 and being completed in 2022.

Construction works would be likely to comprise:

- Site preparation activities including:
 - Enabling works and prefabrication
 - Site clearance activities
 - Installation of erosion and sediment controls and site fencing
 - Provision of construction power
 - Minor earthworks to form a level BESS pad, switchyard area and construction laydown areas, including potential import or export of fill as required
 - Development of site access
- Structural, civil, mechanical and electrical works
 - Connections to surrounding utilities, as required
 - Structural works to support BESS facilities
 - Construction of supporting structures, e.g. office building, workshop, and transmission line landing gantry
 - Delivery, installation and electrical fit-out of BESS
 - Construction of transmission connection between the Site and the TransGrid Broken Hill substation including installation of supporting structures, stringing the transmission line, and works at the transmission line landing gantry on site-and the 22 kV busbar at the substation
 - Transportation of plant, equipment, materials and workforce to and from the Site, as required
- Commissioning
 - Testing and commissioning activities

- Finishes and demobilisation
 - Provision of landscaping, as required
 - Removal of construction equipment and rehabilitation of construction areas.

A construction laydown area would also most likely be provided on the Site. Minor earthworks would be required across this Site, including levelling it to ensure a suitable development footprint and establishment of site access. Excavations within the Site are expected to be a maximum depth of 3 m.

The operational and maintenance phase of the Project (Operation) is anticipated to run 24 hours a day, 7 days a week.

1.2 The Project Area

The Project Area encompasses 2.5 hectares (ha) of land and is zoned IN1 (General Industrial) under the Broken Hill Local Environment Plan, 2013 (LEP).

The Project Area contains the existing TransGrid Broken Hill Substation and has been subject to extensive disturbance from recent vegetation clearing and use of areas for equipment storage. There is sparse regrowth of native flora species within highly disturbed areas, and a lack of larger woody vegetation across the Project Area. Lot 7302 includes an ephemeral north-south running 1st order stream and an unsealed vehicle track.

As shown on Figure 2, the Project Area occurs within the:

- Broken Hill Complex Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion
- Barrier Range IBRA Sub-region
- Barrier Downs Mitchell Landscape.

A list of the digital files created for the BDAR are included in Annex 8.

1.2.1 Development footprint/direct impact area

Within the Project Area (which encompasses 2.5 ha), only 1.4 ha of land would comprise the development footprint. This 1.4 ha includes the whole of the Site, as well as a 20 m corridor outside of the Site to allow construction of a transmission line to the TransGrid Broken Hill Substation. 0.82 ha of this is comprised of native vegetation with the remaining area currently being used as a storage area.

The area of the development footprint for the transmission line would not require entire vegetation removal; however, a worst-case scenario considering full clearing of a 20 m wide corridor has been assessed.

1.3 Approval and assessment process

The following legislation or planning instruments are relevant to the works associated with the Project within the Project Area.

1.3.1 State approval and assessment process – application of the BAM

In accordance with section 7.9 of the *Biodiversity Conservation Act 2016 (BC Act)*, an application for development consent under Division 4.7 of the EP&A Act to carry out SSD must be accompanied by a BDAR unless the Planning Agency and the Environment Agency Heads determine that the Project is not likely to have any significant impact on biodiversity values. The SEARs issued for the Project have determined the need for a BDAR in accordance with Section 4.12(8) of the EP&A Act and Schedule 2 of the *Environmental Planning and Assessment Regulations 2000* (EP&A Reg).

The Biodiversity Offsets Scheme (BOS) Threshold is a test used to determine when it is necessary to apply the BAM to assess the impacts of a proposal. The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)). The minimum lot size as specified in the *Broken Hill LEP 2013* for land within the Project Area is 0.023 ha. The Project exceeds the BOS Threshold of 0.25 ha of native vegetation clearing, being the applicable threshold for a minimum lot size of less than 1 ha (DPIE 2020a). As such, the Project requires use of the BOS and approval for offsetting as per the requirements of the BDAR and the BC Act.

The Project triggers the BAM and as such this BDAR describes the biodiversity values present within the Project Area and identifies impacts from the Project on these values. This assessment has used the BAM Calculator (BAM-C) (version 1.3).

1.3.2 Commonwealth approval and assessment process

Matters of National Environmental Significance (MNES) are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The BAM requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near a development site. This BDAR has identified threatened biodiversity listed under the EPBC Act that may be potentially impacted by the Project. This BDAR also includes an assessment of significance for a single MNES (Dusky Hopping Mouse – listed as vulnerable under the EPBC Act) identified as having the potential to be affected by the Project (Annex 7).

Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the Commonwealth Minister for the Environment and Energy for assessment. An EPBC Act referral was submitted in March 2021 however no significant impacts on MNES are anticipated from the Project. The Project Area does not support any TECs or important habitats for threatened flora, migratory species or any other MNES. The small loss of potential Dusky Hopping Mouse habitat is not likely to cause any significant impacts to this species, given the limited records of this species in bluebush shrubland, and the degraded state of the Project Area. The Project is unlikely to cause any significant impacts on MNES and is not a controlled action.

1.3.3 Biosecurity Act 2015

The broad objectives for biosecurity in NSW under the *Biosecurity Act 2015* are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by:

- Preventing their entry into NSW
- Quickly finding, containing and eradicating any new entries
- Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

Under the *Biosecurity Act 2015*, priority weeds are defined in the following categories:

- Weeds of National Significance
- National environmental Alert List Weeds
- Water weeds
- Native plants considered weeds.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any

biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Weeds identified under the *Biosecurity Act 2015* have been identified in section 3.1.4.

1.3.4 Broken Hill Local Environmental Plan 2013

Local Environment Plans are created by Councils in consultation with their community and guide planning decisions for Local Government Areas (LGAs). They apply either to the whole or part of an LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

The Project Area is subject to the LEP and is zoned IN1 (General Industrial), for which development is permitted, with consent from Council. As the Project is SSD it will not be assessed by Broken Hill Council (Council) under the LEP however, Council will be consulted.

1.4 Assessment objectives and format

The primary objective of this assessment is to use the guidelines and methodology provided in the BAM to determine the impact the Project would have on biodiversity, avoid and mitigate these impacts and then calculate the Project's biodiversity offset requirement.

This BDAR has two broad stages consistent with the BAM methodology:

Stage 1 – Biodiversity Assessment

- assessment of landscape features
- assessment of native vegetation
- assessment of threatened species and populations.

Stage 2 – Impact Assessment

- avoid and minimise impacts on biodiversity values
- consider impact and offset thresholds
- determine and calculate offset requirements.

1.5 Assessment resources and assessor qualifications

This BDAR has been prepared by the accredited personnel and support staff identified in Table 2. Resources and survey guidelines used in the development of this BDAR are detailed in Table 3.

Table 2: Assessor qualifications and resources

Personnel	Qualifications	Tasks carried out
Simon Tweed	Senior Ecologist Accredited Biodiversity Assessor (BAAS 18088)	Review of credit calculations, peer review and quality assurance
Patrick McEvoy	Ecologist Accredited Biodiversity Assessor (BAAS 20018)	BAM plots and targeted threatened flora searches, data management, data entry
Radika Michniewicz	Senior Ecologist	Threatened flora survey
Kurtis Lindsay	Principal Ecologist	Threatened flora survey
Freya Gordon	Senior Ecologist	Report preparation
Greg Tobin Yin Hua	GIS Specialists	Mapping

Table 3: Assessment resources and guidelines used

Assessment resources/guideline	
Resources	<ul style="list-style-type: none"> Biodiversity Assessment Method (BAM) (OEH 2017) BAM Operational Manual – Stage 1 (OEH 2018) BAM Operational Manual – Stage 2 (DPIE 2019a) BAM Calculator User Guide (OEH 2018)
Survey guidelines	<p>NSW</p> <ul style="list-style-type: none"> Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020c) 2004 Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DECC 2004) <p>Commonwealth</p> <ul style="list-style-type: none"> Survey Guidelines for Australia’s Threatened Birds (DEWHA 2010) Survey Guidelines for Australia’s Threatened Reptiles (DSEWPaC 2011)

2. Landscape Assessment

2.1 Landscape assessment - methods

As detailed in section 4 of the BAM (OEH 2017), a landscape assessment for the Project is required, which was conducted within ArcGIS and implemented within the BAM Calculator. Landscape value is an assessment of a number of factors, including:

- Native vegetation cover
- Rivers, streams and estuaries
- Areas of geological significance
- Habitat connectivity.

For each factor the current state of the landscape is assessed then compared with the state of the landscape if the Project were to proceed.

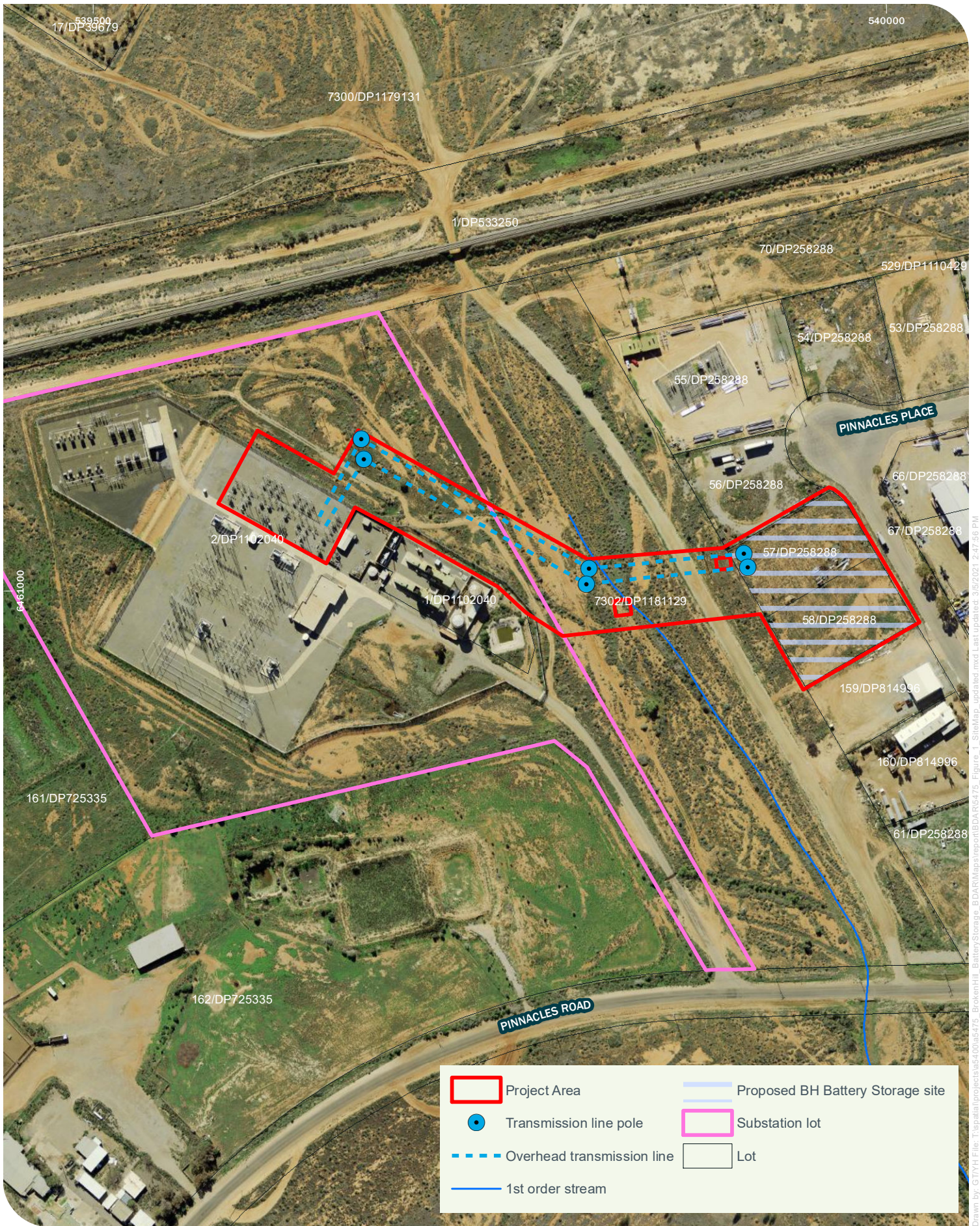
2.1.1 Landscape features and scoring

Table 4 provides details of the landscape settings and scored landscape features for the Project.

