Biodiversity Development Assessment Report

SANDY HOLLOW SOLAR FARM

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ngh environmental

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ACRONYMS AND ABBREVIATIONS

BAM	Biodiversity Assessment Methodology
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	*Biosecurity Act 2015*
Cwth	Commonwealth
DBH	Diameter at Breast Height
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
GHG	Greenhouse gases
ha	Hectares
HBT	Hollow-bearing trees
km	Kilometres
LEP	Local Environment Plan
LRET	Large-scale renewable energy target
m	Metres
MW	Megawatt
MNES	Matters of National environmental significance under the EPBC Act (*c.f.*)
MW	Megawatt
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PCT	Plant Community Type
PV	Photovoltaic
SAII	Serious and Irreversible Impact
TEC	Threatened Ecological Community
VIS	Vegetation Integrity Score

EXECUTIVE SUMMARY

Vernon Trust is planning for the construction of a 6 Megawatt (MW) photovoltaic solar farm east of Sandy Hollow, NSW. This Biodiversity Development Assessment Report (BDAR) has been prepared by NGH Environmental as requested by Renewable Management on behalf of the proponent, Vernon Trust.

The aim of this BDAR is to address the requirements of the *Biodiversity Conservation Act 2016* (BC Act). This BDAR forms part of a Development Application (DA) prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Biodiversity Assessment Methodology (BAM) is the required assessment methodology for local developments that trigger the NSW Biodiversity Offsets Scheme (BOS), under the BC Act. This report follows the field work methodologies and assessment required by the BAM.

Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM. The majority of the development site has been cleared of native vegetation, and purposed for cattle grazing, which is the dominant land use in the area. Around 35.8 ha of native vegetation occurs in the development site comprised of cleared grassland and a patch of remnant woodland of *PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter* (PCT 1612). PCT 1612 is not listed as a Threatened Ecological Community (TEC) under the BC Act, but may represent the federally listed *Central Hunter Valley eucalypt forest and woodland* under certain conditions. In this instance, PCT 1612 has been determined to not constitute the federal TEC.

Consideration has been given to avoiding and minimising impacts to native vegetation throughout each phase of the proposal. Site design options have been assessed against key environmental, social and economic criteria. The vast majority of woodland has been avoided by the development footprint. Mitigation and management measures would be put in place to adequately address impacts associated with the proposal, both direct and indirect.

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- 13.55 ha of PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter

The removal of this native vegetation generated the following ecosystem credits

- PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter - **4 credits**

0.19 ha of planted vegetation that does not resemble a native plant community type would also be removed.

One (1) ecosystem species, Grey-crowned Babbler *Pomatostomus temporalis*, was detected during the site surveys. The BAM Calculator required that three (3) candidate species credit species, Barking Owl *Ninox connivens*, Large-leafed Monotaxis *Monotaxis macrophylla* and Scant Pomaderris *Pomaderris queenslandica*, be considered. All three species were excluded from this assessment on the basis of the development site lacking suitable habitat or more specifically in the case of Barking Owl, no suitable breeding habitat would be directly or indirectly impacted. No predicted candidate species credit species were considered to warrant inclusion due to the general low habitat quality within the development site. However, two orchid species, Pine Donkey Orchid Diuris tricolor and Tarengo Leek Orchid Prasophyllum petilum, have significant records to the north-east at Mangoola Mine in vegetation likely to be similar to that of PCT 1612. Given this, both these species were included for assessment and in lieu of targeted surveys being undertaken, presence was assumed in the portion of the development site where conditions

are most favourable. favourable. Assumption of presence for these two species generated four (4) species credits for Pine Donkey Orchid and five (5) for Tarengo Leek Orchid.

The retirement of the credits generated will be carried out in accordance with the BOS under the BC Act. With the retirement of credits and effective implementation of the mitigation measures, the proposal would be consistent with the requirements of the BAM.

1 INTRODUCTION

A 6 MW solar farm is proposed at Sandy Hollow, NSW (the proposal). This development is being assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). An initial flora and fauna constraint assessment by NGH Pty Ltd (NGH) determined that the development exceeded the Biodiversity Offset Scheme (BOS) Thresholds for the clearing of native vegetation. As such, this triggered the requirement for the preparation of a Biodiversity Development Assessment Report (BDAR). This BDAR assesses the impacts of the proposal according to the NSW Biodiversity Assessment Methodology (BAM) and determines the offset requirements for the proposal.

The following terms are used in this document:

- **Development footprint** – The area of land that is directly impacted on by the proposal including, solar array design, perimeter fence, Asset Protection Zones (APZ), access roads, switching station and temporary areas used to store construction materials etc.
- **Development site** – The development site is approximately 38.1 hectares (ha). The development site is the area surveyed for this assessment.
- **Subject land –** All land that has been assessed. It is the same as the development site.
- **Buffer area –** All land within 1500 m of the outside edge of the boundary of the development footprint.

1.1 THE PROPOSAL

Sandy Hollow Solar Farm would occupy about 38.1 ha of the 55.6 ha subject land, retaining existing viable native vegetation remnants where they occur. The proposed solar farm infrastructure layout has been located and designed to avoid and minimise environmental impacts. It has been developed in tandem with the Statement of Environmental Effects (SEE) that will accompany the DA to ensure potential impacts are avoided and minimised wherever possible. A preliminary constraints analysis of the subject land was used to help design the solar farm layout and plan the environmental assessment. Biodiversity features such as native forest remnants have been excluded from the development footprint to minimise removal of native vegetation. The key features of the proposed development are summarised in Table 1-1. Note that component specifications are subject to detailed design and product selection. For the purposes of this assessment, total clearing within the solar footprint has been assumed.

Table 1-1 Summary of the key features of the proposal

Proposal element	Description
Proposal	Sandy Hollow Solar Farm
Capacity	6 MW *Note: the capacity is based on products and technology available at the time of the proposal but may change through the life of the solar farm as advances in technology occur.*
Development footprint	Approximately 14 hectares solar farm infrastructure area
Solar array	Approximately 16,200 solar panels mounted in rows on tracker tables and approximately 2, 000 array posts. One containerised power station (containing 2 x SMA MV Power Station 4950 or similar) on the eastern side of the solar array.
Substations	A grid connection switching station on the northern side of the site is proposed. This would connect to the existing 33kv transmission line which would be extended to a proposed containerised power station within the development site. A right of carriageway would need to be established on the property title, in favour of AusGrid, for access/maintenance purposes.

Site compound	Approximately 800sqm containing containerised inverter, control facilities, storage as well as temporary site office and amenities.
Access tracks	Internal access tracks would be constructed of engineered fill topped with crushed stone pavement would access the solar farm infrastructure for maintenance.
Perimeter fencing, lighting and CCTV	Wire mesh fencing installed around the site would indicatively be 1.94 metres high. Continuous infra-red security technology and CCTV cameras would be installed on posts around the perimeter fence and on the main access track.
Construction hours	Standard daytime construction hours would be 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays.
Construction timing	9 months
Workforce	Construction – approximately 30 workers Operation – 1 operation and maintenance contractor, stationed off-site
Operation period	Up to 40 years
Decommissioning	The site would be returned to its pre-works state. All above ground infrastructure would be removed to a depth of 1000mm (exceptions apply, see Section 2.6). The site would be rehabilitated in consultation with the landowner, consistent with future land use requirements.
Capital investment value	Calculated $5.6 million.

In total, the construction phase of the proposal is expected to take nine months. Sandy Hollow Solar Farm would be expected to operate for up to 25 years. Approximately two to three operations and maintenance personnel would operate the plant. The solar farm would be decommissioned at the end of its operational life; all above ground infrastructure and below ground infrastructure up to 1000 mm deep would be removed in consultation with the landowner, with the site to be returned to its existing land capability for agricultural land use.

1.2 THE DEVELOPMENT SITE

1.2.1 Site location

The proposed location of Sandy Hollow Solar Farm is in the Muswellbrook Local Government Area (LGA). The land is legally identified as Lot 12 DP 1042612, which is bisected by the Muswellbrook-Merriwa rail line. The land is situated on the southern side of Merriwa Road (the Golden Highway), 1km east of the intersection with Bylong Valley Way. The village of Sandy Hollow is located approximately 2.6km to the west of the development site.

The existing 11kv overhead transmission line currently runs in a southeast direction from Bylong Valley Way in the northwest corner of the site, toward Rosemount Road. There is also an existing 33kv line that runs from Denman to Merriwa that runs along the Merriwa Road to the north. Both would be utilised as part of the proposed development.

1.2.2 Site description

The development site is bordered by the Golden Highway to the north, train line to the south and agricultural land to the east and west. Access points for the development site occur off of the Golden Highway.

Sandy Hollow Solar Farm development site comprises around 38.1 ha of freehold land. The majority of the development site has been cleared of native vegetation, and modified for agriculture, which is the dominant land use in the area. Specific to the subject land, this has included:

- Extensive clearing of native vegetation;
- Paddocks sown with pasture;
- Widespread earth moving to flatten and level the paddocks; and
- Modification of a natural drainage line into farm dams.

The proposal is located within the Sydney Basin Bioregion with the remaining vegetation on the development site comprising a modified dry sclerophyll forest characterised by the presence of Narrow-leaved Ironbark *Eucalyptus crebra*. Planted areas of non-local, non-NSW native and exotic vegetation, comprising trees and shrubs such as Sugar Gum *Eucalyptus cladocalyx*, Pepper Tree *Schinus molle*, Lemon-scented Gum *Corymbia citriodora* and Silky Oak *Grevillea robusta* are planted along the driveway and surrounding the homestead.

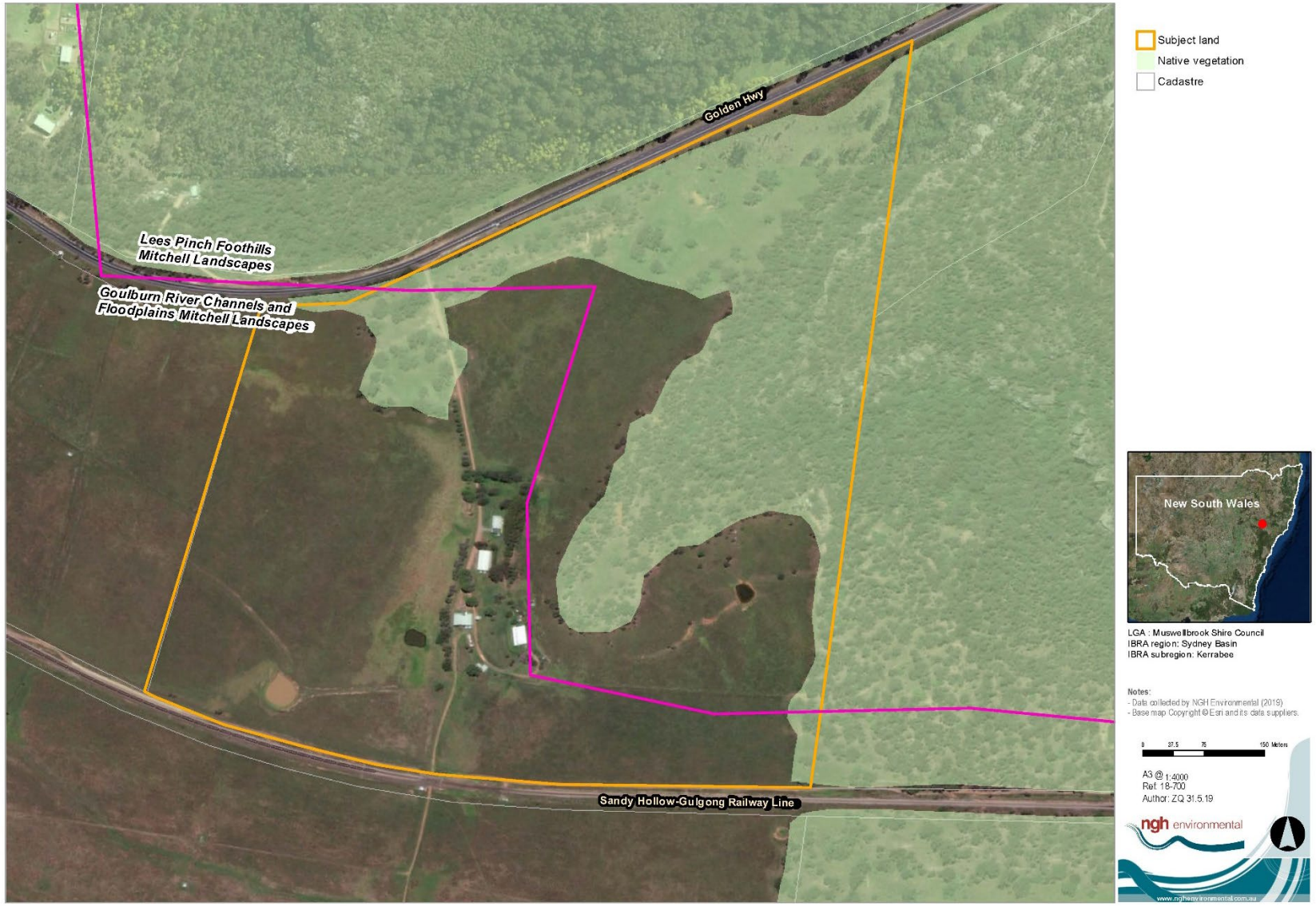


Figure 1-1 Site Map

1.3 STUDY AIMS

This BDAR has been prepared by NGH on behalf of Vernon Trust. The aim of this BDAR is to address the requirements of the BAM and BOS, as mandatory for qualifying developments.

1.4 SOURCE OF INFORMAITON USED IN THE ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by Renewable Management on behalf of the proponent
- Australian Government's Species Profiles and Threats (SPRAT) database http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- NSW OEH's Threatened Species Profiles http://www.environment.nsw.gov.au/threatenedspeciesapp/
- DPI profiles of threatened species, population, and ecological communities
- Commonwealth Department of Environment and Energy Protected Matters Search Tool

  Accessed online at http://environment.gov.au/epbc/protected-matters-search-tool
- Australia's IBRA Bioregions and sub-bioregions. Accessed http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- NSW OEH's Biodiversity Assessment Method (BAM) calculator http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx.
- NSW OEH's BioNet threatened biodiversity database

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

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

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

  Accessed online via login at http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx
- OEH VIS Mapping

  Accessed online at http://www.environment.nsw.gov.au/research/VISmap.htm
- Office of Environment and Heritage (OEH) (2017a). Biodiversity Assessment Method.
- NSW Government SEED Mapping

  https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- NSW Biodiversity Values Map https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap

2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGIONS

The development site falls within the Sydney Basin IBRA Bioregion and the Kerrabee Subregion.

The Sydney Basin is contained wholly on the central east coast of NSW and extends from just north of Batemans Bay to Nelson Bay on the Central Coast, and almost as far west as Mudgee. The Sydney Basin is dominated by a temperate climate characterised by warm summers with no dry season. It consists of a geological basin where sedimentary rocks have been subject to uplift and gentle folding and minor faulting during the formation of the Great Dividing Range. Erosion by coastal streams has created a landscape of deep cliffed gorges and remnant plateaus. The Sydney Basin Bioregion includes coastal landscapes of cliffs, beaches and estuaries.

The Kerrabee Subregion is characterised by sandstone plateaus with cliffed edges into wide valleys with sandy alluvial fill. The geology of the Kerrabee Subregion is comprised of Triassic Narrabeen quartz and lithic sandstones and shales.

Vegetation communities within the subregion occupy suitable landscapes, such as:

- Yellow Bloodwood, Broad-leaved Ironbark, Rough-barked Apple, Grey Gum with Scribbly Gum and shrubs and patches of dry heath on plateau;
- Rough-barked Apple, Forest Red Gum, Grey Box, White Box, Yellow Box, Fuzzy Box, with Qld Blue Grass and Three-awned Spear Grass in valleys;
- River Oak on the main streams;
- Volcanic necks and domes always support distinctive local vegetation, usually a box with grassy understorey.

2.1 NSW LANDSCAPE REGIONS AND AREA

The development site is situated across the boundary of the Goulburn River Channel and Floodplains and Lees Pinch Foothills Mitchell Landscapes. The majority occurs on Goulburn River Channel and Floodplains, so this was entered into the BAM Calculator for the proposal.

2.2 NATIVE VEGETATION

As determined by aerial imagery and GIS software, approximately 466 ha of native vegetation occurs in the surrounding 1500 m buffer area. This vegetation in the landscape surrounding the development site is predominantly a grassy/shrubby dry forest dominated by Narrow-leaved Ironbark *Eucalyptus crebra*, Grey Gum *Eucalyptus punctata/ Eucalyptus canaliculata*, Red Ash *Alphitonia excelsa*, Rough-barked Apple *Angophora floribunda*, Blakely's Red gum *Eucalyptus blakelyi* and Brown Bloodwood *Corymbia trachyphloia.*

2.3 CLEARED AREAS

Within the 1500 m buffer around the development site, around 679 ha has been cleared of native vegetation. These cleared areas in the development site are primarily used for grazing.

Figure 2-1 Example of cleared areas in the development site

2.4 RIVER AND STREAMS

The development site is located within the Hunter River Catchment, about 15 km west from the Hunter River. No named creeks, streams or waterways, ephemeral or otherwise, run through the development site. However, one artificial drainage line, purposed for feeding a farm dams occur in the south-east. Movement of water outside of the development site is not evident through any feature, therefore the development site is unlikely to contribute to the flow of the nearby Goulbourn River to the south.

2.5 WETLANDS

No wetlands occur within the development site; however, four small, man-made dams are present. All dams contain minimal fringing vegetation and are heavily utilised by stock (Figure 2-2 and Figure 2-3).

Figure 2-2 Northernmost farm dam within the development footprint

An EPBC Protected Matters search completed on 20 February 2019 identified one wetland of international importance, Hunter Estuary Wetlands, which is located over 100 km east from the development site (DEE 2010). This would not be impacted by the proposal.

2.6 CONNECTIVITY FEATURES

The portion of the buffer area to the south of development site is largely cleared such that very little wooded vegetation remains. Conversely, the northern portion is far more vegetated as it contains hillsides and slopes less suitable for human land use. These hillsides and slopes occur on the edge of a significant tract of bushland that extends northwest into ultimately Manobalai Nature Reserve. The fringe of this vegetation enters into the development site from the north, though minimally, in the form of remnant Narrow-leaved Ironbark and Rough-barked Apple. As such, the development site is arguably a minute part of a much larger connectivity feature. Connectivity within the development site is limited to east-west movement in the north where wooded vegetation remains.

Figure 2-3 Southernmost farm dam in the development site

2.7 AREAS OF GEOLOGICAL SIGNIFICANCE

No karsts, caves, crevices or cliffs or other areas of geological significance occur within the development site. Some of these features, in the form of crevices and sandstone overhangs, however, do occur in the surrounding vegetated ridgelines but will not be directly or indirectly impacted.

2.8 AREAS OF OUTSTANDING BIODIVERSITY VALUE

No Areas of Outstanding Biodiversity Value occur within the development site, however, bushland in the east of the subject land is mapped on the NSW Biodiversity Values Map under the *Biodiversity Conservation Regulation 2017* (Figure 2-4). The potential impact to an area of high biodiversity value would trigger the BOS and requirement of a BDAR if not already necessary.

Figure 2-4 Areas mapped on the NSW Biodiversity Values Map.

2.9 SITE CONTEXT COMPONENTS

Method applied

The proposal conforms to the definition of a *site-based development* under the BAM and therefore the site-based development assessment methodology has been used in this BAM assessment. Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the PCT. PCTs were allocated based on existing vegetation mapping, field inspections and aerial imagery.

Percent Native Vegetation Cover

The 1500m buffer area around the development site comprises as area of 1145 ha. As determined by GIS mapping from aerial imagery, approximately 466 ha of native vegetation occurs in the 1500 m buffer area (Figure 2-5).

The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 40.7%. This was entered into the BAM calculator for the assessment.

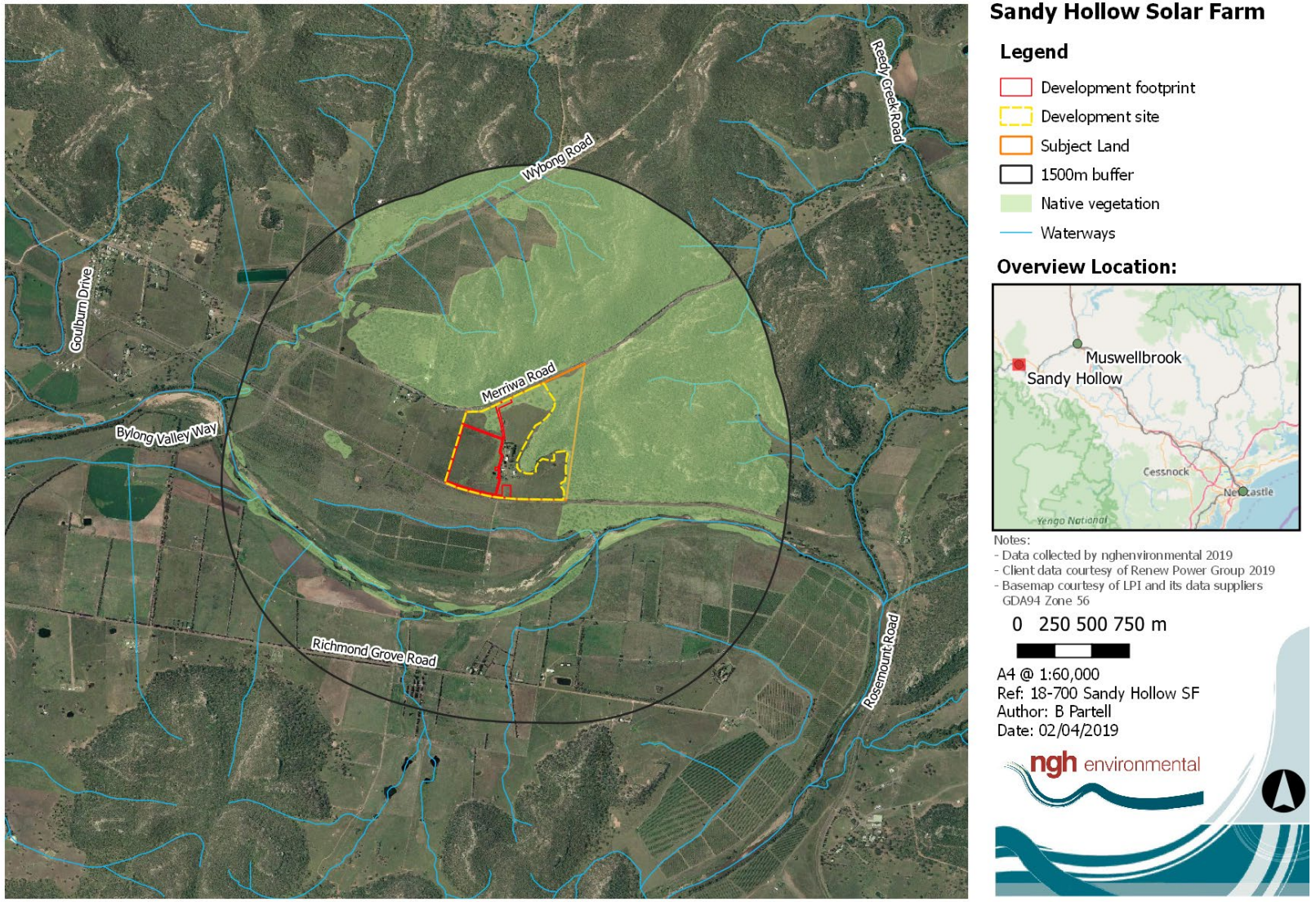


Figure 2-5 Location Map

3 NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT

35.8 ha of native vegetation occurs within the development site comprised of Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter.

No paddock trees occur within the development site. Paddock trees are defined as:

- a tree or a group of up to three trees less than 50 m apart from each other, and
- over an exotic groundcover, and
- more than 50 m away from any other living tree greater than 20 cm DBH, and
- on category 2 land surrounded by category 1 land (as defined by the BAM, 2017).*

*The regulatory land mapping has not been yet been published under the new *Local Land Service Act 2016* (LLS Act). During the transitional period, land categories are to be determined in accordance with the definitions of regulated land in the LLS Act. In this case, the paddock trees are located on land with native vegetation present since January 1990, surrounded by land that has been cleared of native vegetation since January 1990.

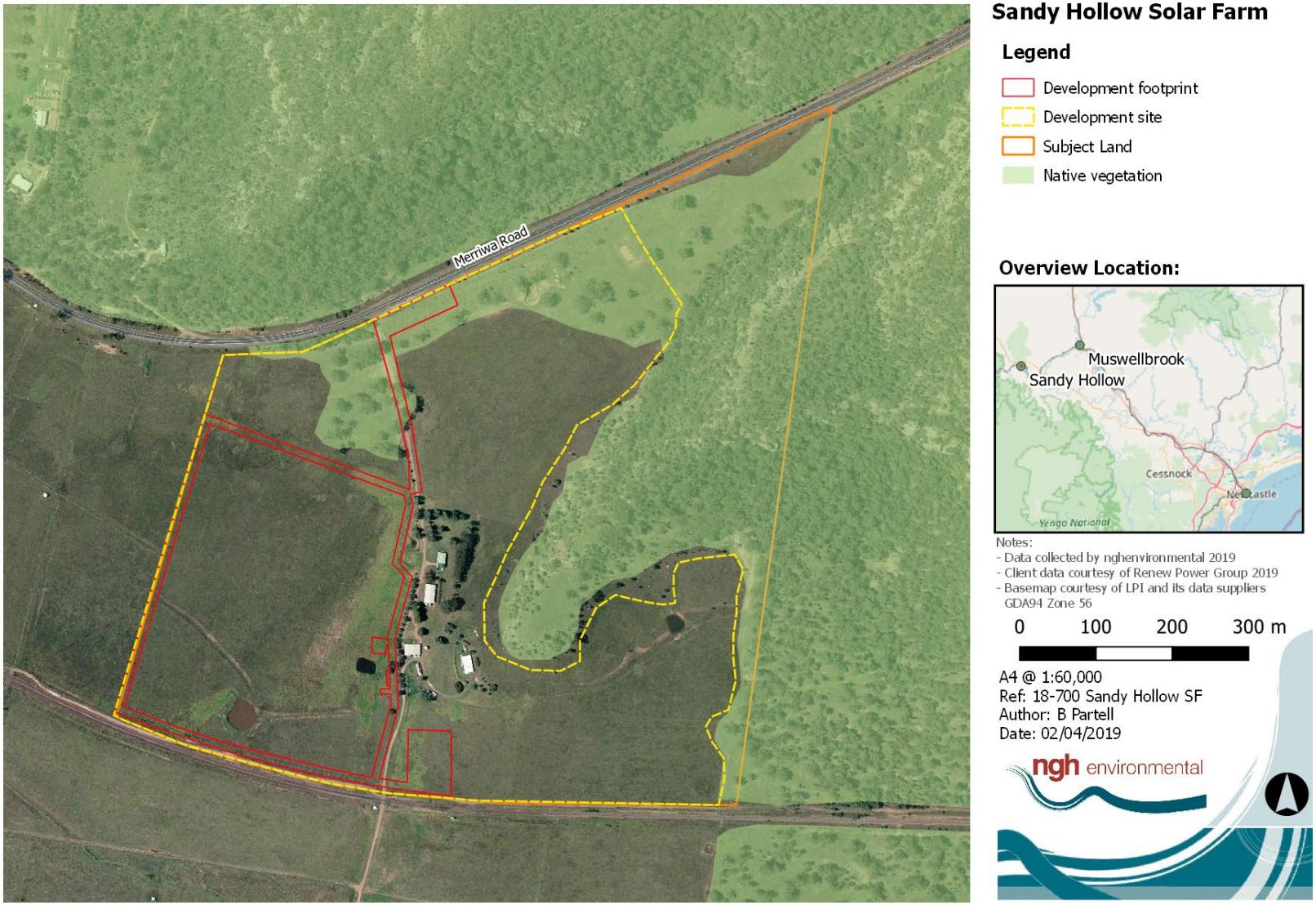


Figure 3-1 Native vegetation extent within the development site.

3.2 PLANT COMMUNITY TYPES (PCTS)

3.2.1 Methods to assess PCTs

Review of existing information

A search was undertaken of OEH Vegetation Information System (VIS) database and NSW SEED mapping to access existing vegetation mapping information within the development site. Two relevant existing vegetation maps were assessed;

- Greater Hunter Native Vegetation Mapping – VIS_ID 3855; and
- State Vegetation Type Map: Upper Hunter v1.0 - VIS_ID 4894.