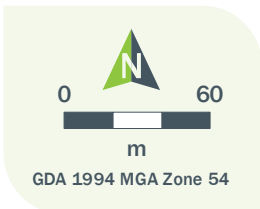
Table 4: Landscape features and scoring under the NSW BAM

Landscape features	Description	Figure reference
Project Area size	2.5 ha	Figure 1
IBRA bioregion/subregion	The Project is located within the Barrier Range IBRA Sub-region which is within the Broken Hill Complex IBRA bioregion.	Figure 2
NSW (Mitchell) Landscapes	The Project Area is mapped as occurring within the Barrier Downs Landscape.	Figure 2
Rivers, streams and estuaries and Strahler stream order	There are no rivers or estuaries in close proximity to the study area. There is an unnamed non-perennial watercourse that crosses the transmission line easement in Lot 7302. This is classified as a 1 st order stream; however, no water was present during the surveys.	Figure 2
Wetlands within and adjacent to development	There are no wetlands in close proximity to the study area.	Figure 2
Connectivity features	Limited connectivity due to the presence of roads on all sides, railway track to the north of the Project Area, and industrial infrastructure in neighbouring properties. Large tracts of shrubland vegetation to the north and south of the Project Area.	Figure 1 and Figure 2

Landscape features	Description	Figure reference
Buffer area (percent native vegetation cover)	<p>A 1,500 m buffer was applied to the Project Area resulting in an overall buffer area of 1,056 ha. Existing vegetation mapping (OEH 2016) is quite coarse and identified large areas of vegetation within the buffer area.</p> <p><i>Native vegetation cover</i></p> <p>The native vegetation extent and cover of woody vegetation was determined via aerial photography interpretation based on canopy cover, local vegetation mapping (OEH 2016) and knowledge of the Project Area.</p> <p>For woody vegetation 95 per cent of the buffer area was determined to support native woody vegetation with benchmark cover (999.51 ha).</p> <p>For non-woody vegetation (grassland) 4 per cent of the buffer area was determined to support native grassland with benchmark cover (42.55 ha).</p> <p><i>Total native vegetation cover</i></p> <p>Combining the estimated woody and non-woody vegetation cover resulted in 99 per cent of the buffer area supporting native vegetation. This is an overestimation given the coarse vegetation mapping available; however, it has been adopted as a precautionary approach. The total native vegetation cover falls within the >70 percent category within the BAM-C.</p>	Figure 2
Site context	Site-based assessment	-
Geological significance and soils	There are no karst, caves, crevices, cliffs or other areas of geological significance within the Project Area. There are no high hazard soil areas.	-



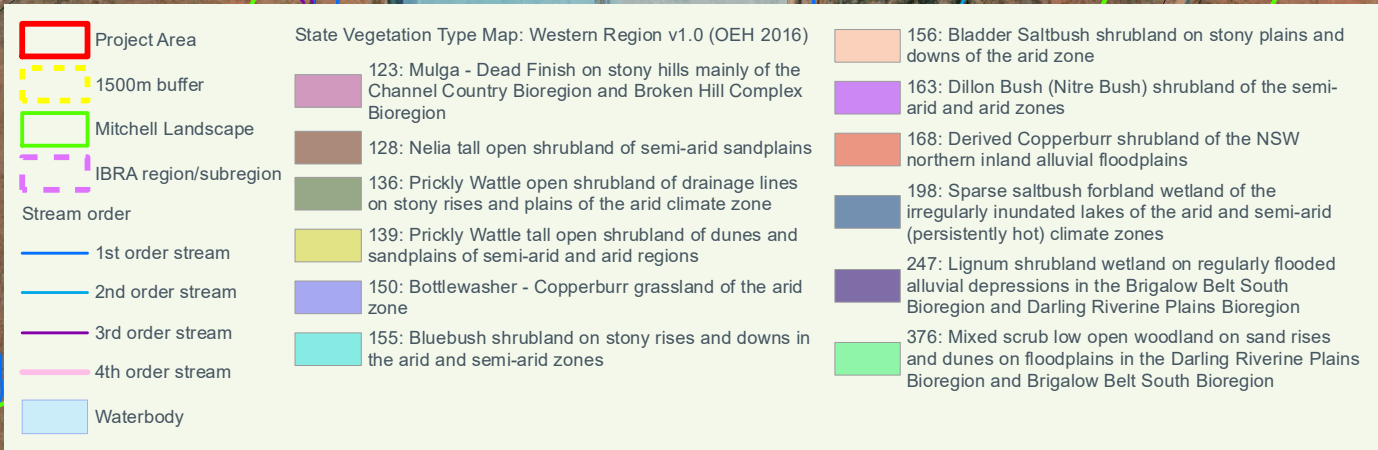
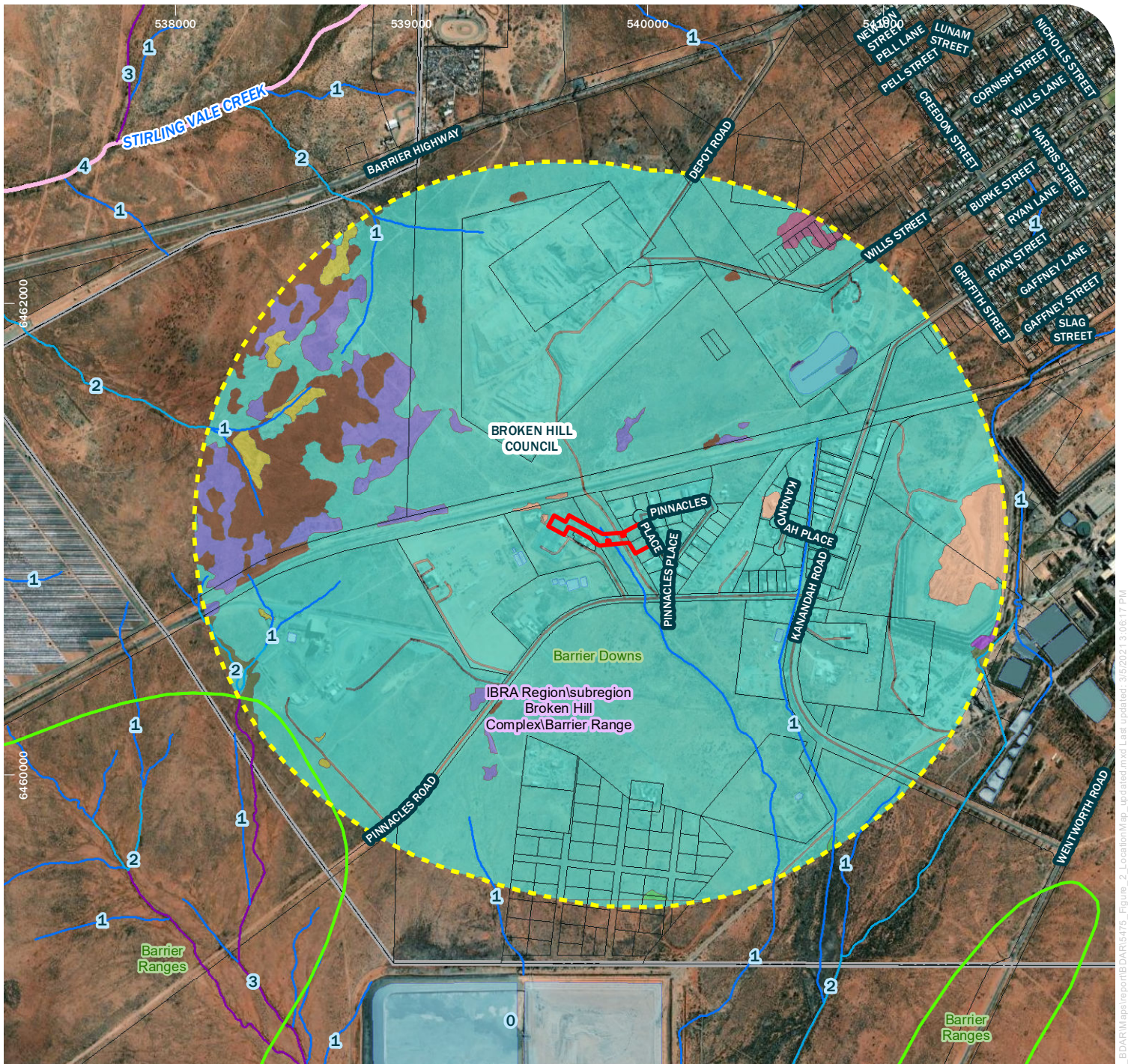
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Niche PM: Patrick McEvoy
 Niche Proj. #: 5475
 Client: AECOM

Site Map
 Broken Hill Battery Storage BDAR

Figure 1



3. Native vegetation and flora assessment

3.1 Methods - assessment of threatened species and populations

3.1.1 Data review

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify likely vegetation communities and threatened biodiversity with the potential to occur in the Project Area. This information was reviewed prior to field surveys being undertaken to inform initial survey effort and design and identify species for consideration.

Database searches within the locality (a 30 km radius around the study area) were conducted prior to the site visit in December 2019, and updated in December 2020, to identify threatened biodiversity and migratory species with known occurrences or with the potential to occur in the Project Area. A likelihood of occurrence analysis (Annex 5) was then undertaken prior to field surveys for each species/TEC, based on preliminary information regarding habitat present within the Project Area. The following resources were used for this purpose:

- Database searches:
 - *NSW BioNet Atlas Database* (DPIE 2020) for spatial records of threatened flora listed under the BC Act within a 30 km radius of the Project Area (Accessed 18/12/2020).
 - *EPBC Act Protected Matters Search Tool* (PMST) (DAWE 2021) for fauna, flora and ecological communities identified as MNES known from or with potential habitat within a 30 km radius of the Project Area (Accessed 06/01/2021).
 - BAM-C tool (using benchmark condition for previously mapped Plant Community Types, PCTs) to identify candidate species credit species and predicted ecosystem credit species known or predicated to occur within the IBRA subregion (Accessed 03/03/2021).
- Vegetation mapping: existing vegetation mapping (State Vegetation Type Map: Western Region v1.0. VIS_ID 4492) (DPIE, 2019c) was examined prior to the field survey to determine the vegetation communities likely to be present in the study area.

Five categories for likelihood of occurrence were attributed to threatened biodiversity after considering the number and proximity of known records, presence or absence of preferred habitat types (e.g. native vegetation types and microhabitats) and professional judgement. The categories are outlined in Table 5. Species considered further for impact assessment included:

- Those in the 'Known', 'High' or 'Moderate' categories and where impacts for the species could reasonably occur from the Project
- Candidate species as identified by the BAM Calculator.

Species listed with a 'Low' or 'None' likelihood of occurrence are those for which there is limited, or no habitat present within the study area.

The likelihood of occurrence analysis (Annex 5) was updated for each species following the on-site habitat assessment based on final PCT and habitat assessment or targeted survey. Threatened flora species identified as candidate species in the BAM Calculator and those considered likely to occur and be impacted by the Project are listed in Table 6. Their survey requirements as detailed in Table 6 were used to inform targeted surveys as per Stage 2 of the BAM.

Table 5: Likelihood of occurrence criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the Project Area.	The species was observed within the Project Area.
High	It is likely that a species inhabits or utilises habitat within the Project Area.	It is likely that a species inhabits or utilises habitat within the Project Area.
Moderate	Potential habitat for a species occurs within the study area. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the Project Area.	Potential habitat for a species occurs within the study area and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the Project Area.
Low	It is unlikely that the species inhabits the Project Area.	It is unlikely that the species inhabits the Project Area. If present within the Project Area, the species would likely be a transient visitor. The study area contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the study area is unsuitable for the species.	The habitat within the study area is unsuitable for the species.

3.1.1.1 Threatened flora requiring survey

A total of four threatened flora species were identified by the BAM Calculator as species credit species and/or having a moderate to high likelihood of occurring in the Project Area (Table 6 and Annex 5). There were an additional two species identified in the EPBC Act PMST search as having a moderate likelihood of occurrence (Annex 5). Of the candidate species identified, two are species subject to serious and irreversible impacts (SAII) (Table 6). Table 6 includes habitat constraints and survey timing (as identified in the Threatened Biodiversity Profile Data Collection (TBDC)) for each species and identifies whether targeted surveys were required/undertaken and where species were assumed present. Where species presence could not be ruled out based on lack of associated PCTs or quality of habitat, a conservative approach was taken, and targeted surveys conducted.