No PCTs are mapped for the development site, however three are mapped in the east of the subject lands, these are;

- (PCT 1607) - Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter
- (PCT 1611) - Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi
- (PCT 1543) – Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

Floristic Survey

Detailed floristic surveys were undertaken on 1 March 2019. Vegetation integrity plots, of 20 m by 50 m, were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation. Data was collected utilising the methodology presented in the BAM 2017 by persons trained in the BAM and under the direction of persons accredited under the BAM.

3.2.2 PCTs identified on the development site

Based on the field surveys, one PCTs was identified to occur within the development site (Figure 3-1), that of:

- PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter

Existing vegetation mapping suggested that the development site is likely to contain *PCT 1611 - Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi*, however, based on the species recorded and observations made during the site survey, PCT 1612 was determined to be present.

A description of the PCTs identified in the development site follows overleaf.

Table 3-1 Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter.

Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter		
Vegetation formation	Dry Sclerophyll Forests (Shrub-grass sub-formation)	
Vegetation class	Hunter-Macleay Dry Sclerophyll Forests	
Vegetation type	**PCT ID**	1612
	Common Community Name	Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter
Approximate extent within the development site	35.8 ha of this PCT occurs in the development site. This is comprised of; 4.8 ha as woodland 30.9 ha as a derived grassland (cleared)	
Species relied upon for PCT identification	***Species name***	***Relative abundance***
	Narrow-leaved Ironbark *Eucalyptus crebra*	20%
	Black Pine *Callitris endlicheri*	5%
	Grey Gum *Eucalyptus punctata*	3%
	Red Ash *Alphitonia excelsa*	3%
	Native Olive *Notelaea microcarpa*	5%
	Narrow-leaved Wattle *Acacia linearifolia*	10%
	Bead Bush *Teucrium junceum*	<1%
	Weeping Grass *Microlaena stipoides*	<1%
	Berry Saltbush *Einadia hastata*	<1%
	Shade Plantain *Plantago debilis*	<1%
Justification of evidence used to identify the PCT	PCT 1612 was identified with a dominance of Narrow-leaved Ironbark *Eucalyptus crebra*. The shrub layer is absent and groundcover generally sparse, though is reasonably diverse in terms of native forbs and grasses. Four PCTs were considered that have Narrow-leaved Ironbark as the dominant species in the Kerrabee Subregion. These are: *PCT 1611 - Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi* *PCT 1612 - Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter* *PCT 1656 - Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin* *PCT 1661 - Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin* PCT 1612 was considered the best match for the PCT based on the following criteria present in the community: • Located within the Kerrabee IBRA Subregion • Plant species listed above characteristic to this PCT • Suitable landscape position and soil landscape	

Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	
	As such it was selected as the most appropriate PCT.
TEC Status	Not a TEC listed under the BC Act, however, may constitute or EPBC Act.
Estimate of percent cleared in NSW	23% cleared
Examples	 Figure 3-2 Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter woodland (left) and cleared (right).

Areas mapped and defined as planted vegetation occur surrounding the homestead and comprise planted non-local, non-NSW and exotic vegetation. This area is highly modified and unable to be attributed to a PCT and therefore has been excluded from this BAM assessment with exception of impacts prescribed by the regulations under section 6.3 of the *Biodiversity Conservation Act 2016* (BC Act).

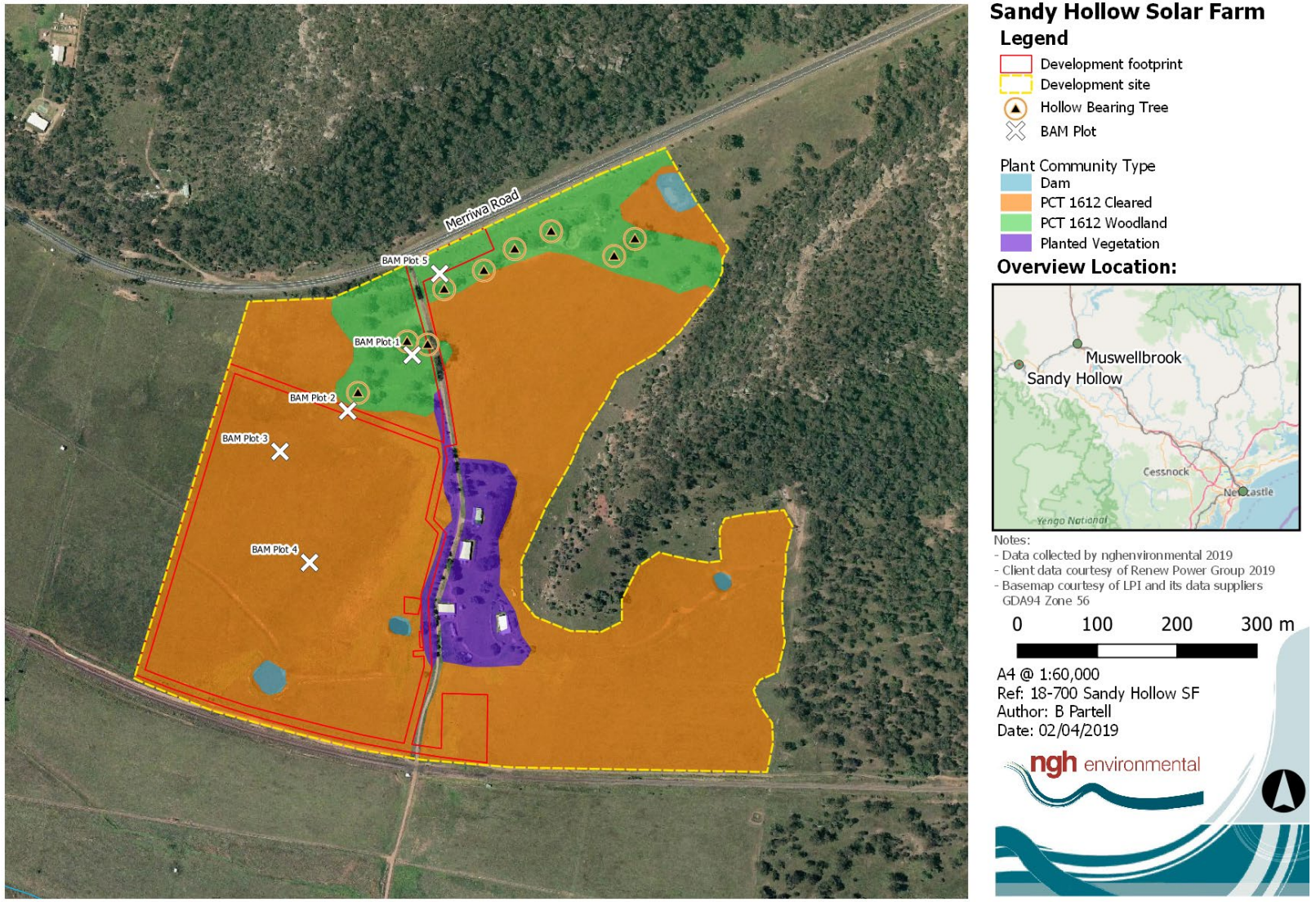


Figure 3-3 PCTs at the development site

3.3 VEGETATION INTEGRITY ASSESSMENT

3.3.1 Vegetation zones and survey effort

One PCT was identified in the development site. This PCT was considered in terms of whether it should be further stratified into zones on the basis of current condition state / management or other environmental variables. PCT 1612 was stratified into two zones, on the basis of tree cover (Table 3-2). A third zone was added for planted vegetation associated with man-made structures in the centre of the development site that does not resemble a native PCT and is excluded from the BAM assessment with exception to addressing potential prescribed impacts as mentioned in Section 3.2.2.

Five plots were undertaken throughout the two PCT 1612 zones in the development site. The number of floristic plots undertaken in each zone was in line with the minimum plot requirements per zone area as specified in the BAM (2017).

Table 3-2 Vegetation zones in the development site

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Survey effort (# plots)	Patch size (ha)	Example
1	1612	**Cleared** Remnant native vegetation comprising grassy groundcover only amongst a heavy exotic weed burden. This woodland is not a TEC under the BC Act.	30.2	3	100+	
2	1612	**Woodland** This zone occurs in the north eastern corner of the development site. It is comprised of a sparse overstory of mature Narrow-leaved Ironbark and occasional Rough-barked Apple. The middle strata has all but been eliminated save for a small amount of understorey. The area is grazed by livestock but there is higher cover of native grasses and forbs and less exotic influence than cleared areas. This woodland is not a TEC under the BC Act.	4.4	2	100+	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Survey effort (# plots)	Patch size (ha)	Example
3	N/A	**Planted Vegetation** The centre of the development site contains a residence and associated farm structures and includes planted vegetation. Species include Silky Oak *Grevillea robusta* and Sugar Gum *Eucalyptus cladocalyx.* These areas were not considered to represent a PCT.	2.3	0	N/A	 

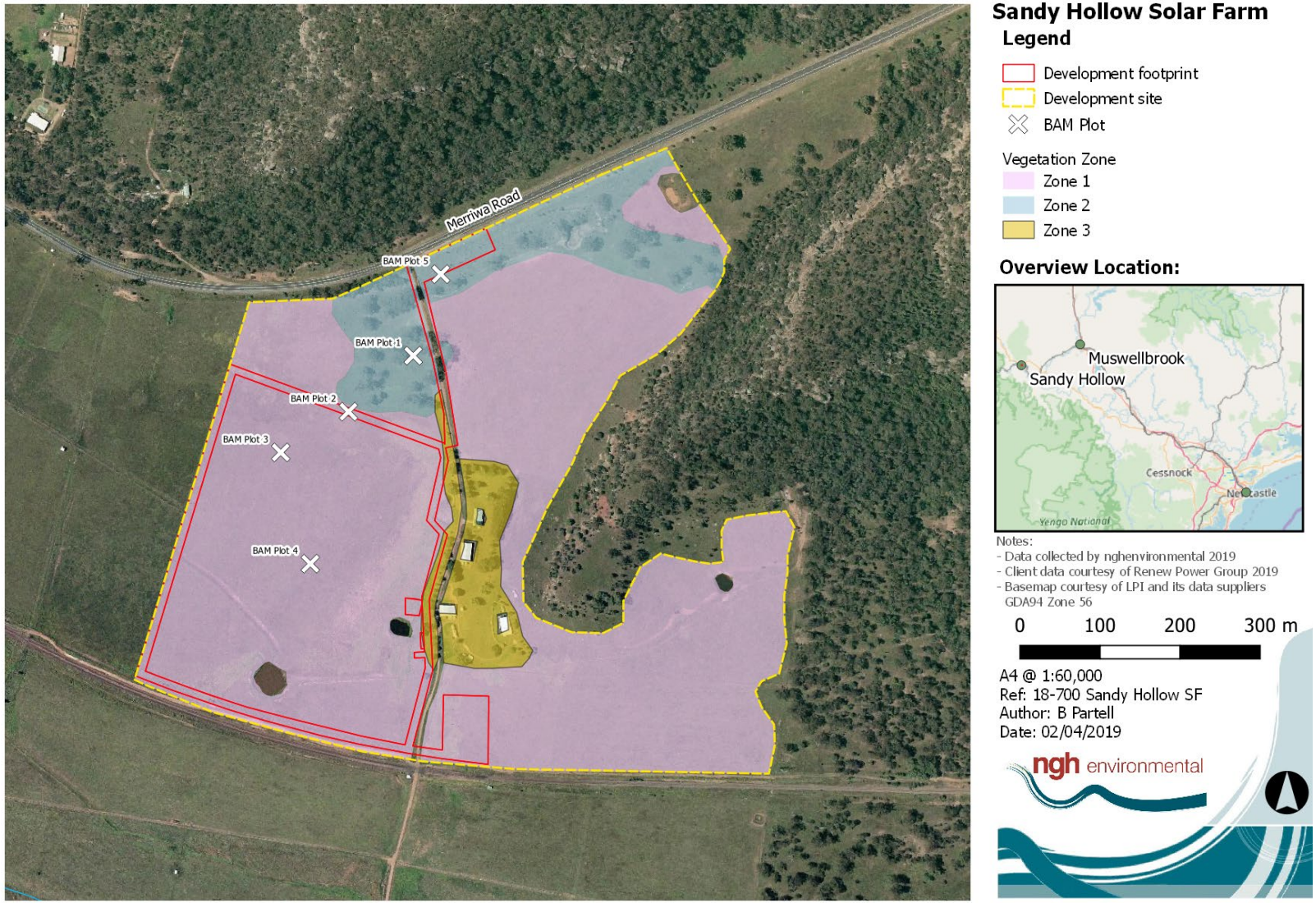


Figure 3-4 Vegetation zones at the development site

3.3.1 Vegetation integrity assessment results

Fifty-one plant species were identified within the five vegetation integrity survey plots, comprised of 29 native species and 22 exotic species. The data collected at each vegetation integrity survey can be found in Appendix A.

The plot data from the vegetation integrity survey plots was entered into the BAM calculator by an accredited assessor. The results of the vegetation integrity assessment are provided in Table 3-3.

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

Zone ID	Composition score	Structure score	Function score	Vegetation Integrity Score
1 PCT1612_Cleared	28.1	2.1	4.9	6.6
2 PCT1612_Woodland	32.6	10.2	52	25.9

4 THREATENED SPECIES

4.1 ECOSYSTEM CREDIT SPECIES

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

Table 4-1 Ecosystem credit species.

Ecosystem credit species	Associated PCT	NSW listing status	National listing status
Grantiella picta Painted Honeyeater	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Vulnerable
Dasyurus maculatus maculatus Spot-tailed Quoll	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Endangered	Endangered
Glossopsitta pusilla Little Lorikeet	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Neophema pulchella Turquoise Parrot	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Ninox connivens Barking Owl	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Chthonicola sagittata Speckled Warbler	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Daphoenositta chrysoptera Varied Sittella	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Petroica boodang Scarlet Robin	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed
Petroica phoenicea Flame Robin	PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	Vulnerable	Not listed

4.1.1 Species excluded from the assessment

No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits.

4.2 SPECIES CREDIT SPECIES

4.2.1 Candidate species to be assessed

The BAM Calculator predicted three species credit species to occur at the development site (Table 4-2). As per the Biodiversity Assessment Method Operational Manual - Stage 1, an assessor must consider species recorded on or near the subject land even if they are not predicted by the BAM Calculator. In this instance, two orchid species, Pine Donkey Orchid *Diuris tricolor* and Tarengo Leek Orchid *Prasophyllum petilum*, have numerous NSW BioNet records within Mangoola Mine, approximately 5.5 km north-east of the subject site. Review of reference mapping suggests that vegetation where these records are located is likely to be similar to that within the development site. On this basis, both orchid species have been added to this assessment (Table 4-2).