Table 6: Candidate and other threatened flora species with the potential to occur and requirement for survey

Scientific name	Common name	NSW BC Act	EPBC Act	Subject to SAII?	Habitat constraint (BAM)	Survey timing/effort	Inclusion in assessment based on?	Targeted survey undertaken?
Candidate species								
<i>Acacia notabilis</i>	Mallee Golden Wattle	E	-	No	None identified in BAM-C	Year-round	BAM-C Candidate species	Yes Associated PCTs present in relevant IBRA subregion Initial survey carried out in required season. Conspicuous. Not detected.
<i>Swainsona flavicarinata</i>	Yellow-Keel Swainsona	E	-	Yes (Principle 3)	None identified in BAM-C	June-October. Survey 4 to 7 weeks after above average rainfall to detect flowering. Erratic occurrence, dying back under dry conditions	BAM-C Candidate species	Yes Associated PCT present in relevant IBRA subregion. Targeted survey carried out in required season and after appropriate recent rainfall. Not detected.
<i>Swainsona viridis</i>	Creeping Darling Pea	E	-	Yes (Principal 3)	None identified in BAM-C	September-October. Survey after average to wet seasonal conditions. Flowers mainly in September to October but will sporadically flower earlier or later with above average rainfall. Above ground components are not detectable in dry conditions.	BAM-C Candidate species	Yes Associated PCT present in relevant IBRA subregion Targeted survey carried out in required season. Not detected.
<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	No	None identified in BAM-C	September. Survey outside specified months however known to flower in spring to early summer. Evidence of dieback should have been detectable during targeted searches.	BAM-C Candidate species	Yes Associated PCT present in relevant IBRA subregion Targeted survey carried out. Not detected.
Total number of species	4	-	-	2 candidate SAII	-	-	-	-

NSW and Commonwealth Status: E = Endangered, V = Vulnerable.

3.1.2 Methods – field survey

Field surveys were undertaken on two occasions and included the following:

1. BAM plots, vegetation mapping, incidental threatened flora survey and habitat assessment – 10 and 11 December 2019.
2. Targeted threatened flora survey and further habitat assessment – 29 October 2020.

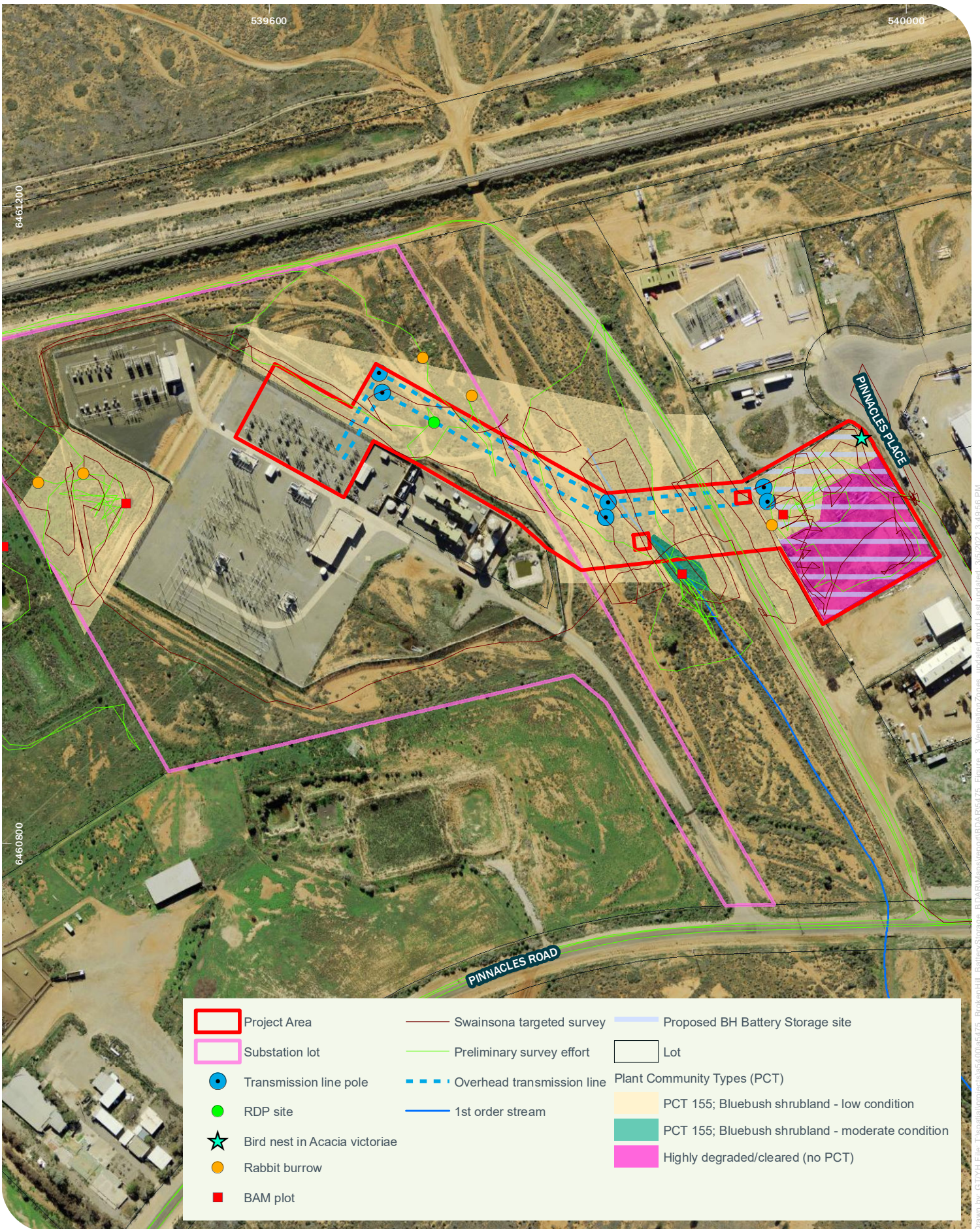
Plot/transect surveys and targeted threatened species surveys were conducted throughout the Project Area and immediate surrounds (see Figure 3) with results used within the BAM-C to generate credit requirements. The Plant Community Type (PCT) within the study area was recorded and mapped using a combination of vegetation quadrats, transects and walking meanders. Surveys were conducted both within and outside of the Project Area, as the project design location was not finalised until after the surveys. Vegetation mapped as occurring within the Project Area and flora survey effort is shown on Figure 3. Table 7 lists the PCT present, including its vegetation formation, class and status. Alignment of the vegetation community to a PCT is discussed in Annex 1.

The following survey tasks were completed for the flora survey:

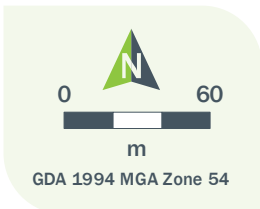
- Plant community delineation and mapping, using a combination of floristic assessments within BAM plots (four plots as per the BAM requirements) and one Rapid Data Point along walking meanders.
- Targeted flora surveys, including four person hours by two ecologists (29 October 2020).
- Opportunistic observations of flora and fauna, Threatened Ecological Communities (TECs), habitat quality and high threat and priority weeds.

Table 7: Plant Community Types present across the Project Area

PCT ID	PCT name	Condition	TEC status per BioNet Vegetation Classification (BC Act/EPBC act)	Vegetation Formation (Keith 2004)	Vegetation Class (Keith 2004)	PCT % cleared	Area to be cleared /impacted for development (ha)	BAM Plots required for the impact area	BAM Plots completed
155	<i>Bluebush shrubland on stony rises and downs in the arid and semi-arid zones</i>	Low	Not listed	Arid Shrublands (Chenopod sub-formation)	Gibber Chenopod Shrublands	50	0.82	1	1



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Vegetation zones and plot locations
Broken Hill Battery Storage BDAR

Niche PM: Patrick McEvoy
Niche Proj. #: 5475
Client: AECOM

Figure 3

3.1.2.1 BAM plots

The BAM plot requirement was determined using the BAM (OEH 2017) and was based on the area of each PCT condition type to be impacted.

The number of plots conducted for each PCT and vegetation zone is provided in Table 7 and the location of the completed plots is shown on Figure 3. Details regarding PCT delineation and mapping are provided in Section 3.1.3. A total of four plots were undertaken during surveys for the preliminary biodiversity assessment, before the exact Project Area footprint was confirmed. Data from one of these plots, which is within the BESS footprint, was added to the BAM-calculator as this was considered the most representative of areas impacted by vegetation clearing.

3.1.2.2 Threatened flora survey effort

Targeted threatened flora surveys were undertaken within areas of suitable habitat for three threatened flora species, as shown in Table 8.

Surveys were undertaken according to relevant survey guidelines (DPIE 2020c), with survey effort shown in Figure 3.

Table 8 Survey effort (flora and vegetation)

Field survey activity	Method	Effort/timing
Plant community delineation and mapping	4 BAM plots (BCD 2020) and 1 RDP Transects and walking meanders to record boundaries between vegetation zones Habitat quality High threat and priority weeds.	10 & 11 December 2019
Threatened flora surveys	As above. Random meander for potentially occurring threatened flora plus additional targeted survey during relevant flowering periods. Mallee Golden Wattle (<i>Acacia notabilis</i>) Yellow-keeled Swainsona (<i>Swainsona flavicarinata</i>) Creeping Darling Pea (<i>Swainsona viridis</i>)	10 & 11 December 2019 29 October 2020

More detailed vegetation community descriptions, including species used to aid in determining PCTs and justification for alignment to each of the nominated PCTs are provided in Annex 1.

3.1.3 Site values

Flora

A total of 37 flora species were recorded across the four plots; including 26 native species and 11 exotic species. Floristic plot data, including cover and abundance of all species recorded is provided in Annex 2.

Plot and transect values

Results of the floristic composition, structure and function data obtained during the field assessment is provided in Annex 3.

Site value scores

The site value assessment was carried out by entering plot data into the BAM-C. The data provides quantitative measures of composition, structure and function for each vegetation zone (Annex 3). The BAM-C compares the values recorded with the benchmark for the vegetation class to provide the site value

score. This score represents the overall condition of the vegetation compared to the benchmark value (out of 100).

The score from these inputs, coupled with data in the following section of this report, is used to determine the number of ecosystem credits that are required for development.

Patch size for all vegetation zones was given the highest score in the BAM (>100 hectares), as the native vegetation in the Project Area is directly connected to other large areas of native vegetation (as can be seen on Figure 1 and Figure 2).

The current and future vegetation integrity (VI) scores from the BAM-C are detailed in Table 9. The future integrity scores for the direct impact zones are reduced to zero as all vegetation and habitats within this zone is assumed to be removed. In practice, vegetation under the transmission line may remain undisturbed or regenerate towards its current condition.

Table 9: Vegetation zones with current and future vegetation integrity scores

Vegetation zone	BAM Plot #	Area (ha)	Patch size	Current VI score	Future VI score	Change in VI score
155_Low03	3	0.82	101	21.9	0	-21.9

3.1.4 High threat and priority weeds

During the field surveys one high threat weed (HTW) species was recorded: African Boxthorn (*Lycium ferocissimum*), present in BAM plots 1 and 4. It is listed as a manageable HTW which is capable of being effectively managed with specific management practices. African Boxthorn is also listed as a priority weed for the western region. Mesquite (*Prosopis spp.*) are listed as priority weeds for the western region of NSW. Velvet Mesquite (*Prosopis velutina*) was recorded within the study area at BAM plot 1.

3.1.5 Threatened ecological communities

PCT 155 does not qualify as a TEC under either the BC Act or the EPBC Act. The Project would not impact on a TEC.

3.1.6 Threatened flora

As detailed in section 3.1.2, surveys for four threatened flora species predicted or considered to potentially occur were undertaken. All four species were identified as candidate species by the BAM Calculator, and none were identified as additional species from the EPBC Act PMST search as having a moderate likelihood of occurrence (Annex 6).

Of the candidate species identified, two are species identified as subject to serious and irreversible impacts (SAII). Table 10 details the list of candidate and threatened flora species, including habitat constraints and survey timing (as identified in the TBDC). Table 10 lists those species for which surveys were undertaken.

None of the candidate flora species were recorded during targeted searches. Based on the results of the field survey and habitat assessment, candidate flora species are considered to be absent from the Project Area as shown in Table 10.

Table 10: Candidate flora species and assessment of credit requirement

Common name	Scientific name	BC Act	EPBC Act	Subject to SAI?	Habitat constraint (BAM)	Survey timing/effort	Status
Candidate species (species credit species)							
Mallee Golden Wattle	<i>Acacia notabilis</i>	E	n/a	No	None identified in BAM-C	Year-round	Absent
Yellow-Keel Swainsona	<i>Swainsona flavicarinata</i>	E	-	Yes	None identified in BAM-C	June -October Survey 4 to 7 weeks after above average rainfall to detect flowering. Erratic occurrence, dying back under dry conditions	Absent
Creeping Darling Pea	<i>Swainsona viridis</i>	E	-	Yes	None identified in BAM-C	September -October Survey after average to wet seasonal conditions. Flowers mainly in September to October but will sporadically flower earlier or later with above average rainfall. Above ground components are not detectable in dry conditions.	Absent
Slender Darling Pea	<i>Swainsona murrayana</i>	V	V	No	None identified in BAM-C	September. Survey outside specified months however known to flower in spring to early summer. Evidence of dieback should have been detectable during targeted searches.	Absent

3.1.7 Threatened fungi

There were zero threatened fungi species identified by the BAM Calculator as species credit species and/or having a moderate to high likelihood of occurring in the impact area (Annex 5).

3.2 Fauna assessment

3.2.1 Methods - assessment of threatened species and populations

3.2.1.1 Data review

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify fauna habitat and threatened fauna with the potential to occur within the Project Area. The methodology is detailed in section 3.2.2. Results of the searches and reviews were undertaken prior to field survey to inform field survey requirements.

A likelihood of occurrence analysis was undertaken for each species, prior to field surveys, based on the PCTs/vegetation mapped within the Project Area. This was updated within the current report (Annex 5) to reflect the suitability of habitat present within the Project Area, as identified following the on-site habitat assessment. Threatened species identified as subject species requiring further assessment included:

- Species with a moderate or higher likelihood of occurrence
- Candidate species as identified in the BAM Calculator.

Subject species requiring further assessment and/or survey are detailed below in Table 11.

3.2.1.2 Threatened fauna requiring survey

Targeted threatened fauna surveys are required for those species identified as candidate species by the BAM Calculator once the BAM plot data were entered, unless their presence could be ruled out due to other factors such as absence of habitat, degraded habitat or vagrancy as per Section 6.4 of the BAM. Additionally, species identified as having a moderate to high likelihood of occurrence (based on presence of suitable habitat/required habitat constraints) (Annex 5) were considered for survey.

All ecosystem (predicted) credit species generated by the BAM-C were assumed present for the purposes of credit calculations; however, the likelihood of occurrence for each species is summarised in Annex 5. The ecosystem credit species are listed in Table 14.

A total of seven threatened fauna species were identified by the BAM Calculator as species credit species, and eight threatened fauna species were assessed as having a moderate likelihood of occurring in the impact area (Table 11 and Annex 5). This included one species identified in the EPBC Act PMST search as having a moderate likelihood of occurrence (Dusky Hopping Mouse). Of the candidate species identified, one species, Thick-billed Grasswren, is subject to serious and irreversible impacts (SAIL).

The requirement for targeted survey for each of these species to determine presence/absence from the Project Area (and the subsequent requirement for credits to be generated) was determined by consideration of the following:

- For each candidate species, review of PCTs associated with each species (as per the TBDC) and presence of those PCTs within each sub-region for which the species was identified as a candidate species
- Presence of habitat constraints (as identified in the TBDC) within the impact area
- Quality/suitability of habitat present as determined during the initial field survey
- Survey effort undertaken during the initial BAM site assessment/survey.

Species were excluded from candidacy in the BAM Calculator for the following reasons:

- Excluded from the entire relevant IBRA subregion due to absence of required habitat (habitat constraints) regardless of the presence of the species associated PCTs
- Excluded due to degraded habitat as per section 6.4 of the BAM
- Excluded as having been surveyed, based on the absence of large stick nests suitable for large raptors within the impact area, which indicates no suitable breeding habitat within the impact area.

Table 11 lists threatened fauna species identified as requiring further assessment including habitat constraints and survey timing (as identified in the TBDC) for each species and identifies whether targeted surveys were required/undertaken and where species were assumed present.

Table 11: Candidate (species credit) threatened fauna species with the potential to occur or requirement for survey

Scientific name	Common name	NSW BC Act	EPBC Act	Subject to SAIL?	Habitat constraint (BAM)	Survey timing/effort	Degraded habitat	Vagrant species	Reason for inclusion?	Survey undertaken and comments/justification	Presence
Candidate species											
<i>Amytornis modestus obscurior</i>	Thick-billed Grasswren (north-west NSW subspecies)	CE	CE	Yes	None identified in BAM-C.	Jul-Sep	Yes		BAM-C	No The species is known from one population at Packsaddle approximately 175km to the north of Broken Hill. It is very unlikely to be present within the study area. Opportunistic survey did not detect this species.	No
<i>Antaresia stimsoni</i>	Stimson's Python	V	n/a	No	Rocky areas within 500m of rocks or gibber	Sep-Mar			BAM-C	No Limiting habitat not present	No
<i>Ardeotis australis</i>	Australian Bustard	E	n/a	No	None identified in BAM-C	Year-round			BAM-C	Yes Habitat is unlikely to be core habitat but might be used from time to time.	Yes – habitat degraded however species is wide-ranging and unable to be excluded (see Section 3.2.4).
<i>Ctenophorus mirrityana</i>	Barrier Range Dragon	E	n/a	No	Rocky areas Requires rock crevices	Oct-Mar			BAM-C	No Limiting habitat not present	No
<i>Hieraetus morphnoides</i>	Little Eagle	V	n/a	No	Nest trees - live (occasionally dead) large old trees within vegetation)	Aug-Oct			BAM-C	No Limiting habitat not present	No
<i>Lophocroa leadbeateri</i>	Major Mitchell's Cockatoo	V	n/a	No	Hollow bearing trees Living or dead tree with hollows greater than 10 cm diameter	Sep-Dec			BAM-C	No Limiting habitat not present	No
<i>Lucasium stenodactylum</i>	Crowned Gecko	V	n/a	No	None identified in BAM-C	Oct-Mar	Yes		BAM-C	No No nearby records (or any in the subregion), disturbance within the Project Area and poor match for any of the habitat it has been recorded in, the Project Area was deemed unsuitable.	No
Total number of species	7	-	-	1 x candidate SAIL	-	-	-	-	-	-	-

NSW and Commonwealth Status: E = Endangered, V = Vulnerable. n/a = not applicable. Likelihood rating: M = Moderate, H = High, K = Known.

3.2.2 Methods – field survey

Field surveys across the study area included habitat assessment and opportunistic sightings of threatened fauna. This was undertaken during both survey periods (December 2019 and October 2020).

Key habitat features recorded, and used to determine the likely presence of threatened species, included:

- Type, condition and diversity of vegetation communities present
- Presence of roosting/breeding/shelter resources such as hollow-bearing trees, rock ledges/rocky outcrops/shelters/caves and logs/leaf litter.

Targeted threatened fauna survey was not undertaken as the survey effort was considered sufficient to accurately characterise the general quality of the available habitat and determine the likelihood of occurrence (Annex 5). The list of candidate fauna species and the requirement for survey is shown in Table 11. Of the seven candidate species generated by the BAM Calculator, only one (Australian Bustard) was found likely to occur on occasion. This has been further discussed in Section 3.2.4.

3.2.2.1 Habitat assessment

The key habitat features recorded were used to determine the likely presence of threatened species. These included:

- Type, condition and diversity of vegetation communities present
- Presence of roosting/breeding/shelter resources such as:
 - large stick nests suitable for raptors
 - hollow-bearing trees and stags
 - rock ledges, shelters, caves, outcrops, gibber plains
 - logs and leaf litter.

The fauna survey methods and effort consisted of the following tasks (Table 12, Figure 3):

- Opportunistic observations made throughout the survey team’s time on site, including tracks, scats and signs.

Table 12: Fauna survey effort

Survey technique	Date	Survey effort	Species targeted
Habitat survey	10-11 December 2019	6 person hours.	Mapping of hollow-bearing trees and searching for the presence of nests, logs, outcrops and other important habitat features.
Opportunistic survey	10-11 December 2019, 29 October 2020	6 person hours Conducted in conjunction with targeted flora surveys. 4 person hours	All threatened fauna species with a moderate to high likelihood of occurrence
	29 October 2020	4 person hours	All threatened fauna species with a moderate to high likelihood of occurrence

Weather conditions

Conditions were warm to hot on all survey days, with no rainfall (Table 13).

Table 13: Weather conditions during survey

Survey	Wind direction and max. speed (km/h)	Max. temperature (°C)	Rain (mm)	Relative humidity at 9am (%)
10 Dec 2019	SSW 43	33.6	0	34
11 Dec 2019	S 44	32.7	0	33
29 Oct 2020	WNW 65	26.6	0	38

Data from Broken Hill Airport (047048) BOM weather station, www.bom.gov.au.

3.2.3 Fauna and fauna habitats

No rocky areas or rock piles suitable for fauna habitat were observed within the Project Area. Mature trees are absent from the Project Area, with only two recorded outside the Project Area boundary. Small shrubs and forbs provide some potential shelter habitat for small mammals and reptiles. Some disused rabbit burrows were identified both within the Project Area and to the north and west of the Project Area. The greater part of the Site is currently used for equipment and vehicle storage. While equipment and vehicle storage may provide limited shelter for a range of smaller terrestrial fauna species, the overall habitat quality is poor. One *Macropus robustus erubescens* (Euro) was observed and Euro scats were abundant. One nest was recorded in an *Acacia victoriae* shrub adjacent to Pinnacles Place. Bird species may utilise the Project Area to forage, but overall there are very few resources within the Project Area for roosting and nesting.

Fauna species recorded in the study area are listed in Annex 4. A total of four fauna species were recorded during field surveys, comprising two birds, one mammal, and one reptile (Annex 4).

3.2.4 Threatened fauna

As detailed in section 3.2.2, targeted surveys for threatened fauna species were not undertaken due to limited habitat availability. No threatened species were detected opportunistically during the surveys.

Based on the results of the BAM calculator, field survey and habitat assessment, species were identified as present or absent from the Project Area as shown in Table 14.

Table 14: Candidate fauna species and assessment of credit requirement

Common name	Scientific name	Status
Predicted threatened species (ecosystem credit species)		
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	Yes – assumed present
Bolam’s Mouse	<i>Pseudomys bolami</i>	Yes – assumed present
Dusky Hopping-mouse	<i>Notomys fuscus</i>	Yes – assumed present
Dusky Woodswallow	<i>Artamus cyanopterus</i>	Yes – assumed present
Flock Bronzewing	<i>Phaps histrionica</i>	Yes – assumed present
Forrest’s Mouse	<i>Leggadina forresti</i>	Yes – assumed present
Grey Falcon	<i>Falco hypoleucos</i>	Yes – assumed present
Kultarr	<i>Antechinomys laniger</i>	Yes – assumed present
Little Eagle	<i>Hieraetus morphnoides</i>	Yes – assumed present
Little Pied Bat	<i>Chalinolobus picatus</i>	Yes – assumed present
Long-haired Rat	<i>Rattus villosissimus</i>	Yes – assumed present

Common name	Scientific name	Status
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	Yes – assumed present
Marble-faced Delma	<i>Delma australis</i>	Yes – assumed present
Pied Honeyeater	<i>Certhionyx variegatus</i>	Yes – assumed present
Redthroat	<i>Pyrrholaemus brunneus</i>	Yes – assumed present
Ringed Brown Snake	<i>Pseudonaja modesta</i>	Yes – assumed present
Rufous Fieldwren	<i>Calamanthus campestris</i>	Yes – assumed present
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>	Yes – assumed present
Spotted Harrier	<i>Circus assimilis</i>	Yes – assumed present
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>	Yes – assumed present
Wedgesnout Ctenotus	<i>Ctenotus brooksi</i>	Yes – assumed present
White-fronted Chat	<i>Epthianura albifrons</i>	Yes – assumed present
Woma	<i>Aspidites ramsayi</i>	Yes – assumed present
Candidate species (species credit species)		
Australian Bustard	<i>Ardeotis australis</i>	Yes – assumed present on occasion
Thick-billed Grasswren (north-west NSW subspecies)	<i>Amytornis modestus obscurior</i>	No – closest population 175 km away. Habitat degraded.
Stimson's Python	<i>Antaresia stimsoni</i>	No – key habitat features absent
Barrier Range Dragon	<i>Ctenophorus mirrityana</i>	No – habitat absent
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	No – limiting habitat not present
Crowned Gecko	<i>Lucasium stenodactylum</i>	No – habitat degraded. Species not detected.
Little Eagle	<i>Hieraetus morphnoides</i>	No – key habitat features absent
MNES		
Dusky Hopping-mouse	<i>Notomys fuscus</i>	Yes – assumed present

One threatened fauna species listed in the EPBC Act has a moderate likelihood of occurrence in the Project Area due to an association with PCT 155: Dusky Hopping Mouse (*Notomys fuscus*). An Assessment of Significance in accordance with the 'significant impact' criteria for Vulnerable Species under the EPBC Act was undertaken for the species and concluded that given the limited records of this species in bluebush shrubland, the degraded state of the Project Area, and the absence of tracks or burrows, it is highly unlikely to occur within the Project Area and be impacted by the Project.