Table 4-2 Candidate species credit species requiring assessment

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
FAUNA							
Barking Owl *Ninox connivens* (Breeding)	Woodland and open forest, including fragmented remnants and partly cleared farmland. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	High	Vulnerable	Not listed	Suitable hollow-bearing trees not present in development site.	Excluded	Breeding habitat components not development site.
FLORA							
Large-leafed Monotaxis *Monotaxis macrophylla*	There is a great diversity in the associated vegetation within NSW, encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude. Grows on rocky ridges and hillsides.	High	Endangered	Not listed	Nil, habitat components such as rocky ridges and hillsides not present in development site.	Excluded	Habitat components not present within development site.
Scant Pomaderris *Pomaderris queenslandica*	Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	High	Endangered	Not listed	Nil, moist Eucalypt forest or sheltered woodlands with shrubby understory not present. No creek lines present.	Excluded	Habitat components not present within development site.

Pine Donkey Orchid ***Diuris tricolor***	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as *Bulbine* species.	Moderate	Vulnerable	Not listed	Associated species present in the north of the development site.	Included	Potential habitat present within Zone 2
Tarengo Leek Orchid ***Prasophyllum petilum*** **(formerly known as *Prasophyllum* spp Wybong)**	Known form five sites in NSW with the population west of Muswellbrook newly recognised. Tends to prefer grassy woodland, or	High	Endangered	Endangered	Grassy woodland present in the north of the development site. More highly grazed areas unlikely to support the species.	Included	Potential habitat present within Zone 2.

4.2.2 Exclusions based on habitat features and quality

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

The majority of the development site has undergone under scrubbing of understorey species and extensive grazing by livestock for many years such that the shrub layer is largely absent. The understory is predominantly exotic with diversity of native species limited to small patches associated with remaining woodland. The following zones (Table 4-3) have been excluded for targeted flora and fauna searches as they are considered to be substantially degraded and are no longer representative of the habitats in which these species could occur.

Table 4-3 Exclusions of species based on habitat quality

Species Credit Species	Zones Excluded	Reason for exclusion
Flora		
Large-leafed Monotaxis *Monotaxis macrophylla*	Zone 1 & 2	The development site lacks the habitat components associated with this species (rocky ridges and hillsides). Furthermore, these zones have been subject to heavy grazing by livestock for many years, conditions that this species is unlikely to have survived.
Scant Pomaderris *Pomaderris queenslandica*	Zone 1 & 2	The development site lacks the habitat components associated with this species (moist eucalypt forest or sheltered woodlands with a shrubby understorey and creeks lines). Furthermore, these zones have been subject to heavy grazing by livestock for many years, conditions that this species is unlikely to have survived.

4.2.3 Candidate species requiring confirmation of presence or absence

All three candidate species predicted by the BAM Calculator have been excluded from this assessment, however, Pine Donkey Orchid and Tarengo Leek Orchid have been included. Both species are considered unlikely to inhabit Zone 1 based on the zones condition. Zone 1 is highly degraded, modified by past land use and has little native diversity. Zone 2, while having some edge effects and weed invasion, is less impacted by land use changes and degradation. Targeted surveys were not undertaken for these species and both are assumed present across Zone 2. Therefore, the species polygons for both species are equivalent to Zone 2 (0.37 ha). Targeted surveys were not undertaken for Tarengo Leek Orchid and Pine Donkey Orchid due to non-optimal survey conditions due to persistent drought conditions that would suppress the growth of any potential individuals as has been the case with known populations.

4.3 ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS

4.3.1 Occurrences of karst, caves, crevices and cliffs

As verified by the field inspection, there are no occurrences of karst, caves, crevices, or cliffs in the development site. Vegetated sandstone ridgelines surrounding the development site may well contain caves, crevices and overhangs that represent suitable habitat for Microchiroptera bats species, however, as they are outside of the development site, these areas would not be impacted.

4.3.2 Occurrences of rock

As verified by the field inspection, there are no occurrences of surface rock in the development site.

4.3.3 Occurrences of human made structures and non-native vegetation

As verified by the field inspection, there are several human made structures within the development site that are outside the development footprint and would not be impacted. Zone 3 comprises planted vegetation which is native to Australia but does not constitute vegetation native to NSW for the purposes of this assessment. 0.37 ha of Zone 3 would be removed. Large agricultural buildings within the development site used to store farm machinery were observed. No evidence of use by Microchiroptera bats was observed during the field surveys. These would not be impacted by the proposal.

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

Two (2) farm dams would be filled by the proposal. These dams contain very minimal fringing vegetation with poor water quality. This is not anticipated to have any broader impacts for environments that sustain and interact with the rivers, streams and wetlands offsite. No rivers or streams would be impacted.

5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC Act protected matters report was undertaken on the 20th February 2019 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site (refer to Appendix D). Relevant to this BDAR, these include:

- Wetlands of International Importance – 1;
- Threatened Ecological Communities – 3;
- Threatened fauna species – 18;
- Threatened flora species – 21; and
- Migratory species – 14.

The potential for these MNES to occur at the development site are discussed below.

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

One wetland of international importance was returned from the protected matters report. Hunter Estuary Wetlands occurs around 125 km east of the development site. The Goulburn River is around 425 m to the south of the development site at its closest point, though there is no indication that the proposal will impact the Goulburn River.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Three (3) threatened ecological communities (TECs) were returned from the protected matters report. Only one of these TECs has characteristics present in the development site.

The presence of Narrow-leaved Ironbark indicates the potential for the federally listed critically endangered community, *Central Hunter Valley eucalypt forest and woodland* to occur.

As assessment was undertaken to determine if PCT 1612 meets the key diagnostic characteristics and minimum condition thresholds of the EPBC Act listed community. In this instance, PCT 1612 does not contain sufficient perennial native vegetation cover (≥ 50%) to be considered part of the EPBC Act listed *Central Hunter Valley eucalypt forest and woodland*.

No federally listed TECs are considered to occur in the development site.

5.3 THREATENED SPECIES

Thirty-nine threatened species were returned from the protected matters report. The development site is considered to contain marginal habitat for 10 of these species, however, the quality of habitat present, owing to the development site's disturbance history, is of low quality such that none are considered likely to occur (Appendix E).

5.4 MIGRATORY SPECIES

Fourteen listed migratory species were returned from the protected matters report. None of these species are considered to have the potential to occur at the development site (Appendix E).

6 AVOID AND MINIMISE IMPACTS

6.1 AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT

6.1.1 Site selection – consideration of alternative locations/routes

During the development of the proposal, a number of alternatives were considered. These include the 'do nothing option' (not developing the solar farm), alternative proposal area locations, and developing different renewable technologies.

During the site selection process for the proposal, the proponent reviewed the solar generation potential of many areas in NSW using a combination of computer modelling and analysis, on the ground surveying, and observation and experience of the proponent. The development site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared cropping and grazing land);
- Level terrain for cost effective construction;
- High quality solar resource;
- Low flood risk;
- Existing road access;
- Onsite connection to the transmission network;
- High levels of available capacity on the grid transmission system; and
- Land availability and support from the landowner.

The development site is of a scale that allows for flexibility in design, allowing site constraints to be avoided or effectively mitigated.

6.1.2 Proposal components – consideration of alternate modes or technologies

The Australian Government's Large-scale Renewable Energy Target (LRET) and NSW Government's Renewable Energy Action Plan (REAP) outline the commitment by both Australia and NSW more specifically to reducing GHG emissions and have set targets for increasing the supply of renewable energy. Other forms of largescale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depend on the availability of energy resources and grid capacity.

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. Unlike wind farms, which are installed on elevated topography, solar energy farms can be effectively screened by vegetation to reduce the impact of visual disturbance, which would also provide additional habitat for local fauna. Solar energy farms also have few moving parts and are less likely to interfere with bird flight patterns.

Superior solar resources have been identified in NSW, providing excellent opportunities for solar projects.

6.1.3 Proposal planning phase – detailed design

A preliminary constraints analysis was conducted by an NGH ecologist, which informed the detailed design of the proposal. Vegetation constituting the highest ecological constraints, such as avoiding important habitat value areas for threatened flora and fauna were avoided and minimised as far as practical by amending the development footprint to avoid the removal of trees present at the proposal site.

Key aspects of avoiding and minimising impacts were;

- reducing the clearing footprint of the project to avoid areas of remnant woodland patches were possible (Zone 2)
- avoiding removal of hollow-bearing trees;
- locating ancillary facilities in areas where there are minimal important biodiversity values;
- maintaining the landscape to allow surface water to follow existing drainage routes; and
- making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.

Avoiding areas of highest biodiversity value means that 99.9% of Zone 2, which had the highest Vegetation Integrity Score (VIS), would be retained.

The final design footprint is detailed in Figure 6-1.

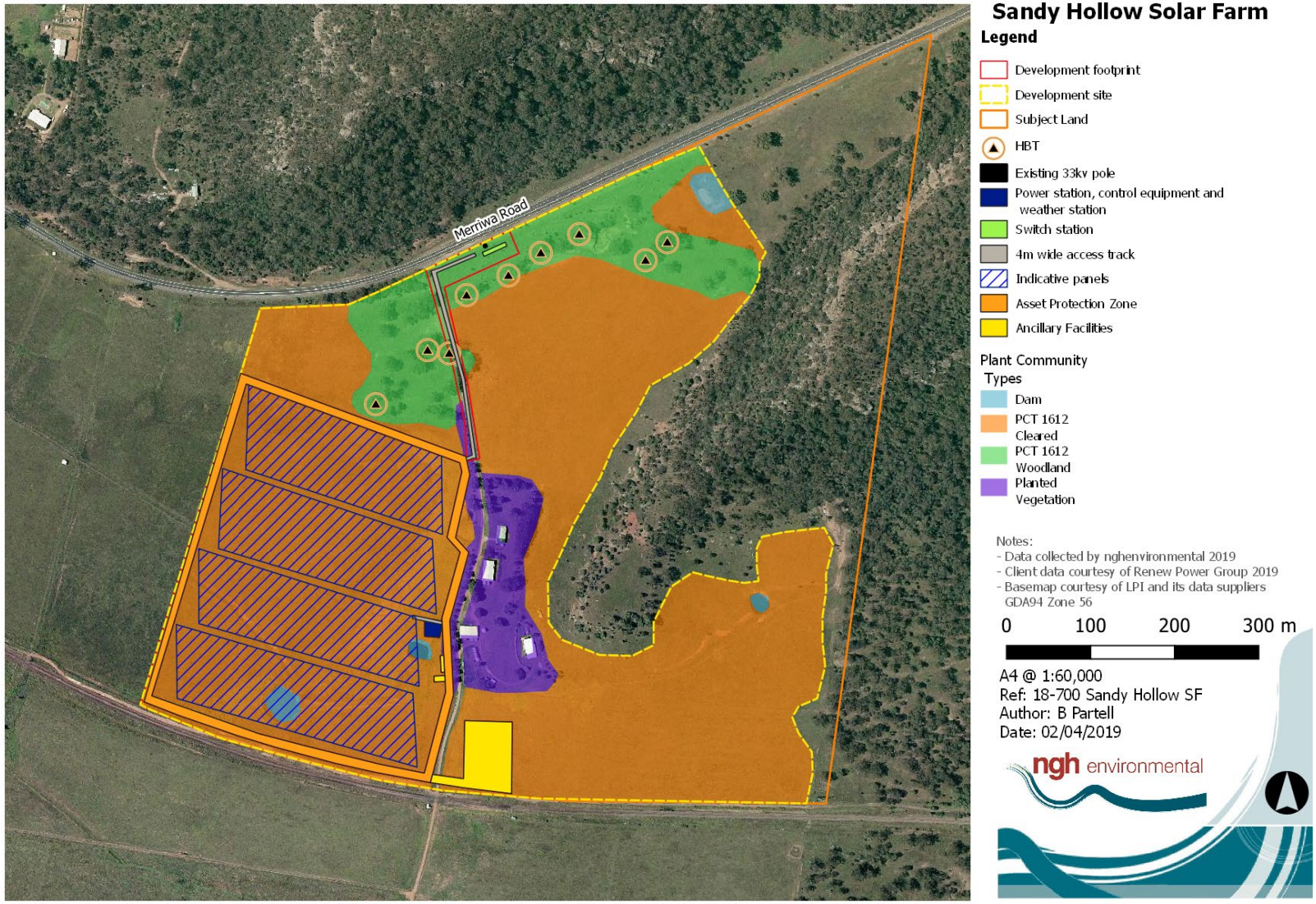


Figure 6-1 Final project footprint

6.2 AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS

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

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

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

6.2.1 Impacts of development on the habitat of threatened species associated with non-native vegetation.

Zone 3 incudes planted vegetation that is native to Australia generally but does not represent PCT of NSW. Nevertheless, this vegetation would still serve as a foraging resource for mobile threatened species such as Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis* which was observed within the development site twice during site surveys. Removal of vegetation within Zone 3 has been avoided as much as possible, however, 0.19 ha would be removed to facilitate a new access track required for the proposal.

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

The development site is not a known migratory path for threatened species and connectivity across the development site is poor as remaining wooded vegetation is confined to the northeast corner (Zone 2). Zone 2 occurs on the western edge of the main connectivity feature present in the adjacent lands, namely Pikes Gap to the northeast. Pikes Gap, despite the Golden Highway acting as an impediment to movement of less mobile threatened species, is likely to be utilised by threatened fauna traversing the area given the extent of bushland habitat either side. As only 0.37 ha of Zone 2 is proposed to be impacted, much of which is minimal understorey and juvenile Narrow-leaved Ironbark regrowth, the present level of connectivity within the development footprint and Pikes Gap would be maintained. Through this avoidance of impacts, the proposal is considered unlikely to reduce the bioregional persistence of any threatened species via impedance of movement.

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

The development site is not a known migratory path for threatened species. For threatened species that may move across the development site and adjoining bushland at Pikes Gap, the retention of 4.58 ha of Zone 2 will maintain the present level of connectivity. Similarly, vegetation associated with Pikes Gap would still function as a connectivity feature for mobile species such as Barking Owl which may traverse the landscape in search of prey or suitable breeding sites.

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

No aquatic features other than four small farm dams occur within the development site. Two of these dams, which would be filled during construction, are unlikely to interact with any hydrological processes that sustain threatened species and/or TECs.