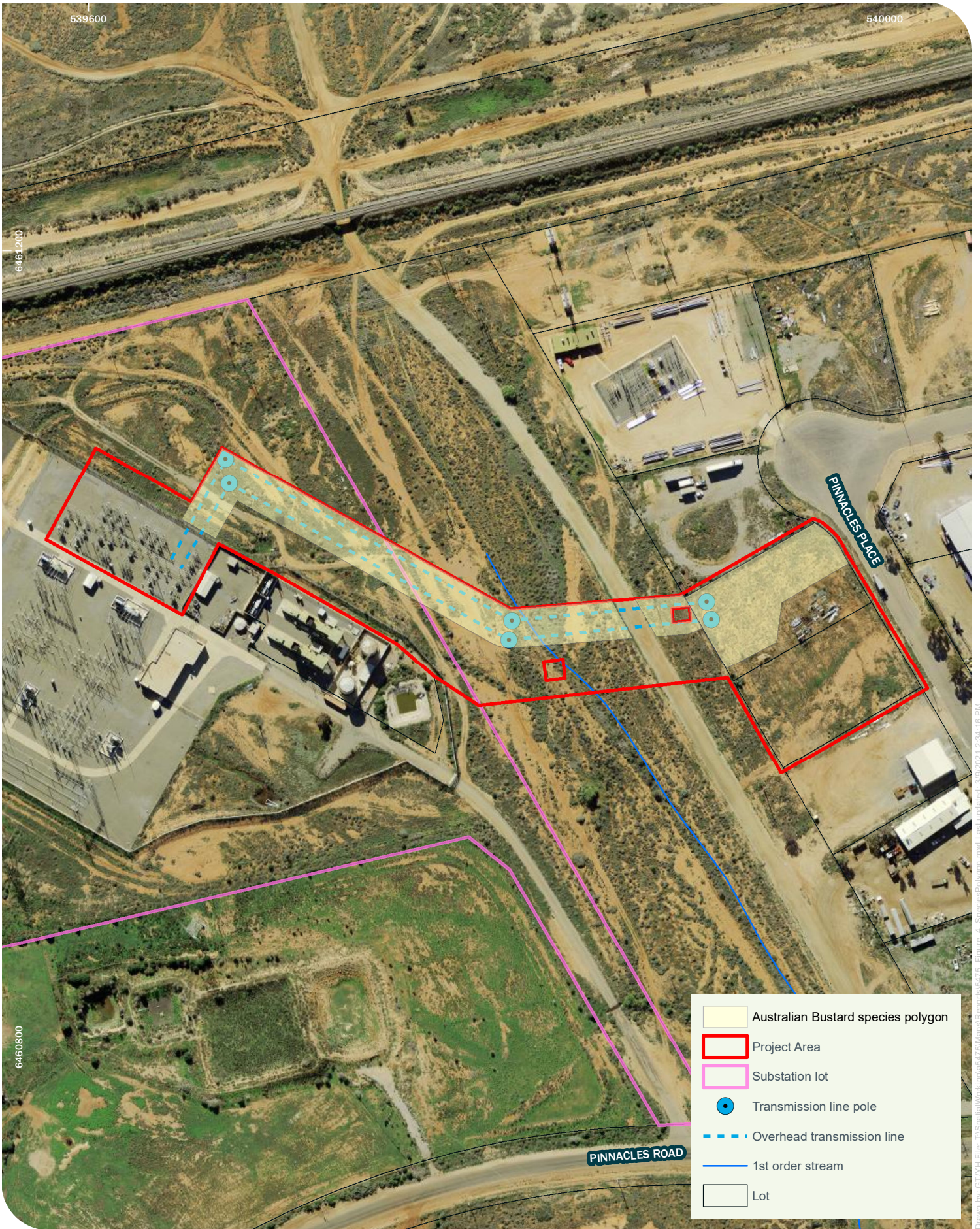
Species credits are required for those candidate species identified as present within the Project Area (see Table 14). In order to determine the offset requirement, a species polygon (areas of occupied/potential habitat for the species) was developed for the Australian Bustard as described below.

Species polygons

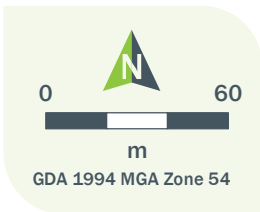
As required by step five of section 6.4 of the BAM, a species polygon was prepared which identifies the areas of the Project Area that contain habitat suitable for each candidate species (Figure 4). The Australian Bustard is the only candidate species which has been assumed present. This species is mobile and wide-ranging and could not be eliminated due to absence of limiting habitat. The Australian Bustard has a biodiversity risk weighting of two (2) which was factored into credit calculations. The species polygon for the Australian Bustard comprises all of PCT 155 in the Project Area, since the PCT is listed as associated habitat in the BioNet Threatened Species Database (DPIE 2020b).

3.2.5 Connectivity

Mobile species such as Australian Bustard may move through the Project Area on occasion. The placement of the BESS would not prevent habitat connectivity due to its location adjacent to an industrial area. Lot 7302 DP1181129 would provide habitat connectivity for species such as the Australian Bustard; however, post-construction the overhead transmission line would not prevent movement of fauna through this area. The Project is unlikely to alter fauna movements and there are many connectivity opportunities throughout the region.



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Niche PM: Patrick McEvoy
Niche Proj. #: 5475
Client: AECOM

Species polygon: Australian Bustard
Broken Hill Battery Storage BDAR

Figure 4

4. Impact Assessment

The Impact Assessment forms Stage 2 of the BDAR as detailed in section 8 of the BAM.

4.1 Avoid and minimise impacts

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a Project on biodiversity values. This section outlines the avoidance, management and mitigation measures that AGL have incorporated into the Project design or would employ during construction, operation or completion of the Project to reduce impacts on biodiversity values.

A summary of the avoidance and mitigation measures including action, outcome, timing and responsibility are provided in Table 15.

4.1.1 Avoidance measures (pre-construction)

Three siting options were considered in 2019 by Niche as part of a Preliminary Biodiversity Assessment (2020) to identify key biodiversity values and constraints. The assessment concluded that all options offered limited important habitat for threatened flora and fauna and were variously disturbed. Native vegetation present comprised PCT 155 of which there was a single patch in moderate condition. Avoidance of this vegetation patch was recommended and incorporated into the chosen design.

4.1.2 Mitigation measures (construction and post construction)

Mitigation measures that would be implemented during the construction and operational phases of the Project would be documented within a Construction Environmental Management Plan (CEMP).

This will include a Biodiversity Management Plan. This plan would include delineation of the Project Area to ensure there are no impacts outside of the Project Area boundary, staff training, erosion and sediment controls, weed control measures, and management and removal of waste from the site (see Table 15). A small area of PCT 155 in moderate condition occurs within the Project Area but would not be impacted by the Project. The Biodiversity Management Plan would include the requirement for exclusion fencing around this vegetation to ensure there are no direct or indirect impacts during construction.

Table 15: Mitigation measures

Mitigation measure and timing	Responsibility
Pre-construction	
<i>Preparation of a Biodiversity Management Plan – to include measures listed below</i>	Project manager
<i>Delineation of the site – establish exclusion zone around the Project Area to ensure clearing does not occur outside those boundaries. This will include an exclusion zone around the area of PCT 155 in moderate condition, to ensure it would not be impacted by the Project.</i>	Project manager
<i>Establish a clearing exclusion zone either side of the riparian corridor – transmission line poles should not be placed within 10 m either side of the 1st order stream. No vegetation clearing should occur within this riparian corridor. Refer to NSW Office of Water (2012).</i>	Project manager
<i>Staff training – e.g. communicate the importance of exclusion zones, erosion and sediment controls, unexpected species finds procedure.</i>	Project manager

Mitigation measure and timing	Responsibility
Construction	
<i>Erosion and sediment controls</i> – Implementation of erosion and sediment controls for the duration of construction works (detailed in CEMP).	Project manager
<i>Hygiene protocols</i> - prevent the spread of weeds or pathogens between affected areas and unaffected areas	Project manager
<i>Weed control</i> - measures would form part of operational maintenance to manage the potential dispersal and establishment of weeds during operation in accordance with the <i>Biosecurity Act 2015</i>	Project manager/ Weed contractor
Operation	
All waste will be managed and removed from the Project Area	Project manager

4.2 Impact summary

An assessment of the potential impact of the Project on biodiversity is provided below. It considers direct and indirect impacts as defined in OEH (2018), which states:

“Direct impacts are those that directly affect habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development. When applying each factor, both long-term and short-term impacts are to be considered.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.”

The Project would affect biodiversity through both direct and indirect impacts. The areas subject to direct and indirect impact are shown in Figure 4 and discussed in Table 16 below.

A likelihood rating of Known, High, Moderate, Low or None has been assigned to each of the potential impacts listed in Table 6.

Table 16 Assessment of direct and indirect impacts as a result of the Project

Impact	Extent of impact as a result of the Project
Direct impacts	
Removal or modification of native vegetation	Known: approximately 0.27 ha of low condition native vegetation (PCT 155) would be removed on the Site. Another 0.55 ha of low condition native vegetation (PCT 155) occurs

Impact	Extent of impact as a result of the Project
	along the transmission line corridor which has a buffer of 20 m. This is a worst-case scenario and all vegetation within the corridor would not require removal. See Section 4.1.1 for avoidance measures.
Loss of individuals of a threatened species	Low: no threatened species were recorded, and due to the low condition habitat within the Project Area, there is a low likelihood that any individuals would be impacted by the Project.
Removal or modification of threatened species habitat other than native vegetation (micro-habitat features)	Low: the area to be impacted contains limited habitat features (e.g. coarse woody debris) which may be used by threatened species. The Project would not limit foraging or breeding habitat for threatened species in the locality. Vagrant or wide-ranging species such as the Australian Bustard may occur on occasion.
Death through trampling or vehicle strike	Low: clearing is the main impact from the Project, there would be limited increased risk from trampling or vehicle strike.
Death through poisoning	Low: no poisons are proposed to be used as part of the Project. Harmful substances used in construction and during weed management (if required) would all be controlled in accordance with Australian Standards.
Fragmentation	Moderate: vegetation within the Project Area is already fragmented by other land uses and informal tracks. Clearing proposed would marginally increase fragmentation impacts; however, only low condition vegetation would be impacted.
Indirect impacts	
Predation by domestic and/or feral animals	Low: the Project is not likely to increase the presence of domestic or feral animals in the local area. Feral animals (e.g. rabbits) are already present.
Loss of shade/shelter	Known: the removal of 0.82 ha of native vegetation (worst-case scenario) in the Project Area would result in a loss of a small portion of shade and shelter for local fauna. This impact is considered low considering there is similar habitat in the immediate vicinity that would not be impacted by the Project.
Loss of individuals through starvation	Low: the habitat to be removed in the Project Area is not considered likely to cause loss of individuals through starvation.
Loss of individuals through exposure	Low: habitat to be removed in the Project Area occurs primarily as patchy stands of native groundcover and midstory vegetation. Areas of habitat nearby would not be impacted by the Project. The Project is not considered likely to cause a loss of individuals through exposure.
Edge effects (noise, light, traffic)	Low: the Project would introduce edge effects such as noise and traffic during construction. Post-construction, these impacts would be infrequent and relatively unchanged from present conditions.

Impact	Extent of impact as a result of the Project
Deleterious hydrological changes	None: the Project would not alter existing flow regimes of any watercourses. The watercourse that passes through the Project Area is ephemeral and would not be impacted by the Project during construction. Transmission line poles would not be erected within the riparian corridor (i.e. 10 m either side of the waterway).
Weed invasion	Low: weeds may be introduced or spread at the Project Area if weed control protocols are not adhered to. This would be monitored and managed via weed control.
Increased human activity within or directly adjacent to sensitive habitat areas	Known: there are no sensitive habitat areas within the Project Area, and human activity is unlikely to increase substantially post-construction.

4.2.1 Potential serious and irreversible impacts (SAII)

The BC Act imposes various obligations on decision-makers in relation to impacts on biodiversity values that are at risk of Serious and Irreversible Impacts (SAII). These obligations generally require a decision-maker to determine whether the residual impacts of a proposed development on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been taken) are serious and irreversible (DPIE 2019b).

No threatened biodiversity at risk of SAI are known or considered likely to occur in the Project Area.

5. Quantifying Offset Requirements

The BAM identifies the BAM-Calculator (BAM-C) as the appropriate tool for quantifying the offsets required in both ecosystem credit and species credit terms. A calculation of the nature and extent of biodiversity credits required due to ecological impacts associated with the Project has been undertaken using the BAM-C.

The case will be finalised and submitted via the online BAM C post-finalisation of this BDAR. The date of submission of the BDAR must be within 14 days of the date shown on the relevant finalised credit report generated using the BAM Calculator.

No threatened biodiversity listed on the EPBC Act are required to be offset for the Project, as the Project does not result in a significant impact on any threatened biodiversity listed on the EPBC Act. An EPBC Act Referral has been prepared and submitted to DAWE. The Referral concluded that potential impacts to the Dusky Hopping Mouse (the only MNES species potentially impacted) were unlikely.

5.1.1 Summary of ecosystem credits required

The results of the BAM-C ecosystem offset credit requirements, including current, future and change in vegetation integrity scores are shown in Table 17.

Impacts to native vegetation communities within a development site generate a requirement for 8 ecosystem credits. These 8 ecosystem credits also cover the credit requirement for ecosystem credit species. The full BAM-C biodiversity credit report is provided in Annex 6.

Table 17: Ecosystem credit requirement

PCT – best fit	Impact area (ha)	Current Vegetation Integrity score	Future Vegetation Integrity score	Change in Vegetation Integrity Score	Biodiversity risk weighting	Required credits
PCT - 155	0.82	21.9	0	-21.9	1.75	8

5.1.2 Summary of species credits required

The results of the BAM-C species offset credit requirements are shown in Table 18. Threatened species identified or assumed to be present within a development site and likely to be impacted by the Project generate a requirement for a total of 9 species credits. The full BAM-C biodiversity credit report is provided in Annex 6.

Table 18: Species credits required

Threatened species	Habitat impacted (ha)	Required credits
Australian Bustard (<i>Ardeotis australis</i>)	0.82	9

6. Summary

Impacts of the Project on ecological values are summarised as follows:

- Direct removal of 0.82 ha of native vegetation containing one non-threatened PCT in low condition
- Removal of 0.82 ha of fauna habitat (native vegetation) including potential low-quality habitat for threatened fauna
- Removal of 0.82 ha of flora habitat.

No flora listed under the BC Act or EPBC Act are considered affected species. One assessment of significance under the EPBC Act was required for threatened fauna (Dusky Hopping Mouse *Notomys fuscus*), which concluded a significant impact as a result of the Project was unlikely. An EPBC Act Referral regarding Commonwealth threatened species has been submitted.

AGL has aimed to avoid and minimise environmental impacts from the Project through its design and siting of the Project and implementation of actions aimed at mitigating and managing potential indirect impacts of the Project as detailed in Section 4.1.

Biodiversity offsets required for unavoidable impacts of the Project have been calculated as follows:

- Ecosystem credits: a total of 8 ecosystem credits for PCT 155. These ecosystem credits also cover the credit requirement for ecosystem credit species.
- Species credits: a total of 9 species credits for the Australian Bustard.

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Annex 1. Plant community descriptions

PCT 155: Bluebush shrub land on stony rises and downs in the arid and semi-arid zones

Extent:

This community was present throughout the study area, and 0.82 ha within the Project Area.

Condition and presence of weeds:

Within the study area PCT 155 is considered to be in low to moderate condition. It has been subject to recent vegetation clearing and use of areas for equipment storage. Weeds of National Significance (WONS) observed include *Lycium ferocissimum* (African Boxthorn, also a High Threat Weed (HTW) under the BAM) and *Prosopis velutina* (Velvet Mesquite).

Conservation status:

Has an associated TEC, being *Acacia loderi* shrublands (Part) which is listed as Endangered under the BC Act. Where *Acacia loderi* (Nelia) occurs within PCT 155 vegetation, it is likely to form part of the *Acacia loderi* Shrublands TEC. No *Nelia* individuals were identified within the study area and thus no vegetation within the study area forms part of this TEC.

Characteristic species used for identification of PCT:

The key diagnostic species used to identify this PCT in the study area were *Sclerolaena* (Copper-burr), *Maireana pyramidata* (Black Bluebush), Thorny Saltbush (*Rhagodia spinescens*), Bladder Saltbush (*Atriplex vesicaria*), and *Atriplex stipitata* as listed in the BioNet VIS (DPIE 2020b).

Justification of evidence used to identify the PCT:

While regrowth is only sparse, there are sufficient plant species present, to consider it as an intact native PCT.

The description of PCT 155, as provided in the BioNet VIS (DPIE 2020b), is highly consistent with the geographic location, habitat and floristics of this PCT as identified in the study area. Key matching characteristics include:

- Its geological and geographical occurrence on red or brown clays, calcareous red loams and skeletal soils derived from shales, ferruginous sandstone and other substrates, often containing gibbers on undulating gibber plains, stony rises, adjoining slopes and associated drainage lines. Distributed in the Barrier Ranges north of Broken Hill and the Noonthorangee Range west of White Cliffs in the arid zone of far north-western NSW and extending into South Australia.
- Its species composition which matches that described in the BioNet VIS (DPIE 2020b), namely the presence of key dominant diagnostic species Black Bluebush (*Maireana pyramidata*) along with associated shrub and understorey species as listed above.

Photograph:



Annex 2. Floristic plot data

Table 19 Floristic plot cover (%) data

Family	Scientific name	Common name	BAM Plot 1	BAM Plot 2	BAM Plot 3 ¹	BAM Plot 4
Aizoaceae	<i>Sarcozona praecox</i>	Sarcozona			0.1	
Asteraceae	<i>Ambrosia artemisiifolia</i> *	Annual Ragweed	0.5			
Asteraceae	<i>Brachyscome ciliaris</i>	Variable Daisy	0.2			
Asteraceae	<i>Calotis spp.</i>	A Burr-daisy	1			
Asteraceae	<i>Lactuca serriola</i> *	Prickly Lettuce				0.1
Asteraceae	<i>Onopordum acanthium</i> *					0.1
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	0.1			
Asteraceae	<i>Xanthium ambrosioides</i> *		0.1			
Boraginaceae	<i>Heliotropium supinum</i> *	Prostrate Heliotrope	0.1			
Chenopodiaceae	<i>Atriplex nummularia</i>	Old Man Saltbush	20			
Chenopodiaceae	<i>Atriplex spp.</i>	A Saltbush	0.1			
Chenopodiaceae	<i>Atriplex stipitata</i>	Mallee Saltbush			0.1	0.1
Chenopodiaceae	<i>Atriplex vesicaria</i>	Bladder Saltbush	5			
Chenopodiaceae	<i>Dissocarpus paradoxus</i>	Cannonball Burr	0.1		1	
Chenopodiaceae	<i>Maireana brevifolia</i>					5
Chenopodiaceae	<i>Maireana pyramidata</i>	Black Bluebush	20	30	0.1	
Chenopodiaceae	<i>Maireana spp.</i>	Cotton Bush, Bluebush, Fissure-weed				1
Chenopodiaceae	<i>Maireana turbinata</i>				2	
Chenopodiaceae	<i>Rhagodia spinescens</i>	Thorny Saltbush	15	10		0.2
Chenopodiaceae	<i>Sclerolaena divaricata</i>	Tangled Copperburr	0.1		10	
Chenopodiaceae	<i>Sclerolaena spp.</i>	Copperburr, Poverty-bush		0.1		
Chenopodiaceae	<i>Sclerolaena tricuspis</i>	Giant Redburr		1		

¹ BAM Plot 3 was used for BAM-C calculations

Family	Scientific name	Common name	BAM Plot 1	BAM Plot 2	BAM Plot 3 ¹	BAM Plot 4
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides subsp. zygomphylla</i>				4	
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides subsp. filifolia</i>		5	10	2	
Fabaceae (Faboideae)	<i>Medicago praecox*</i>	Small-leaved Burr Medic	0.5			
Fabaceae (Faboideae)	<i>Vicia sativa*</i>	Common vetch	0.1			
Fabaceae (Mimosoideae)	<i>Acacia victoriae subsp. arida</i>		2		2	
Fabaceae (Mimosoideae)	<i>Prosopis velutina*</i>	Velvet Mesquite	2			
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida	0.1			
Myoporaceae	<i>Eremophila spp.</i>		0.1			
Myrtaceae	<i>Eucalyptus spp.</i>			7		
Nitrariaceae	<i>Nitraria billardierei</i>	Dillon Bush			1	
Papaveraceae	<i>Argemone ochroleuca*</i>					0.1
Poaceae	<i>Cynodon dactylon</i>	Common Couch	0.1			
Poaceae	<i>Enneapogon avenaceus</i>	Bottle Washers	0.1			
Solanaceae	<i>Lycium ferocissimum*</i>	African Boxthorn	1			10
Zygophyllaceae	<i>Zygophyllum eremaum</i>	Climbing Twinleaf			0.1	

* exotic species

Note: field data were collected in electronic format, therefore raw data sheets have not been provided.

Annex 3. BAM plot transect scores

Plot no.	PCT code	PCT abbreviated name and condition	Species richness							Cover (%)						
			Tree	Shrub	Grass	Forb	Fern	Other	High threat weed	Tree	Shrub	Grass	Forb	Fern	Other	High threat weed
1	155	Bluebush shrub land on stony rises and downs in the arid and semi-arid zones – moderate condition	0	10	2	3	0	7	1	0	67.4	0.2	1.3	0	3.4	1
2	155	Bluebush shrub land on stony rises and downs in the arid and semi-arid zones – low condition	1	5	0	0	0	0	0	7	51.1	0	0	0	0	0
3	155	Bluebush shrub land on stony rises and downs in the arid and semi-arid zones – low condition	0	10	0	2	0	0	0	0	22.2	0	0.2	0	0	0
4	155	Bluebush shrub land on stony rises and downs in the arid and semi-arid zones – low condition	0	4	0	0	0	3	1	0	6.3	0	0	0	0.3	10

* 1 m² litter quadrats were placed at 5 m (left), 15 m (right), 25 m (left), 35 m (right) and 45 m (left) along the central 50 m transect, all positioned 5 m from the transect centreline and alternating to the left and right from the transect centreline (as indicated).

Note: field data were collected in electronic format, therefore raw data sheets have not been provided.

Annex 4. Fauna species list

Scientific name	Common name	Observation type
Birds		
<i>Corvus coronoides</i>	Australian Raven	Observed
<i>Epthianura aurifrons</i>	Orange chat	Observed
Mammals		
<i>Oryctolagus cuniculus</i>	European Rabbit	Signs/scats
<i>Macropous robustus erubescens</i>	Euro	Observed
Reptiles		
<i>Tiliqua rugosa</i>	Shingleback	Observed

Note: field data were collected in electronic format, therefore raw data sheets have not been provided.

Annex 5. Threatened species status and likelihood of occurrence

Those subregions where a species was recorded (NSW BioNet Atlas database record) or where the BAM-C considered a species as potentially occurring are presented in red text.

Data source: BAM-C = BAM Calculator output Impact Area (direct impacts); ATLAS = NSW BioNet Atlas; PMST = Commonwealth Protected Matters Search Tool.

E = Endangered; V = Vulnerable, CE = Critically Endangered, R = Rare, Ex = Presumed Extinct.

Unless otherwise stated, habitat information obtained from DoEE 2021 and DPIE 2021.

Note: fish have been excluded from this table due to the absence of habitat in proximity to the study area.