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

The proposal would not directly increase impacts of vehicle strikes on threatened species. The development site is currently surrounded by country roads that species would be crossing. Common and threatened species would not be funnelled into transport corridors as a result of the proposal. However, an increase in vehicle traffic is likely to indirectly increase (albeit marginally) the risk of vehicle strikes on common species such as Kangaroos and Wombats as well as common and threatened avifauna. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes.

7 IMPACTS UNABLE TO BE AVOIDED

7.1 DIRECT IMPACTS

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

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

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	13.36 ha (Zone 1 0.37 ha (Zone 2)	Regular	Construction	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Displacement of resident fauna	Unknown	Regular	Construction, operation	• Direct loss of native fauna • Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction	• Direct loss of native fauna • Decline in local fauna populations
Shading by solar infrastructure	6.51 ha (70% of solar array)	Regular	Operational Phase: Long-term	• Modification of native fauna habitat • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure (Fencing, array infrastructure).	13.54 ha of native vegetation 0.19 ha of planted vegetation	Regular	Operational Phase: long-term	• Modification of habitat beneath array • Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats (fencing).

7.1.1 Changes in vegetation integrity scores

13.54 ha of native vegetation would be removed by the development. The changes in vegetation integrity scores as a result of vegetation clearing are documented for each vegetation zone in Table 7-2 below.

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

Zone ID	PCT	TEC and/or threatened species habitat?	Impact Area (ha)	Current vegetation integrity score	Future vegetation integrity score
1	PCT1612_Cleared	Not a TEC or candidate species habitat. May provide habitat for non-species credit species such as Grey Crowned Babbler.	13.36	**6.6**	**0**
2	PCT1612_Woodland	Not a TEC or candidate species habitat. May provide habitat for non-species credit species such as Grey Crowned Babbler	0.37	**25.9**	**0**

7.1.2 Loss of Paddock Trees

No paddock trees would be removed for the proposal.

7.1.3 Loss of species credit species habitat or individuals

The proposal is not considered to result in the loss of species credit species habitat (Table 4-3).

7.2 INDIRECT IMPACTS

Indirect impacts can occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities or threatened species habitat beyond the development site. Table 7-3 below details the type, frequency, intensity, duration and consequence of indirect impacts of the proposal.

Table 7-3 Potential impacts on biodiversity during the construction and operational phases.

Nature of impact	Extent	Frequency	Duration and timing	Native vegetation, TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short-term	• PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	• Injury and mortality of fauna during clearing of fauna habitat and habitat trees; • Disturbance to stags, fallen timber; and • Increased edge effects.
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	• PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	• Loss of connectivity between remnant PCT 1612 within the development site and surrounds
Reduced viability of adjacent habitat due to noise, dust, heat or light spill	Unknown	Rare	Operational Phase: Short-term	• Barking Owl	• May alter fauna activities and/or movements; • Minimal loss of arboreal foraging habitat
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction & Operational Phase: Long-term	• PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	• Degradation of community biodiversity and integrity; a • Weed encroachment (remnant veg)
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction & Operational Phase: Long-term	• Barking Owl	• Minimal loss of arboreal foraging habitat
Loss of breeding habitats	1 HBT containing one (1) small hollow	Constant	Construction Phase: Long-Term	• PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter • No candidate species would be impacted	• Loss of potential breeding habitat including fallen and hollow logs at height; • Loss of vegetation close to water; and • Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna.

Nature of impact	Extent	Frequency	Duration and timing	Native vegetation, TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Earthworks and mobilisation of sediments	Unknown	Regular	Construction	• PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	• Erosion and sediment deposition pollution on downstream habitats; and • Alternation of surface watercourses (isolating high biodiversity value communities).

7.3 PRESCRIBED IMPACTS

The following prescribed biodiversity impacts are relevant to the proposal:

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

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

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

The proposal would remove 0.19 ha of planted vegetation (Zone 3). Although this vegetation does not represent specific habitat for any candidate species credit species, it may be utilised by mobile threatened species such as Grey-crowned Babbler. The 0.19 ha to be removed lines an existing accessway that would be widened to facilitate construction and operation of the proposal. Given this positioning, it cannot be avoided. As the surrounding lands contain significant amounts more preferred foraging habitat, it is not anticipated that it's removal would jeopardise the long-term survival of any threatened fauna that may utilise it infrequently.

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

The development site is not a known migratory path for threatened species and connectivity across the development site is generally poor and confined to the north where 4.76 ha of wooded vegetation remains (Zone 2). The proposal would result in the removal of 0.37 ha of wooded vegetation (three (3) small Narrow-leaved Ironbark, juvenile Narrow-leaved Ironbark and Acacia understorey) in Zone 2, a degree of clearing that, given the poor level of connectivity within the development site, is unlikely to disrupt the movement of any threatened species within the development site or the greater landscape.

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

The development site is not a known migratory path for threatened species and is unlikely to be vital to the movement of any threatened species that maintains their lifecycle. For threatened species that may move across the landscape, the retention of 4.58 ha of wooded vegetation in Zone 2 will maintain the present level of connectivity for mobile species in an already highly cleared environment.

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

Of the four farm dams present with the development site, two would be filled as they are within the proposed array footprint. These dams are deemed are unsuitable for threatened amphibians and they are unlikely to be of be part of a hydrological process that sustains a TEC outside the development site.

Although the construction and operation of the proposal would involve a range of activities that would disturb soils and potentially impact surface water quality. Appropriate drainage features would be constructed along internal access roads to minimise the risk of dirty water leaving the site or entering waterways. With the exception of internal roads, parking areas and areas around site offices, the site would be largely vegetated with grass cover (specifically, ground cover would be maintained beneath the solar array). There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

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

An increase in vehicle traffic during construction and required maintenance may slightly increase the risk of vehicle strike on threatened species occurring in or near the development site. The development site is surrounded by country roads that common and threatened species would currently be crossing. It is most likely to occur to common species such as Kangaroos and Wombats as well as common and threatened avifauna. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes within the subject land.

7.4 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

7.4.1 Wetlands of International Importance

No wetlands of international importance would be impacted by the development

7.4.2 Threatened Ecological Communities

No federally listed communities are considered to occur within the development site

7.4.3 Threatened Species

Based on a habitat assessment (Appendix E), habitat value for federally listed threatened species has been determined to be marginal at best. As such, no federally listed threatened species are considered likely to occur within the development site or to be impacted by the proposal.

No referral is considered necessary to the Federal Department of Environment and Energy (DoEE) for threatened species.

7.4.4 Migratory species

Based on a habitat assessment (Appendix E), no federally listed migratory species are considered likely to occur on the development site.

No referral is considered necessary to the DoEE for migratory species.

7.5 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

The floristic plots are based on a single visit survey. Floristic surveys were undertaken during early Autumn 2019 so it is possible that not all plant species were detected that may be present at the development site due to seasonal and climatic constraints. In particular, inconspicuous or geophytic species which flower outside the surveyed period may not have been recorded.

Plots within Zone 1 (PCT 1612_Cleared) produced a Vegetation Integrity Score (VIS) of 6.6, which is below the minimum VIS of 17 required for PCTs that are not PCTs to generate an offset obligation. Although the drought conditions at the time of survey may have reduced the abundance and cover of native understory species in Zone 1, it is deemed unlikely that survey during more favourable conditions would result in a VIS greater than or equal to 17.

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

8 MITIGATING AND MANAGING IMPACTS

8.1 MITIGATION MEASURES

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

8.1.1 Impacts from the clearing of vegetation and habitats

1. Time works to avoid critical life cycle events;
2. Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler; and
3. Relocate habitat features (fallen timber, hollow logs) into retained vegetation patches.

8.1.2 Indirect impacts

1. Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed;
2. Adaptive dust monitoring programs to control air quality;
3. Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas; and
4. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented.
5. No barbed wire to be used on security fencing

8.1.3 Prescribed impacts

1. Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation;
2. Adaptive dust monitoring programs to control air quality;
3. Sediment barriers and spill management protocols to control the quality of water runoff from the site into the receiving environment; and
4. Enforce site speed limits to reduce impacts of vehicle strikes on threatened fauna.

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

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Displacement of resident fauna through vegetation clearing and habitat removal						
Time works to avoid critical life cycle events	• If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur (see below)	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
Implement clearing protocols during tree clearing works, including pre-clearing surveys, and staged clearing, the presence of a trained ecological or wildlife handler	• Ecologist to conduct a pre-clearing survey and pre-clearing checklist no more than 7 days prior to tree clearing. • If nesting/roosting fauna are observed during the pre-clearing survey, an ecologist or trained wildlife handler would be present during the felling of the tree to either relocate said fauna or take to nearest veterinary hospital or wildlife carer. • Pre-clearing checklist • Tree clearing procedure	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted
Relocate habitat features (fallen timber, hollow logs) from within the development site	• Tree-clearing procedure including relocation of habitat features to adjacent areas of Zone 2 for habitat enhancement	Construction	Regular	Contractor	Low	None
Indirect impacts on native vegetation and habitat						
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and	• Approved clearing limits to be clearly delineated with temporary	Construction	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	fencing or similar prior to construction commencing • No stockpiling or storage within dripline of any mature trees to be retained; • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance; and • Where trees are to be retained, an adequate protection zone (TPZ) will be provided around each tree for the duration of construction, where possible. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development site*.					
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	Construction	Regular	Contractor	Low	None
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	• Avoid night works; and • Direct lights away from vegetation.	Construction/ Operation	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Adaptive dust monitoring programs to control air quality	• Daily monitoring of dust generated by construction activities; and • Construction would cease if dust observed being blown from site until control measures were implemented; and • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	Construction	Regularly	Contractor	Moderate	Sedimentation in ephemeral waterways and dams.
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	• Machinery would be cleaned prior to entering the site to ensure that weed seeds and propagules are not imported to the site. • Weeds shall be managed according to the requirements of the Biosecurity Act; in that they are to be disposed of at a licenced waste management facility or similar. Weeds are not to be mulched and repurposed for any landscaping use. • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported.	Construction, Operation	Regular	Contractor	Moderate	Weed encroachment
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	• Site induction; and • Toolbox talks.	Construction	Regular	Contractor	Moderate	Impacts to native vegetation or threatened species for Staff training not being followed

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Injury and mortality of fauna entering the proposal site during construction and road strike risk	• If fauna are encountered during construction, allow fauna to leave an area without intervention as much as possible. • The project manager and/or environment manager should ensure the contact details of the animal rescue agency/wildlife care group or vet are provided to the site manager, displayed in the site office and included in the Construction Environmental Management Plan (CEMP) or other relevant management plans for the project • Install perimeter fencing to deter fauna from entering the proposal site.	Construction	Regular	Contractor	Moderate	Local decrease in fauna populations.
Prescribed biodiversity impacts						
Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented; and • Spill management procedures would be implemented.	Construction	Regular	Contractor	Moderate	Impacts may occur to waterway if erosion and sedimentation control plan not implemented
Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation	• Landscape plantings will be comprised of local indigenous species	Operation	Regular	Client	Moderate	Plants not surviving

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Staff training and site briefing to communicate impacts of traffic strikes on native fauna	• Awareness training during site inductions regarding enforcing site speed limits; and • Site speed limits to be enforced to minimise fauna strike.	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles resulting in decrease of local fauna populations.

9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

The principles used to determine if a development will have Serious and Irreversible Impacts (SAII), include impacts that:

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

9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

9.1.1 Threatened ecological communities

No threatened ecological community listed as a potential SAII entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017c) would be impacted by the proposal.

9.1.2 Threatened species

There are no SAII candidate species recorded at the development site.

9.1.3 Additional potential entities

No further species were considered to be potential SAII entities.

9.2 ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS

No assessment of SAIIs are required for the proposal.

10 REQUIREMENT TO OFFSET

10.1 IMPACTS REQUIRING AN OFFSET

10.1.1 Ecosystem credits

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

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

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 10-1 and mapped on Figure 10-1. The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix G.

Table 10-1 PCTs and vegetation zones that require offsets.

Zone ID	PCT ID	Zone name	Impact area (ha)	Vegetation Integrity Score	Future Vegetation Score	Ecosystem credits required
1	1612	Cleared	13.36	6.6	0	0
2	1612	Woodland	0.37	25.9	0	4

10.1.2 Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 10-2.Table 10-2 Species credit species that require offsets

Species Credit Species	Biodiversity Risk Weighting	Area of habitat or count of individuals	Species credits required
Pine Donkey Orchid *Diuris tricolor*	1.5	0.37	4
Tarengo Leek Orchid *Prasophyllum petilum*	2.0	0.37	5

10.1.3 Offsets required under the EPBC Act

No entities listed under the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

10.2 IMPACTS NOT REQUIRING AN OFFSET

Impacts to PCTs that do not meet the thresholds identified in Section 10.1.1 do not require offsets. These PCTs and vegetation zones are identified in Table 10-2 and mapped on Figure 10-1.

Table 10-3 PCTs and vegetation zones that do not require offsets

Zone ID	PCT ID	Zone area (ha)	Vegetation integrity score
1	1612 – Cleared	13.36	6.6

10.3 AREAS NOT REQUIRING ASSESSMENT

Zone 3, which comprises planted vegetation, is not required for assessment.

10.4 SUMMARY OF OFFSET CREDITS REQUIRED

The following credit requirement is generated for the proposal.

Table 10-4 Summary of offset credits required.

Ecosystem Credits	**Offset credits required**
PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter	4
TOTAL:	**4**
Species Credits	Offset Credits required
Pine Donkey Orchid ***Diuris tricolor***	4
Tarengo Leek Orchid ***Prasophyllum petilum***	5
TOTAL:	**9**

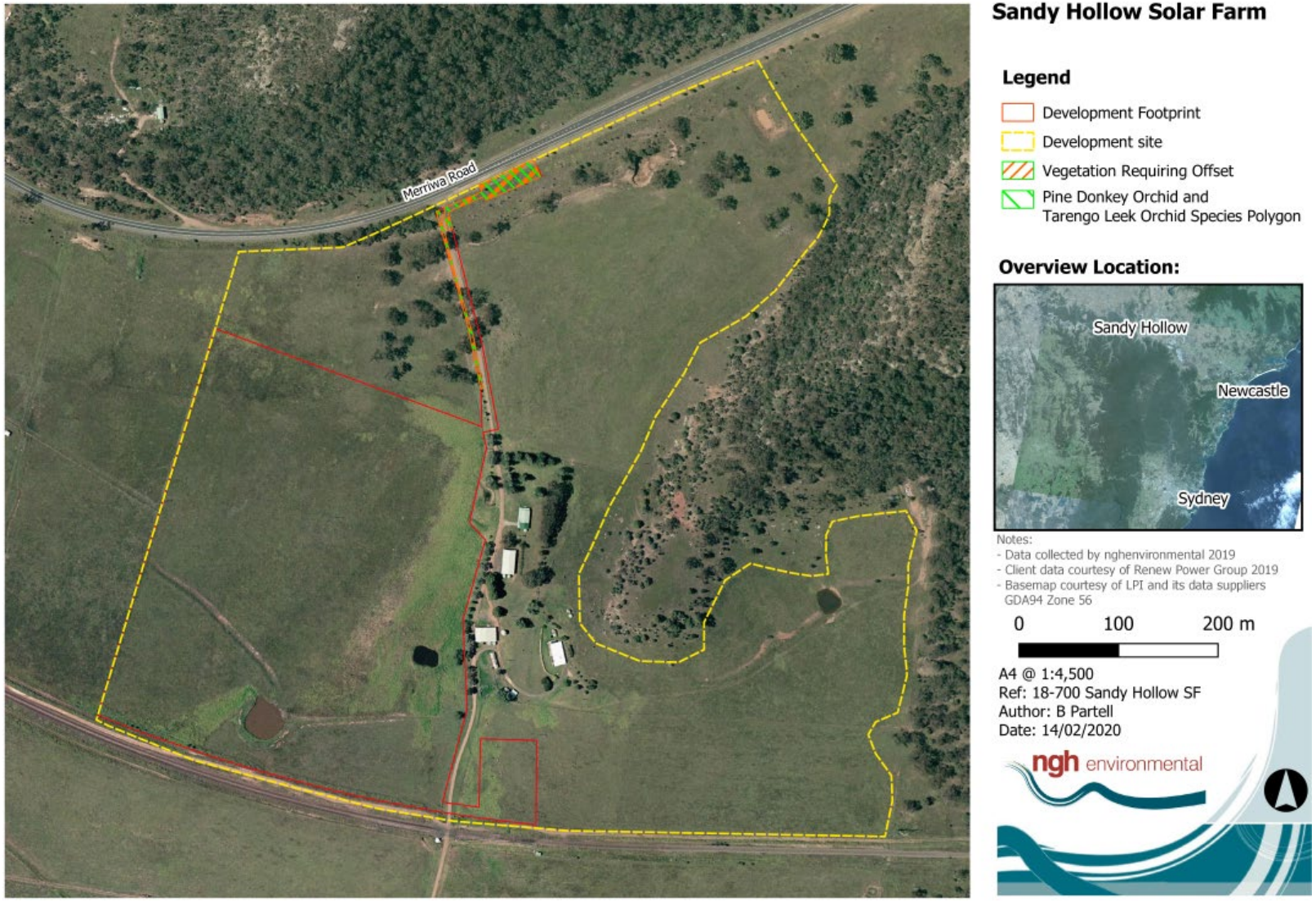


Figure 10-1 Impacts requiring offset, not requiring offset and not requiring assessment

11 CONCLUSIONS

NGH was commissioned by Renewable Management, acting on behalf of the proponent Vernon Trust, to prepare this BDAR for the Sandy Hollow Solar Farm, east of Sandy Hollow, NSW. The purpose of this BDAR is to satisfy the assessment requirements of the BOS and BAM as set out under the BC Act for the proposal and to address the biodiversity matters raised in the SEARs. In this BDAR, biodiversity impacts have been assessed through:

- Comprehensive mapping and assessment completed in accordance with the BAM
- Mitigation measures which have been outlined to reduce the impacts to biodiversity
- The generation of 4 Ecosystem Credits within the development site for PCT 1612
- The generation of 4 species credits for Pine Donkey Orchid which has been assumed present
- The generation of 5 species credits for Tarengo Leek Orchid which has been assumed present

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by making payments into the Biodiversity Conservation Fund using the offset payments calculator,

12 REFERENCES

DECC (2002) Descriptions for NSW (Mitchell) Landscapes Version 2. NSW Department of Environment and Climate Change.

DEE (2010) Directory of Important Wetlands in Australia

DoEE (2012) Interim Biogeographic Regionalisation for Australia, version 7.

DoE (2016). Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: http://www.environment.gov.au/sprat.

Office of Environment and Heritage (OEH) (2017a) Biodiversity Assessment Methodology (BAM). Office of Environment and Heritage for the NSW Government, Sydney, NSW.

Office of Environment and Heritage (OEH) (2017b) BioNet Vegetation Information System: Classification Database. Accessed online at http://www.environment.nsw.gov.au/research/Visclassification.htm

OEH (2017c) NSW OEH *Guidance to assist a decision-maker to determine a serious and irreversible impact*

APPENDIX A VEGETATION INTEGRITY SURVEY DATA

Survey results are presented for the plant community type identified in the development site (PCT)

PCT 1612 – Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter

The foliage cover of species is based on visual estimates of foliage cover within a standard 20 metre x 20 metre plot.

Where uncertainty exists due to the unavailability of reproductive material, the taxon is identified to genus level only.

Plot 1

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	1	Litter Cover	5m	70%	63.00%
	Shrub (SG)	1		15m	80%	
	Forb (FG)	5		25m	75%	
	Grass & grasslike (GG)	7		35m	20%	
	Fern (EG)	0		45m	70%	
	Other (OG)	0	Bare ground cover	5m	10%	18%
	TOTAL	14		15m	5%	
BAM Attribute (20x20m plot) Structure				25m	5%	
	Stratum	Sum		35m	60%	
Count of cover abundance (native vascular plants)	Tree (TG)	20		45m	10%	
	Shrub (SG)	1	Cryptogam cover	5m	0%	0%
	Forb (FG)	2		15m	0%	
	Grass & grasslike (GG)	6		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	29	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	11		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	3		2
50-79			
30-49	1		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		0	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus crebra	Narrow-leaved Ironbark	Myrtaceae	20			Tree (TG)	No		
Sida rhombifolia	Paddy's Lucerne	Malvaceae	0.1	10	*		No		
Sida corrugata	Corrugated Sida	Malvaceae	0.5	50		Forb (FG)	No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	10		Grass & grasslike (GG)	No		
Lepidium africanum	Common Peppercress	Brassicaceae	0.1	10	*		No		
Solanum spp.		Solanaceae	0.2	20	*	Forb (FG)	No		
Einadia nutans	Climbing Saltbush	Chenopodiaceae	0.2	20		Forb (FG)	No		
Opuntia aurantiaca	Tiger Pear	Cactaceae	5		*		No		
Austrostipa verticillata	Slender Bamboo Grass	Poaceae	5			Grass & grasslike (GG)	No		
Digitaria ramularis	Finger Panic Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Maireana microphylla		Chenopodiaceae	1			Shrub (SG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Aristida personata		Poaceae	0.5	10		Grass & grasslike (GG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	1			Forb (FG)	No		
Commelina cyanea	Native Wandering Jew	Commelinaceae	0.1	1		Forb (FG)	No		
Cyperus gracilis	Slender Flat-sedge	Cyperaceae	0.1	5		Grass & grasslike (GG)	No		
Galenia pubescens	Galenia	Aizoaceae	10		*		HTE		
Cymbopogon refractus	Barbed Wire Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Chenopodium album	Fat Hen	Chenopodiaceae	0.1	1	*		No		
Eragrostis curvula	African Lovegrass	Poaceae	1		*		HTE		

Plot 2

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
Count of Native Richness	Stratum	Sum		Tape length	% cover	Average %
	Tree (TG)	0	Litter Cover	5m	15%	16.00%
	Shrub (SG)	0		15m	15%	
	Forb (FG)	4		25m	10%	
	Grass & grasslike (GG)	8		35m	15%	
	Fern (EG)	1		45m	25%	
	Other (OG)	0	Bare ground cover	5m	5%	8%
	TOTAL	13		15m	10%	
BAM Attribute (20x20m plot) Structure				25m	10%	
Count of cover abundance (native vascular plants)	Stratum	Sum		35m	5%	
	Tree (TG)	0		45m	10%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	5.3		15m	0%	
	Grass & grasslike (GG)	13.6		25m	0%	
	Fern (EG)	0.1		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	19	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	30.1		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

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

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Galenia pubescens	Galenia	Aizoaceae	30		*		HTE		
Sida corrugata	Corrugated Sida	Malvaceae	5			Forb (FG)	No		
Carex inversa	Knob Sedge	Cyperaceae	1			Grass & grasslike (GG)	No		
Sida rhombifolia	Paddy's Lucerne	Malvaceae	5		*		No		
Opuntia stricta	Common Prickly Pear	Cactaceae	1		*		No		
Sporobolus africanus	Parramatta Grass	Poaceae	1		*		No		
Digitaria divaricatissima	Umbrella Grass	Poaceae	10			Grass & grasslike (GG)	No		
Portulaca oleracea	Pigweed	Portulacaceae	0.1	5		Forb (FG)	No		
Chloris gayana	Rhodes Grass	Poaceae	0.1	1	*		HTE		
Phyllanthus virgatus	Wiry Spurge	Phyllanthaceae	0.1	2		Forb (FG)	No		
Aristida spp.	A Wiregrass	Poaceae	1			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	1			Grass & grasslike (GG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Austrostipa verticillata	Slender Bamboo Grass	Poaceae	0.2	3		Grass & grasslike (GG)	No		
Senecio madagascariensis	Fireweed	Asteraceae	0.1	1	*		No		
Brassica spp.	Brassica	Brassicaceae	0.1	3	*		No		
Juncus usitatus		Juncaceae	0.2	5		Grass & grasslike (GG)	No		
Cheilanthes sieberi	Rock Fern	Pteridaceae	0.1	1		Fern (EG)	No		
Cynodon dactylon	Common Couch	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Commelina cyanea	Native Wandering Jew	Commelinaceae	0.1	2		Forb (FG)	No		
Lolium perenne	Perennial Ryegrass	Poaceae	1		*		No		
Rytidosperma spp.		Poaceae	0.1	5		Grass & grasslike (GG)	No		

Plot 3

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
Count of Native Richness	Stratum	Sum		Tape length	% cover	Average %
	Tree (TG)	0	Litter Cover	5m	30%	29.00%
	Shrub (SG)	0		15m	25%	
	Forb (FG)	4		25m	35%	
	Grass & grasslike (GG)	6		35m	25%	
	Fern (EG)	1		45m	30%	
	Other (OG)	0	Bare ground cover	5m	20%	17%
	TOTAL	11		15m	15%	
BAM Attribute (20x20m plot) Structure				25m	15%	
Count of cover abundance (native vascular plants)	Stratum	Sum		35m	25%	
	Tree (TG)	0		45m	10%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	1.2		15m	0%	
	Grass & grasslike (GG)	6.9		25m	0%	
	Fern (EG)	0.1		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	8.2	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	11.1		15m	0%	
				25m	0%	
				35m	0%	
				45m		

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

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Sida rhombifolia	Paddy's Lucerne	Malvaceae	1		*		No		
Lepidium africanum	Common Peppercress	Brassicaceae	1		*		No		
Carex inversa	Knob Sedge	Cyperaceae	0.2	20		Grass & grasslike (GG)	No		
Sida corrugata	Corrugated Sida	Malvaceae	0.5	20		Forb (FG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.5	20		Grass & grasslike (GG)	No		
Sporobolus africanus	Parramatta Grass	Poaceae	0.5	20	*		No		
Digitaria divaricatissima	Umbrella Grass	Poaceae	5			Grass & grasslike (GG)	No		
Galenia pubescens	Galenia	Aizoaceae	10		*		HTE		
Portulaca oleracea	Pigweed	Portulacaceae	0.5	10		Forb (FG)	No		
Polygonum aviculare	Wireweed	Polygonaceae	0.5	20	*		No		
Cymbopogon refractus	Barbed Wire Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Cheilanthes sieberi	Rock Fern	Pteridaceae	0.1	5		Fern (EG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Schkuhria pinnata var. abrotanoides	Dwarf Marigold	Asteraceae	0.5	20	*		No		
Chloris gayana	Rhodes Grass	Poaceae	1		*		HTE		
Senecio madagascariensis	Fireweed	Asteraceae	0.1	2	*		No		
Heliotropium amplexicaule	Blue Heliotrope	Boraginaceae	0.1	1	*		HTE		
Opuntia stricta	Common Prickly Pear	Cactaceae	0.5	1	*		No		
Phyllanthus virgatus	Wiry Spurge	Phyllanthaceae	0.1	1		Forb (FG)	No		
Commelina cyanea	Native Wandering Jew	Commelinaceae	0.1	2		Forb (FG)	No		
Eriochloa procera	Spring Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Rytidosperma spp.		Poaceae	1			Grass & grasslike (GG)	No		
Lolium perenne	Perennial Ryegrass	Poaceae	1		*		No		

Plot 4

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
Count of Native Richness	Stratum	Sum		Tape length	% cover	Average %
	Tree (TG)	0	Litter Cover	5m	40%	31.00%
	Shrub (SG)	0		15m	20%	
	Forb (FG)	2		25m	30%	
	Grass & grasslike (GG)	8		35m	25%	
	Fern (EG)	1		45m	40%	
	Other (OG)	0	Bare ground cover	5m	20%	24%
	TOTAL	11		15m	30%	
BAM Attribute (20x20m plot) Structure				25m	25%	
Count of cover abundance (native vascular plants)	Stratum	Sum		35m	25%	
	Tree (TG)	0		45m	20%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	1.1		15m	0%	
	Grass & grasslike (GG)	12.9		25m	0%	
	Fern (EG)	0.1		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	14.1	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	20		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

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

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Sida corrugata	Corrugated Sida	Malvaceae	1			Forb (FG)	No		
Sida rhombifolia	Paddy's Lucerne	Malvaceae	5		*		No		
Galenia pubescens	Galenia	Aizoaceae	20		*		HTE		
Digitaria divaricatissima	Umbrella Grass	Poaceae	10			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.5	20		Grass & grasslike (GG)	No		
Senecio madagascariensis	Fireweed	Asteraceae	0.1	1	*		No		
Cheilanthes sieberi	Rock Fern	Pteridaceae	0.1	3		Fern (EG)	No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	10		Grass & grasslike (GG)	No		
Cynodon dactylon	Common Couch	Poaceae	1			Grass & grasslike (GG)	No		
Chondrilla juncea	Skeleton Weed	Asteraceae	0.1	1	*		No		
Aristida personata		Poaceae	0.1	2		Grass & grasslike (GG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Portulaca oleracea	Pigweed	Portulacaceae	0.1	5		Forb (FG)	No		
Bothriochloa spp.	Redgrass, Bluegrass	Poaceae	0.1	1	*	Grass & grasslike (GG)	No		
Lepidium africanum	Common Peppercress	Brassicaceae	0.5	10	*		No		
Opuntia stricta	Common Prickly Pear	Cactaceae	0.2	1	*		No		
Eriochloa procera	Spring Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Rytidosperma spp.		Poaceae	1			Grass & grasslike (GG)	No		
Lolium perenne	Perennial Ryegrass	Poaceae	1		*		No		