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
Birds					
<i>Actitis hypoleucos</i>	Common Sandpiper		M	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. They have been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep.	None
<i>Amytornis modestus</i>	Thick-billed Grasswren	CE	V	The Thick-billed Grasswren is sedentary, usually inhabiting dense, low saltbush, cottonbush, bluebush and nitre-bush areas on sandy plains or depressions in gibber; also occurs along watercourses in clumps of Canegrass; when disturbed, individuals take refuge in any available cover, including piles of old flood debris along dry sandy watercourses and down rabbit burrows.	Low – known from one population at Packsaddle approximately 175 km to the north of Broken Hill
<i>Apus pacificus</i>	Fork-tailed Swift		M	In Australia, Fork-tailed Swifts mostly occur over inland plains but sometimes above foothills or in coastal areas, where they often occur over cliffs and beaches and also over islands and sometimes well out to sea, as well as over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes.	Low

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Ardeotis australis</i>	Australian Bustard	E		The Australian Bustard mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas.	Moderate
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	-	Dusky Woodswallows are often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. They have also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests.	Low
<i>Burhinus grallarius</i>	Bush Stone-curlew	E		The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia are they still common however and in the south-east it is either rare or extinct throughout their former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.	None
<i>Calamanthus campestris</i>	Rufous Fieldwren	V		The Rufous Fieldwren inhabits low shrublands, particularly saltbush and bluebush communities, and also areas around inland saline lakes.	Moderate
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		M	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season.	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). They occur along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. They generally occupy littoral and estuarine habitats, and in NSW are mainly found in intertidal mudflats of sheltered coasts. They also occur in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	None
<i>Calidris melanotos</i>	Pectoral Sandpiper		M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	None
<i>Certhionyx variegatus</i>	Pied Honeyeater	V		Pied Honeyeaters are widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. They occasionally occur further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. They inhabit wattle shrub, primarily Mulga (<i>Acacia aneura</i>), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (<i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Grevillea</i> spp.); also eats saltbush fruit, berries, seed, flowers and insects.	Low
<i>Circus assimilis</i>	Spotted Harrier	V		The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including <i>Acacia</i> and mallee remnants, inland riparian woodland, grassland and shrub steppe. They are found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		The Brown Treecreeper is found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Low
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	The Varied Sittella inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature eucalypts with hollows.	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Epthianura albifrons</i>	White-fronted Chat	V		The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 metres above sea level. In NSW, they occur mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, they are found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	Low
<i>Falco hypoleucos</i>	Grey Falcon	E	V	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Low
<i>Falco subniger</i>	Black Falcon	V		The Black Falcon is widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of NSW are likely to be referable to the Brown Falcon.	Low
<i>Gallinago hardwickii</i>	Latham's Snipe		M	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 metres above sea-level (Chapman 1969; Naarding 1981). They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (Frith et. al. 1977; Naarding 1983; Weston 2006, pers. comm.). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Frith et al. 1977; Naarding 1983).	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Grantiella picta</i>	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Low
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V		The Black-breasted Buzzard is found sparsely in areas of less than 500 millimetres rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts. They live in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. They also hunt over grasslands and sparsely timbered woodlands.	Low
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Little Eagles are most abundant in lightly timbered areas with open areas nearby. They are often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. They may nest in farmland, woodland and forest in tall trees.	Low
<i>Lophocroa leadbeateri</i>	Major Mitchell's Cockatoo	V		Major Mitchell's Coakatoos are found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW they are found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.	Low

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Lophoictinia isura</i>	Square-tailed Kite	V		The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km ² . Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Low – flyover only
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V		The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, they are common in few places, and rarely found on the coast. They are considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies <i>cucullata</i>) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies <i>picata</i> . Two other subspecies occur outside NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Low
<i>Motacilla cinerea</i>	Grey Wagtail		M, MA	This species has a strong association with water. In their normal breeding range, Grey Wagtails are found across a variety of wetlands, especially water courses, but also on the banks of lakes and marshes, as well as artificial wetlands such as sewage farms, reservoirs and fishponds. This association with water extends into non-breeding habitats with all confirmed Australian records being associated with water; especially creeks, rivers and waterfalls. On migration they may forage on rocky tidal flats.	None
<i>Motacilla flava</i>	Yellow Wagtail		M, MA	The Yellow Wagtail occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra.	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Oxyura australis</i>	Blue-billed Duck	V		The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	None
<i>Pedionomus torquatus</i>	Plains Wanderer	CE	CE	Plains-wanderers live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species	None
<i>Pezoporus occidentalis</i>	Night Parrot	E	E	The Night Parrot is known to occur within Spinifex grasslands in stony or sandy areas and samphire and chenopod associations on floodplains, salt lakes and clay pans. Suitable habitat is characterised by the presence of large and dense clumps of Spinifex, and they may prefer mature spinifex that is long and unburnt. Listed	None – listed as extinct within area
<i>Phaps histrionica</i>	Flock Bronzewing	E		Patchily distributed and rarely observed in NSW. It is likely to occur north of Broken Hill and west of Cobar when conditions are right. The extensive Mitchell grasslands around Brewarrina and Goodooga should also provide suitable habitat. Observed in a variety of vegetation types, including grassy plains, saltbush, spinifex and open mulga. Its preferred habitat is tussock grassland, particularly Mitchell grassland. They need to drink daily and may be seen adjacent to water, e.g. at stock tanks, bore drains and pools in water courses. Rest on the ground during the day and nest in a simple scrape on the ground in the cover of a bush, low branch, grass tussock, or in dust on bare ground around bores, often in close proximity to many others of the same species. Fairly common; highly nomadic, this species was named because of its tendency to form huge flocks (e.g. flocks of up to 100,000 birds were noted during the 1930s). Flocks of over a thousand are rare today.	Moderate – may occur on occasion

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Pomatostomus halli</i>	Hall's Babbler	V		It occurs in central-eastern Australia, from Cobar north into south-western Queensland, particularly along or west of the Warrego Rive. These birds have been recorded from the White Cliffs area through to the Culgoa River, Nocolche Nature Reserve, Sturt National Park and Mutawintji National Park. Recently recorded in Mulga groves near Ledknapper Creek (1993) and near Mt Gunderbooka (1994). Inhabits dry <i>Acacia</i> scrub, mainly Mulga, with a grassy understorey including spinifex, on ridges and plains with either sandy or stony soils. Occasionally occurs in open dry <i>Eucalyptus</i> (Bimblebox) woodland, and mulga- or eucalypt-lined watercourses. Hall's Babblers construct neat spherical dome nests, each with a side entrance, from twigs within the outer branches of acacias, in the upright forks of mulgas and <i>Casuarina</i> , or in a horizontal eucalypt branch 3-10 m above the ground. Probably sedentary, maintaining home ranges of up to several hectares which contain a clump of roosting nests, each securely attached to small branches just inside the foliage, 3-7 m above the ground. Appear to occur in very localised patches.	Low
<i>Pyrholaemus brunneus</i>	Redthroat	V		In NSW the Redthroat has been recorded mainly in chenopod shrublands including Old Man Saltbush, Black Bluebush and Dillon Bush shrublands. Around Broken Hill they appear to be associated with the denser vegetation, particularly Acacias, found in drainage lines that run from the rocky hills. In other locations they are known from Canegrass and Lignum swamps and depressions, particularly on floodplains.	Moderate
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	None
<i>Stictonetta naevosa</i>	Freckled Duck	V		The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Tyto longimembris</i>	Eastern Grass Owl	V		Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Eastern Grass Owl numbers can fluctuate greatly, increasing especially during rodent plagues. Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. If disturbed they burst out of cover, flying low and slowly, before dropping straight down again into cover. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation.	Low
Mammals					
<i>Chalinolobus picatus</i>	Little Pied Bat	V		The Little Pied Bat occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. They can tolerate high temperatures and dryness but need access to nearby open water.	None
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	Low
<i>Notomys fuscus</i>	Dusky Hopping-mouse	E	V	The Dusky Hopping-mouse is nocturnal and terrestrial, feeding primarily on seeds and green vegetation insects. They do not need to drink. Most records are from sand dunes, hills and ridges associated with perennial Sandhill Canegrass (<i>Zygochloa paradoxa</i>), Dillon Bush (<i>Nitraria billardierei</i>) and Acacia species, characteristic of the Simpson Strzelecki Dunefields Bioregion. In contrast, the southern-most record in NSW was from the Broken Hill Complex Bioregion, and collected in Bluebush (<i>Maireana pyramidata</i>) chenopod shrubland near a drainage line with River Red Gums (<i>Eucalyptus camaldulensis</i>), Prickly Wattle (<i>Acacia victoriae</i>) and Western Boobiala (<i>Myoporum montanum</i>).	Moderate

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V	Corben's Long-eared Bat inhabits a variety of vegetation types, including mallee, bulloke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but they are distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	None
<i>Pseudomys bolami</i>	Bolam's Mouse	E		Bolam's Mouse has been recorded in a wide variety of habitats, with a preference for chenopod shrubland plains or low mallee woodland where there is a developed understorey of <i>Acacia</i> , <i>Dodonaea</i> or <i>Eremophila</i> species. They seem to especially favour plains areas, spillways and along valley bottoms where loam or clay soils occur. It has been recorded in four broad vegetation types in Tarawi Nature Reserve: Mallee-spinifex, Mallee shrubland, Belah woodland and Mixed open shrubland/woodland.	Low
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	The Yellow-bellied Sheathtail-bat roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Low
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	V		Stripe-faced Dunnart are found throughout much of inland central and northern Australia, extending into central and northern NSW, western Queensland, Northern Territory, South Australia and Western Australia. They are rare on the NSW Central West Slopes and North West Slopes with the most easterly records of recent times located around Dubbo, Coonabarabran, Warialda and Ashford. Native dry grasslands and low dry shrublands, often along drainage lines where food and shelter resources tend to be better. They shelter in cracks in the soil, in grass tussocks or under rocks and logs.	Moderate
Reptiles					
<i>Antaresia stimsoni</i>	Stimson's Python	V		Occurs in north-west NSW, from Bourke and Gundabooka National Park in the east to Broken Hill and Wilcannia in the south. A terrestrial and semi-arboreal species that inhabits a wide range of arid and semi-arid environments including rock outcrops, sandy plains and dunefields where it is associated with larger trees and termite mounds. The species occupies a broad spectrum of habitats includes woodlands, shrublands (including <i>Acacia</i> and chenopods) and hummock grasslands, where rocky outcrops provide caves and deep crevices and where tree-lined watercourses provide numerous low hollows and fallen trees.	Low

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Aspidites ramsayi</i>	Woma	V		The Woma occurs in north-western NSW, east to about Louth and Bourke. It was last recorded in these eastern districts in the late 1890s, and in 1983 from the Tibooburra region. Its range and abundance in south-eastern Australia is considered to be undergoing serious decline. Terrestrial, inhabiting subtropical to temperate deserts and sandy plains, as well as dunefields and deep cracking black soil plains in semi-arid areas. Occurs in hummock grasslands, shrublands or woodlands and shelters in animal burrows, hollow logs or under grass hummocks.	Moderate
<i>Ctenophorus mirrityana</i>	Barrier Range Dragon	E		The Barrier Range Dragon is currently known from three highly restricted and fragmented sites near Mutawintji National Park and Broken Hill. They are restricted to rock outcrops in ranges and gorges. They are absent from apparently suitable habitat in NSW. Diurnal, basking on exposed rocks.	None
<i>Cyclodomorphus melanops elongatus</i>	Mallee Slender Blue-tongued Lizard	E		The species is widely distributed in inland areas of all mainland states (except Victoria) and the Northern Territory, with the subspecies <i>elongatus</i> occurring from southern Western Australia to central Queensland. In NSW it is restricted to the far south west with records scattered from mallee areas either side of the Darling River (including the Scotia mallee and Mungo and Mallee Cliffs National Parks). Recent surveys have detected this species in spinifex occurring on rocky hillsides to the north west of Broken Hill, a range extension over 100 km in NSW. In NSW, animals inhabit mallee/spinifex communities on a sandy or mixed sand/gravel substrate (plains, ridges or hillslopes). It is assumed that the species seeks refuge in vegetation clumps such as spinifex and in fallen timber and leaf litter.	Low
<i>Delma australis</i>	Marble-faced Delma	E		In NSW, the Marble-faced Delma appears to be restricted to temperate mallee woodlands or spinifex grasslands but elsewhere is also found in chenopod shrublands, heathlands and buloke associated with mallee habitats or eucalypt lined watercourses. The species occupies areas with a sandy substrate but may also utilise cracking red loam soils, but has also recently been recorded in spinifex on rocky hillsides. They are found in deep leaf litter, under rocks, logs, fallen timber or in grass clumps such as spinifex. They are considered to be terrestrial although they may climb into hummock grass and even sleep in the branches of small shrubs.	Low
<i>Pseudonaja modesta</i>	Ringed Brown Snake	E		Determined on the basis of only limited records until recently, the Ringed Brown Snake thought to occupy the north-west portion of the state having been recorded from Tarawi Nature Reserve, 140 km south of Broken Hill, Silverton, Tibooburra, Wanaaring and from Kilberoo, 140 km north-west of Bourke. Recent surveys have identified a large population in the Scotia Sanctuary-Tarawi NR region. They are a terrestrial species that inhabits drier areas including rocky outcrops and dry watercourses. They occur in a variety of vegetation types including woodlands, shrublands, mallee and grasslands. By night they shelter in ground debris or abandoned animal burrows.	Moderate