Plot 5

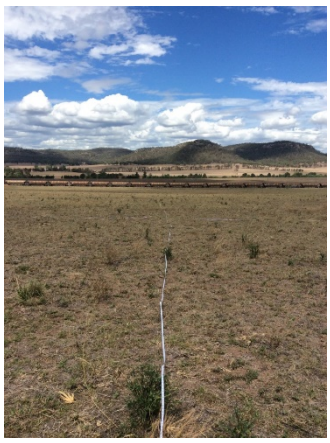
BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
Count of Native Richness	Stratum	Sum		Tape length	% cover	Average %
	Tree (TG)	2	Litter Cover	5m	1%	26.20%
	Shrub (SG)	0		15m	30%	
	Forb (FG)	10		25m	40%	
	Grass & grasslike (GG)	4		35m	50%	
	Fern (EG)	1		45m	10%	
	Other (OG)	0	Bare ground cover	5m	90%	47%
	TOTAL	17		15m	40%	
BAM Attribute (20x20m plot) Structure				25m	25%	
Count of cover abundance (native vascular plants)	Stratum	Sum		35m	20%	
	Tree (TG)	27		45m	60%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	2.3		15m	0%	
	Grass & grasslike (GG)	12.6		25m	0%	
	Fern (EG)	0.2		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	42.1	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	12.3		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49	3		1
20-29	4		
10-19	7		
5-9	4		
<5	6		N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus crebra	Narrow-leaved Ironbark	Myrtaceae	25			Tree (TG)	No		
Aristida personata		Poaceae	2			Grass & grasslike (GG)	No		
Galenia pubescens	Galenia	Aizoaceae	2		*		HTE		
Cheilanthes sieberi	Rock Fern	Pteridaceae	0.2	20		Fern (EG)	No		
Cymbopogon refractus	Barbed Wire Grass	Poaceae	10			Grass & grasslike (GG)	No		
Sida rhombifolia	Paddy's Lucerne	Malvaceae	1		*		No		
Sida corrugata	Corrugated Sida	Malvaceae	0.5	20		Forb (FG)	No		
Acacia linearifolia	Narrow-leaved Wattle	Fabaceae (Mimosoideae)	2			Tree (TG)	No		
Verbascum spp.		Scrophulariaceae	0.1	2	*		No		
Chrysocephalum apiculatum	Common Everlasting	Asteraceae	1			Forb (FG)	No		
Commelina cyanea	Native Wandering Jew	Commelinaceae	0.1	2		Forb (FG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Chondrilla juncea	Skeleton Weed	Asteraceae	0.1	5	*		No		
Solanum spp.		Solanaceae	0.1	2	*	Forb (FG)	No		
Austrostipa verticillata	Slender Bamboo Grass	Poaceae	0.5	5		Grass & grasslike (GG)	No		
Heliotropium amplexicaule	Blue Heliotrope	Boraginaceae	0.1	10	*		HTE		
Andropogon virginicus	Whisky Grass	Poaceae	0.1	3	*		HTE		
Portulaca oleracea	Pigweed	Portulacaceae	0.1	5		Forb (FG)	No		
Plantago debilis	Shade Plantain	Plantaginaceae	0.1	2		Forb (FG)	No		
Pomax umbellata	Pomax	Rubiaceae	0.1	1		Forb (FG)	No		
Opuntia aurantiaca	Tiger Pear	Cactaceae	0.1	2	*		No		
Melinis repens	Red Natal Grass	Poaceae	0.1	5	*		No		
Eragrostis curvula	African Lovegrass	Poaceae	10		*		HTE		
Chloris gayana	Rhodes Grass	Poaceae	0.1	3	*		HTE		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	2	*		No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	5		Grass & grasslike (GG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	1		Forb (FG)	No		
Calotis lappulacea	Yellow Burr-daisy	Asteraceae	0.1	1		Forb (FG)	No		
Cynoglossum australe		Boraginaceae	0.1	3		Forb (FG)	No		

APPENDIX B PLOT PHOTOS

Plot 1 – PCT 1612 Zone 2_Woodland	**Plot 1 – PCT 1612 Zone 2_Woodland**
	
Plot 2 - PCT 1612 Zone 1_Cleared	**Plot 2 - PCT 1612 Zone 1_Cleared**
	
Plot 3 - PCT 1612 Zone 1_Cleared	**Plot 3 - PCT 1612 Zone 1_Cleared**
	
Plot 4 – PCT 1612 Zone 1_Cleared	**Plot 4 – PCT 1612 Zone 1_Cleared**

	
Plot 5 – PCT 1612 Zone 2_Woodland	**Plot 5 – PCT 1612 Zone 2_Woodland**
	

APPENDIX C FAUNA SURVEY RESULTS

Table 12-1 Fauna recorded during survey

			Status	
Family	**Common Name**	**Species**	**BC Act**	**EPBC Act**
Birds				
Acanthizidae	Brown Thornbill	*Acanthiza pusilla*		
Cacatuidae	Galah	*Eolophus roseicapilla*		
Campephagidae	Black-faced Cuckoo Shrike	*Coracina novaehollandiae*		
Climacteridae	White-throated Treecreeper	*Cormobates leucophaea*		
Corvidae	Little Raven	*Corvus mellori*		
Meliphagidae	Noisy Miner	*Manorina melanocephala*		
Meliphagidae	Yellow-faced Honeyeater	*Lichenostomus chrysops*		
Meliphagidae	Spiny-Cheeked Honeyeater	*Acanthagenys rufogularis*		
Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*		
Pomatostomidae	Grey-crowned babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Vulnerable	
Rhipiduridae	Willie Wagtail	*Rhipidura leucophrys*		
Mammals				
Macropodidae	Eastern Grey kangaroo	*Macropus giganteus*		

APPENDIX D PROTECTED MATTERS SEARCH REPORT

Australian Government
Department of the Environment and Energy

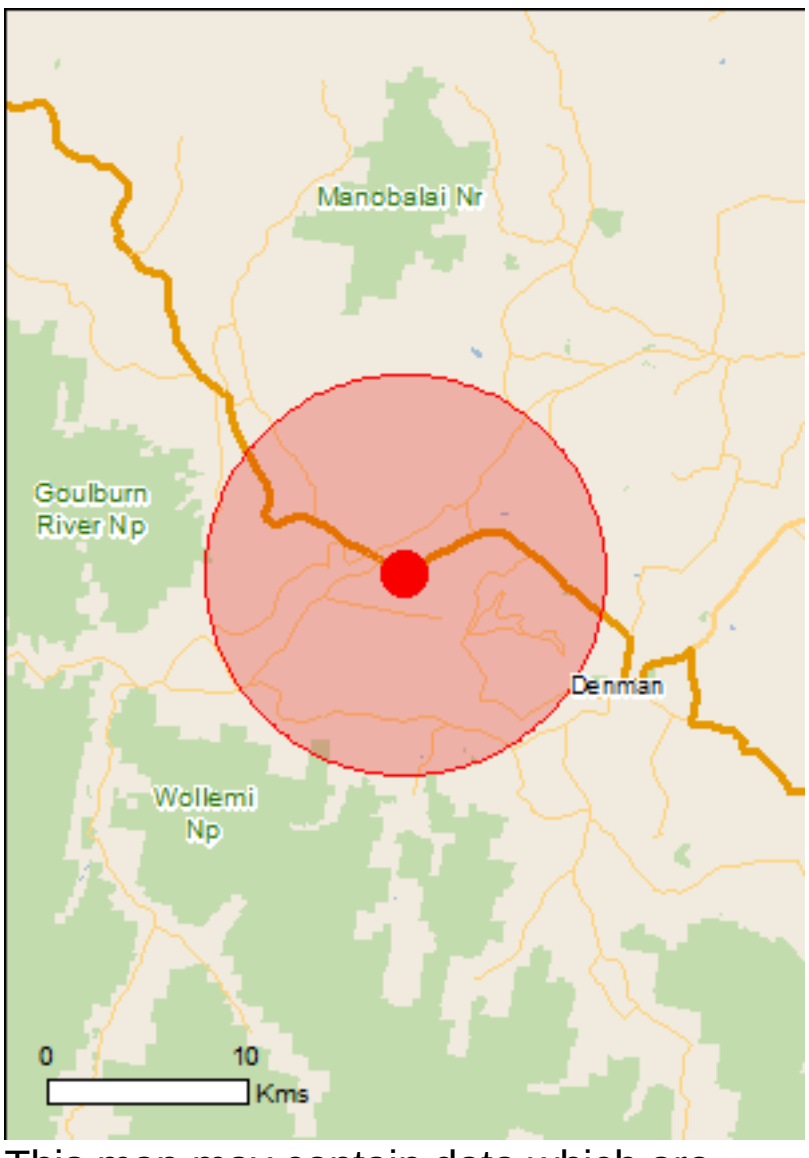
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

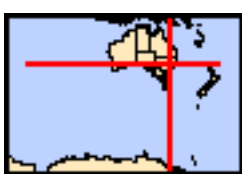
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/02/19 14:25:45



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	39
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	32
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
The Greater Blue Mountains Area	NSW	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Hunter estuary wetlands	100 - 150km upstream

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community likely to occur within area
Hunter Valley Weeping Myall (Acacia pendula) Woodland	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Frogs		
Litoria booroolongensis		
Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Androcalva procumbens		
[87153]	Vulnerable	Species or species habitat known to occur within area
Androcalva rosea		
Sandy Hollow Commersonia [86861]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
Eucalyptus pumila		
Pokolbin Mallee [16510]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area
Homoranthus darwinioides		
[12974]	Vulnerable	Species or species habitat known to occur within area
Kennedia retrorsa		
[19716]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lasiopetalum longistamineum [19181]	Vulnerable	Species or species habitat known to occur within area
Leucochrysum albicans var. tricolor Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat may occur within area
Ozothamnus tesselatus [56203]	Vulnerable	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Philotheca ericifolia [64942]	Vulnerable	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pomaderris reperta Denman Pomaderris [77103]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat known to occur within area
Prostanthera cryptandroides subsp. cryptandroides Wollemi Mint-bush [68496]	Vulnerable	Species or species habitat known to occur within area
Prostanthera stricta Mount Vincent Mintbush [17616]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Wollemia nobilis Wollemi Pine [64545]	Critically Endangered	Species or species habitat likely to occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Telecommunications Commission
Defence - Myambat Barracks

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Goulburn River	NSW
Wollemi	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis		
Skylark [656]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula		
Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		

Name	Status	Type of Presence
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.34744 150.59167

Acknowledgements

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX E EPBC HABITAT ASSESSMENT

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed for the locality identified as potentially occurring in the area according to the Commonwealth EPBC *Protected Matters Search Tool*[1].

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat:

Present: Potential or known habitat is present within the development site.

Marginal: Habitat present that could be used by the species on occasion but not preferred.

Absent: No potential or known habitat is present within the development site

Likelihood of occurrence

Recorded: The species was observed in the development site during the current survey

High: It is highly likely that a species inhabits the development site and is dependent on identified suitable habitat (ie. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.

Moderate: Potential habitat is present in the development site. Species Low to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is Low to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.

Low: It is unlikely that the species inhabits the development site and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

[1] This online tool is designed for the public to search for matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is managed by the Commonwealth Department of the Environment and Energy.

Potential to be impacted

Low: The proposal would not impact this species or its habitats. No Assessment of Significance (AoS) is necessary for this species.

Moderate: The proposal could impact this species or its habitats however the impacts are considered manageable such that no direct or indirect impacts are likely. No Assessment of Significance (AoS) is necessary for this species.

High: The proposal is likely to impact this species or its habitats. An Assessment of Significance (AoS) has been applied to these entities.

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Flora					
Commersonia procumbens	V	Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Fruiting period is summer to autumn. Flowers from August to December. Recorded in Eucalyptus dealbata and Eucalyptus sideroxylon communities, Melaleuca uncinata scrub, under mallee eucalypts with a Calytrix tetragona understorey, and in a recently burnt Ironbark and Callitris area. Also *Eucalyptus fibrosa* subsp. *nubila*, *Eucalyptus dealbata*, *Eucalyptus albens* and *Callitris glaucophylla* woodlands north of Dubbo.	Absent	Low	Low
Commersonia rosea	E	Only known from four localities in the Sandy Hollow district of the upper Hunter Valley, New South Wales, all within an eight kilometre radius of Sandy Hollow. Observed flowering in August, November, January and February. Occurs on skeletal sandy soils in scrub or heath vegetation with occasional emergents of Narrow-leaved Ironbark (*Eucalyptus crebra*), Black Cypress Pine (*Callitris endlicheri*) or *E. caleyi* subsp. *caleyi*.	Marginal	Low	Low

[1] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

OEH threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Cryptostylis hunteriana Leafless Tongue Orchid	V	The species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forested communities. The soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. The larger populations typically occur in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (E. sieberi), Red Bloodwood (Corymbia gummifera) and Black Sheoak (Allocasuarina littoralis); appears to prefer open areas in the understorey of this community.	Absent	Low	Low
Cynanchum elegans White-flowered Wax Plant	E	usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree Leptospermum laevigatum – Coastal Banksia Banksia integrifolia subsp. integrifolia coastal scrub; Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland; Spotted Gum Corymbia maculata aligned open forest and woodland; and Bracelet Honeymyrtle Melaleuca armillaris scrub to open scrub.	Absent	Low	Low
Eucalyptus pumila Pokolbin Mallee	V	Currently known only from a single population west of Pokolbin in the Hunter Valley. Present as a mid-canopy species to a height of 6 m within dry sclerophyll woodland which has a canopy comprising Eucalyptus fibrosa, Callitris endlicheri and, to a lesser extent, Corymbia maculata.	Absent	Low	Low