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	V		There are scattered records of Western Blue-tongued Lizard across central western and western NSW. No observations from northwest NSW to date. Diurnally forages for insects, snails, native vegetation and carrion. Inhabits plains, swales, ranges and sometimes dunes of loamy or clayey/sandy soils vegetated by woodlands, especially mallee, shrublands (including chenopods), heaths or hummock grasslands. Preferred vegetation type appears to be mixed mallee/ <i>Triodia</i> communities. Terrestrial, and known to utilise rabbit warrens for shelter.	Low
Flora					
<i>Acacia carneorum</i>	Purple-wood Wattle	V	V	Purple-wood Wattle grows in grassland and woodland in red, sandy soil; also found in Mulga communities on sand dunes, level sandy sites and alluvial accumulations along watercourses; recorded from inland semi-arid Acacia and Casuarina shrublands and woodlands. Preferred soils are shallow, calcareous and loamy, and include brown earths, crusty alkaline soils and neutral red duplex soils; confined to red-earth dune soils in Kinchega NP as a dominant or occasionally co-dominant, usually on dune crests or slopes.	Low
<i>Acacia notabilis</i>	Mallee Golden Wattle	E		Mallee Golden Wattle occurs west from Menindee in the far western plains of NSW. Early collections come from Byrnedale Station near Menindee and a locality south of Broken Hill. They are known in Victoria from two disjunct locations in the central-north and north-west. They are common throughout some regions of South Australia, and grow in mallee communities and open woodland on stony and rocky hills; soils types include brown lateritic loam, red clay-loam, shallow stony sands and red silty gravely sand.	None – absent from study area
<i>Acacia rivalis</i>	Creek Wattle	V	V	The Creek Wattle has been recorded from the Broken Hill district, but was originally found in SA, where it was described as being endemic and confined to the northern part of the Flinders Ranges region. There is a possibility that the species did not occur naturally in New South Wales but has become naturalised in a restricted area near Broken Hill. In NSW, <i>Acacia rivalis</i> is confined to woodland communities bordering ephemeral creeks and streams and along watercourses. They grow in a variety of stony soils, often with limestone content.	None
<i>Frankenia plicata</i>			E	<i>Frankenia plicata</i> grows in a range of habitats, including on small hillside channels, which take the first run-off after rain (Leigh et al., 1984). In the Simpson Desert, the species has been found predominantly from swales of loamy sands to clay (Neagle, 2002). This species is found in a wide range of vegetation communities that have good drainage (Neagle, 2002).	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Indigofera longibractea</i>	Showy Indigo	E		Showy Indigo is restricted to an area just north of Broken Hill known as the Waukeroo Hills. They also occur in SA at sites in the Musgrave and Flinders Ranges. They are found on rocky hills and creek beds, growing in limited numbers in shallow stony soils among rock outcrops. Across their range they occupy a variety of rocky habitats, ranging from creeks to scree slopes and ridges.	None
<i>Lepidium monoplacoides</i>	Winged Peppergrass	E	E	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but few recent collections. There is a single collection from Broken Hill and only two collections since 1915, the most recent being 1950. Also previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin. Recorded more recently from the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by <i>Allocasuarina luehmannii</i> (Bullock) and/or eucalypts, particularly <i>Eucalyptus largiflorens</i> (Black Box) or <i>Eucalyptus populnea</i> (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising <i>Eragrostis australasicus</i> , <i>Agrostis avenacea</i> , <i>Austrodanthonia duttoniana</i> , <i>Homopholis proluta</i> , <i>Myriophyllum crispatum</i> , <i>Utricularia dichotoma</i> and <i>Pycnosorus globosus</i> , on waterlogged grey-brown clay. Also recorded from a <i>Maireana pyramidata</i> shrubland. Flowers from late winter to spring, or August to October.	Low
<i>Solanum karsense</i>	Menindee Nightshade	V	V	Menindee Nightshade is a species of <i>Solanum</i> endemic to NSW, restricted to the far south-western plains, extending up the Darling River to the Menindee and Wilcannia districts. Mainly restricted to the area between the Darling and Lachlan Rivers. Localities include Kars Station, Lake Tandou, Lake Cawndilla, Oxley area, between Broken Hill and Menindee, and the Darling River. They have been recorded from Kincheha National Park and Nearie Lake Nature Reserve. They grow in occasionally flooded depressions with heavy soil, including level river floodplains of grey clay with Black Box and Old Man Saltbush, and open treeless plains with solonised brown soils. Habitats are generally lake beds or floodplains of heavy grey clays with a highly self-mulching surface. They are also found on sandy floodplains and ridges and in calcareous soils, red sands, red-brown earths and loamy soils.	None

Scientific name (Data source)	Common name	NSW BC Act	EPBC Act	Habitat	Likelihood of occurrence
<i>Swainsona flavicarinata</i>	Yellow-keeled Swainsona	E		Not common in NSW, having an outlier population in the Broken Hill-Menindee district in the far western plains. More common in the southern parts of the NT and inland SA. Grows in deep red sand, recorded from a roadside on a treeless plain in NSW. In central Australia, the species grows in Mulga communities on red earths and on stony soils supporting Bladder Saltbush. Also found on sandy plains and ridges, in grassland, and in watercourses and floodplains near creeks or rock holes. Associated species include <i>Acacia murrayana</i> , <i>A. aneura</i> , <i>Maireana aphylla</i> , <i>Atriplex vesicaria</i> , <i>Triodia</i> , <i>Solanum</i> and <i>Euphorbia</i> spp.	Low – not detected during targeted surveys
<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	The Slender Darling Pea is found throughout NSW, being recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with <i>Maireana</i> species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	Low – marginal habitat within better condition areas of the study area only, which have been avoided through Project design/site selection. Not detected during targeted surveys.

Annex 6. Ecosystem and species credits required (BAM-C Credit report)

Annex 7. EPBC Act Significant Impact Criteria Assessment

Assessments of Significance and supplementary information (where relevant) are presented for the following MNES in relation to the Project:

- Threatened Fauna
 - Dusky Hopping Mouse (*Notomys fuscus*)

Dusky Hopping Mouse (*Notomys fuscus*) (Vulnerable)

Distribution

The Dusky Hopping-mouse occurs in north-eastern South Australia, in the southern Strzelecki and the Cobblers Deserts (Ehmann & Watson, undated), north-western NSW and southwestern Queensland. It is possible the species distribution may extend as far south as Mutawintji, in central-western NSW (Moseby *et al.*, 1999). The Dusky Hopping-mouse occurs within the Sturt National Park, Lake Eyre National Park, and Strzelecki Regional Reserve (DEC, 2005; EPA, 2006; Ehmann & Watson, undated). In NSW it occurs within the Western Natural Resources Management Regions.

Life cycle, habitat requirements and site

It is a nocturnal and terrestrial rodent which feeds primarily on seeds, and also green vegetation and insects. It does not need to drink. Lives in stable colonies of up to five individuals in a burrow system. Forages on open sand areas, rarely venturing into surrounding habitats. The Dusky Hopping Mouse inhabits a variety of soft sandy habitats, preferring sand dunes, hills and ridges with Cane Grass (*Ophiuros exaltatus*), Sandhill Wattle (*Acacia ligulata*), Nitrebush (*Nitraria billardiera*), Sticky Hopbush (*Dodonea viscosa*) and other annual and perennial shrubs (Watts, 1995; DEC, 2005; EPA, 2006; Ehmann & Watson, undated). In contrast, the southern-most record in NSW was from the Broken Hill Complex Bioregion, and collected in Bluebush (*Maireana pyramidata*) chenopod shrubland near a drainage line with River Red Gums (*Eucalyptus camaldulensis*), Prickly Wattle (*Acacia victoriae*) and Western Boobiala (*Myoporum montanum*).

A common characteristic of many Australian desert rodents are large fluctuations in their population densities. Rainfall is usually considered to be the major influence on populations of these rodents (Finlayson 1939; Dickman 1993; Predavec 1994; Dickman *et al.* 1999). Populations increase after rainfall (with a time-lag) and the subsequent increase in food abundance (Predavec 1994; Southgate and Masters 1996; Dickman *et al.* 1999). With the onset of drought conditions populations can crash precipitously (Klöcker 2009).

Survey/records within the Site and surrounds

There is one record of a dead Dusky Hopping Mouse (cat kill) recorded in the front garden of a house in Broken Hill, approximately 5.5 km from the study area.

Impact Summary

The Project would require removal of 0.82 ha of native vegetation providing potential habitat for the Dusky Hopping Mouse. However, given the limited records of this species in bluebush shrubland, the degraded state of the Project Area, and the lack of tracks or burrows, it is unlikely to rely on habitat within the Project Area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. lead to a long-term decrease in the size of an important population of a species

The Project would require the removal of approximately 0.82 ha of potential habitat for the Dusky Hopping Mouse. Habitat within the Project Area is in low condition, consisting of bluebush shrubland that is atypical habitat for this species. Moderate condition habitat is being avoided. Due to current disturbances, including the presence of European Rabbits, and the patchy shelter and foraging habitat within the study area, it is unlikely that the Project would lead to a long-term decrease in the size of an important population.

2. reduce the area of occupancy of an important population

As the Project Area is unlikely to contain a population due to current disturbances and patchy habitat, the removal of 0.82 ha of bluebush habitat is unlikely to reduce the area of occupancy of the species.

3. fragment an existing important population into two or more populations

As the Project Area is unlikely to contain a population due to current disturbances and patchy habitat, the Project is unlikely to fragment a population into two or more populations.

4. adversely affect habitat critical to the survival of a species

Critical habitat has not been defined for this species. The Project Area is unlikely to contain habitat critical to the survival of the species.

5. disrupt the breeding cycle of an important population

The following is known about the breeding cycle of the Dusky Hopping Mouse (NSW SC 2004):

- Inhabits vegetated sand dunes and excavates tunnels that are up to 5m in length, which are accessed via vertical 1m deep shafts.
- Nesting is communal with up to five individuals sharing a tunnel system
- Litter sizes of four to five have been recorded (Klocker 2009)
- Populations can irrupt during favourable conditions – after rainfall and the subsequent increase in food abundance

As the Project Area is unlikely to contain a population due to current disturbances and patchy habitat, the Project is unlikely to disrupt the breeding cycle of an important population.

6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Project would require the removal of 0.82 ha of low condition native vegetation that would provide potential shelter and foraging habitat for the Dusky Hopping Mouse. Given the current disturbances at the within the Project Area (e.g. presence of rabbits, multiple informal tracks), that habitat is in low condition, and that the vegetation is atypical habitat for this species, the removal of 0.82 ha is unlikely to decrease the availability of habitat to the extent that the species is likely to decline.

7. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

*Predation by cats and foxes, particularly in areas where dingoes are excluded, and competition for food and habitat from the introduced house mice (*Mus domesticus*) and rabbits (*Oryctolagus cuniculus*) are both listed as threats to the Dusky Hopping Mouse (DEWHA 2008). The Project is unlikely to result in an increase in the abundance of cats, foxes, house mice or rabbits, however their numbers would currently be well established in the locality and an existing threat to small native fauna.*

8. introduce disease that may cause the species to decline

There are no known documented diseases that are currently contributing to the decline of the species. The Project is not expected to cause an increased risk of any diseases that would impact the Dusky Hopping Mouse.

9. interfere substantially with the recovery of the species.

There is no adopted or made recovery plan for this species. Relevant priority actions listed in the approved conservation advice (DEWHA 2008) include:

- Habitat Loss, Disturbance and Modification
 - Identify sites of high conservation priority.
 - Manage threats to areas of native vegetation containing populations of the Dusky Hopping-mouse.
- Animal Predation and Competition
 - Implement appropriate management recommendations outlined in the threat abatement plans for the control and eradication of feral cats, foxes and rabbits in the local region.
 - Develop and implement a management plan for the control and eradication of house mice in the local region.
- Conservation Information
 - Raise awareness of the Dusky Hopping-mouse within the local community.
- Enable recovery of Additional Sites and/or Populations
 - Investigate options for linking, enhancing or establishing additional populations.

The Project would not interfere substantially with any of the actions listed within the approved conservation advice.

Conclusion: The removal of 0.82 ha of atypical and degraded habitat as part of the Project is unlikely to have a significant impact on the Dusky Hopping Mouse.

References

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Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting

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Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)