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Euphrasia arguta	CE	Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	Absent	Low	Low
Homoranthus darwinioides	V	Grows in in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand. Associated species include Callitris endlicheri, Eucalyptus crebra, E. fibrosa, C. trachyphloia, E. beyeri subsp. illaquens, E. dwyeri, E. rossii, Leptospermum divaricatum, Melaleuca uncinata, Calytrix tetragona, Allocasuarina spp. and Micromyrtus spp.	Marginal	Low	Low
Kennedia retrorsa	V	Believed to be restricted to the Mount Dangar area and the adjacent Goulburn River catchment, within the Muswellbrook and adjacent Merriwa local government areas. Peak flowering occurs September to December.	Absent	Low	Low
Lasiopetalum longistamineum	V	Occurs in the Mt Dangar - Gungal area within Merriwa and Muswellbrook Local Government Areas. A very small number of plants have been recorded within the Goulburn River National Park. Flowers in spring and grows in rich alluvial deposits.	Absent	Low	Low

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Leucochrysum albicans var. *tricolor* Hoary Sunray	E	Endemic to south-eastern Australia, where it is currently known from three geographically separate areas in Tasmania, Victoria and south-eastern NSW and ACT. In NSW it currently occurs on the Southern Tablelands adjacent areas in an area roughly bounded by Albury, Bega and Goulburn, with a few scattered locatlities know from beyond this region. Occurs in a wide variety of grassland, woodland and forest habitats, generally on relatively heavy soils.	Absent	Low	Low
Ozothamnus tesselatus	V	Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Spring flowering.	Marginal	Low	Low
Philotheca ericifolia	V	Associated species include Melaleuca uncinata, Eucalyptus crebra, E. rossii, E. punctata, Corymbia trachyphloia, Acacia triptera, A. burrowii, Beyeria viscosa, Philotheca australis, Leucopogon muticus and Calytrix tetragona. Flowering in spring, grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops.	Absent	Low	Low

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Pomaderris brunnea Brown Pomaderris	V	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands. grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. Flowers Sept - Oct. The species has been found in association with Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa and Kunzea ambigua.	Absent	Low	Low
Pomaderris reperta Denman Pomaderris	CE	Recorded from a small number of sites along a single ridgeline near Denman in the upper Hunter Valley. Occupies woodland in association with Eucalyptus crebra, E. blakelyi, Notelaea microcarpa, Allocasuarina littoralis and sandy loam on sandstone or conglomerate.	Marginal	Low	Low
Prasophyllum sp. Wybong	CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals. A perennial orchid, appearing as a single leaf over winter and spring. Known to occur in open eucalypt woodland and grassland.	Absent	Low	Low
Prostanthera cryptandroides subsp. *cryptandroides* Wollemi Mint-bush	V	Distributed between Lithgow and Sandy Hollow on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions. Populations occur in Wollemi National Park and Gardens of Stone National Park.	Absent	Low	Low

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Prostanthera stricta Mount Vincent Mint-bush	V	Prostanthera stricta is often a locally dominant undershrub in heath or scrub communities along cliff edges, or as an understorey species within a range of open forest or tall open forest types, or in adjacent transitional communities. Associated vegetation includes Eucalyptus blaxlandii, Eucalyptus cannonii and Eucalyptus viminalis with Acacia implexa and Goodenia ovata.	Absent	Low	Low
Pterostylis gibbosa Illawarra Greenhood	E	In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark E. crebra, Forest Red Gum and Black Cypress Pine Callitris endlicheri. Spring flowering.	Absent	Low	Low
Thesium australe Austral Toadflax	V	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (Themeda australis).	Absent	Low	Low
Wollemia nobilis Wollemi Pine	E	Restricted to remote canyons in the Wollemi National Park, north-west of Sydney. Occurs in warm temperate rainforest and rain forest margins in remote sandstone canyons.	Absent	Low	Low
Ecological Communities					

Species	Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Possible impact?
Central Hunter Valley eucalypt forest and woodland	CE	Typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from finer grained sedimentary rocks. The woodland or forest canopy is dominated by one or more of the following four eucalypt species: – narrow-leaved ironbark (Eucalyptus crebra), spotted gum (Corymbia maculata (syn. Eucalyptus maculata), slaty gum (Eucalyptus dawsonii) and grey box (Eucalyptus moluccana).	Present	Low, PCT 1612 does meet key diagnostic characteristics and threshold criteria.	Low
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box Eucalyptus albens, Yellow Box E. melliodora and Blakely's Red Gum E. blakelyi. It occurs in the tablelands and western slopes of NSW.	Absent	Low	Low
Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	CE	Hunter Valley Weeping Myall Woodland of the Sydney Basin bioregion is currently known from parts of the Muswellbrook and Singleton Local Government Areas, but may occur elsewhere in the bioregion. It may also occur in the Upper Hunter Local Government Area within the Brigalow Belt South bioregion, although its presence has not yet been confirmed there. This community is associated with heavy clay soils on depositional landforms in the south-western part of the Hunter River valley floor.	Absent	Low	Low

V = Vulnerable, E = Endangered, CE = Critically Endangered

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Birds					
Anthochaera phrygia Regent Honeyeater	CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.	Absent	Low	Low
Botaurus poiciloptilus Australasian Bittern	E	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.)	Absent	Low	Low
Calidris ferruginea Curlew Sandpiper	CE	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Absent	Low	Low

[2] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

OEH threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Erythrotriorchis radiatus Red Goshawk	V	The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	Absent	Low	Low
Grantiella picta Painted Honeyeater	V	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 (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests.	Marginal	Low	Low
Lathamus discolor Swift Parrot	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes.	Marginal	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Numenius madagascariensis Eastern Curlew	CE	In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	Absent	Low	Low
Rostratula australis Australian Painted Snipe	E	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. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Absent	Low	Low
Frogs					
Litoria booroolongensis Booroolong Frog	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses with riffles, cobble banks and other rock structures within stream margins.	Absent	Low	Low
Mammals					

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Chalinolobus dwyeri Large-eared Pied Bat	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.	Marginal, forage only.	Low	Low
Dasyurus maculatus maculatus Spot-tailed Quoll	E	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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. 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.	Absent	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Nyctophilus corbeni Corben's Long-eared Bat	V	Overall, the distribution of the south eastern form of Corben's Long-eared Bat coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is 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. Mating takes place in autumn with one or two young born in late spring to early summer.	Marginal forage and breeding habitat (hollow-bearing trees)	Low	Low
Petauroides volans Greater Glider	V	Arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	Marginal	Low, woodland habitat present on the development site not optimal or preferred.	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Petrogale penicillata Brush-tailed Rock-wallaby	V	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night.	Absent	Low	Low
Phascolarctos cinereus Koala	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.	Marginal, traversal only. Eucalypts present are not preferred feed trees.	Low	Low
Pseudomys novaehollandiae New Holland Mouse	V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.	Absent	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Pteropus poliocephalus Grey-headed Flying-fox	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Absent	Low	Low
Reptiles					
Aprasia parapulchella Pink-tailed Worm-lizard	V	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (Themeda triandra). Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites.	Absent	Low	Low
Migratory Terrestrial					
Hirundapus caudacutus White-throated Needletail	M	White-throated Needletails arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia.	Absent	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Monarcha melanopsis Black-faced Monarch	M	The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. The Black-faced Monarch builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3 m to 6 m above the ground.	Absent	Low	Low
Myiagra cyanoleuca Satin Flycatcher	M	The Satin Flycatcher is found along the east coast of Australia in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher nests in loose colonies of two to five pairs nesting at intervals of about 20 m - 50 m apart. It builds a broad-based, cup-shaped nest of shredded bark and grass, coated with spider webs and decorated with lichen.	Absent	Low	Low
Rhipidura rufifrons Rufous Fantail	M	The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas The Rufous Fantail builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground.	Absent	Low	Low
Migratory Wetland					

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Actitis hypoleucos Common Sandpiper	M	Found along all coastlines of Australia and in many areas inland. 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. The Common Sandpiper has 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. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags.	Absent	Low	Low
Calidris acuminata Sharp-tailed Sandpiper	M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats.	Absent	Low	Low
Calidris ferruginea Curlew Sandpiper	CE	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Absent	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Calidris melanotos Pectoral Sandpiper	M	The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum.	Absent	Low	Low
Gallinago hardwickii Latham's Snipe	M	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). Known to occur in the upland wetlands of the New England Tablelands and Monaro Plateau.	Absent	Low	Low
Numenius madagascariensis Eastern Curlew	CE	In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	Absent	Low	Low

Species	Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Pandion haliaetus Osprey	M	The osprey tolerates a wide variety of habitats, nesting in any location near a body of water providing an adequate food supply. It is found on all continents except Antarctica, although in South America it occurs only as a non-breeding migrant. In Australia it is mainly sedentary and found patchily around the coastline, though it is a non-breeding visitor to eastern Victoria and Tasmania.	Absent	Low	Low
Tringa nebularia Common Greenshank	M	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. In NSW, the species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions.	Absent	Low	Low

V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory

APPENDIX F PERSONNEL

Personnel involved in the report are:

Name	Title	Qualifications	Roles
Mitch Palmer	Senior Ecologist (Technical Lead)	• BAM Accredited Assessor • B.Science (Geology and Geography)	Fieldwork, review and approval of BDAR
Brendon True	Ecologist/Botanist	• BAM accredited assessor (BAAS18155) • B. Science (Ecology and Biodiversity) • Masters Conservation Biology	Lead author BDAR
Zoe Quaas	Environmental Consultant	BSc Environmental Science and Management (First Class Honours)	Assistance with field work GIS Mapping

APPENDIX G BAM CALCULATOR CREDIT REPORT

BAM Credit Summary Report

Proposal Details

Assessment Id
00014636/BAAS17051/19/00015527

Proposal Name
Sandy Hollow SF

BAM data last updated *
26/11/2019

Assessor Name
Brendon True

Report Created
26/02/2020

BAM Data version *
22

Assessor Number
BAAS18155

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
4

Assessment Type
Part 4 Developments (General)

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Narrow-leaved Ironbark - Grey Gum - Native Olive woodland of Central Hunter								
1	1612_Cleared	6.6	13.4	0.25	High Sensitivity to Potential Gain	1.50		0

2	1612_Woodland	25.9	0.4	0.25	High Sensitivity to Potential Gain	1.50		4
							Subtotal	**4**
							Total	**4**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Diuris tricolor / Pine Donkey Orchid (Flora)						
1612_Woodland	25.9	0.37	0.25	1.5	False	4
					Subtotal	**4**
Prasophyllum petilum / Tarengo Leek Orchid (Flora)						
1612_Woodland	25.9	0.37	0.25	2	False	5
					Subtotal	**5**

APPENDIX H HOLLOW-BEARING TREES WITHIN THE DEVELOPMENT SITE

ID	Species	DBH (cm)	Hollows Present	Credits Required	Zone	To be Removed?
1	Narrow-leaved Ironbark *Eucalyptus crebra*	90	1 medium, 1 large, decorticating bark	0	2	No
2	Narrow-leaved Ironbark *Eucalyptus crebra*	50	1 medium, 1 large	0	2	No
3	Narrow-leaved Ironbark *Eucalyptus crebra*	45	1 small	0	2	No
4	Narrow-leaved Ironbark *Eucalyptus crebra*	90	1 small, 1large	0	2	No
5	Narrow-leaved Ironbark *Eucalyptus crebra*	80	1 small, 1 medium	0	2	No
6	Narrow-leaved Ironbark *Eucalyptus crebra*	75	1 small, 1 medium	0	2	No
7	Narrow-leaved Ironbark *Eucalyptus crebra*	80	1 small, 1 medium	0	2	No
8	Grey Gum *Eucalyptus punctata*	90	1 small, 1 medium, 1 large	0	2	No
9	Narrow-leaved Ironbark *Eucalyptus crebra*	50	1 small	0	2	No

Size classes:

- Small = 0-10 cm
- Medium = 10 -20 cm
- Large = >20cm

Brendon True

MConBio, BSc (Ecology and Biodiversity)
Accredited NSW BAM Assessor (BAAS18155)

KEY PROJECTS

Infrastructure projects

- Sydney Northern Beaches B-Line Program
- NorthConnex
- Traffic light installation and road widening Cranebrook
- Moorebank Intermodal Facility
- The Northern Road Upgrade Stages 2 and 3
- Intersection Upgrade at Morisset for Roads and Maritime Services
- Central Coast Safety Upgrades for Roads and Maritime Service (3 sites)
- M1 Kariong to Somerby Upgrade

Development projects

- Sydney Northern Beaches Hospital
- Cherrybrook Train Station Precinct Rezoning

Biobanking projects

- Sutherland Shire Council reserves
- Burragorang Biobanking site (private)

Recreational infrastructure projects

- Various sport's fields within The Hills Shire Council LGA

Renewable Energy Projects (under NSW BOS)

- Dunedoo Solar Farm
- Flyers Creek Wind Farm
- Wollar Solar Farm
- Horns Crossing Solar Farm (Martins Creek)
- Nana Glen Solar Farm
- Beryl Solar Farm (BSAR)
- Emmaville Solar Farm
- Newstead Solar Farm

Ecologist

Brendon has over 12 years of botanical experience with key expertise in the identification of native flora and invasive weed species of the greater Sydney region. Brendon's experience coupled with strong project management experience has equipped him with a thorough understanding of environmental issues in urban environments. Brendon has a strong background in flora and fauna survey and identification (including highly detailed vegetation assessments, BioBanking and targeted threatened species surveys), project ecologist duties (including pre-clearing surveys, biodiversity advice, clearing supervision and biodiversity monitoring) and high level reporting (including Biodiversity Assessments under FBA, Flora and Fauna Assessments, ecological constraints analyses, ecological monitoring and reporting, Reviews of Environmental Factors, Vegetation Management Plans and Species Impact Statements).

Brendon is an accredited NSW Biodiversity Assessment Methodology (BAM) Assessor with experience preparing Biodiversity Development and Stewardship Assessment Reports (BDAR and BSAR) in accordance with the NSW Biodiversity Offsets Scheme (BOS).

Tertiary Qualification

University of New South Wales, Sydney
Master of Conservation Biology (2005)

Victoria University of Wellington, New Zealand
Bachelor of Science (Ecology and Biodiversity) (2004)

Professional Experience

Ecologist – NGH Pty Ltd

May 2017 - present

- Flora and Fauna Surveys
- Biobanking assessments and offset planning
- Review of Environmental Factors
- Assessment of Significance
- Preparation of Environmental Management Plans
- Pre-clearing surveys and clearing supervision
- General Biodiversity Assessments
- BDAR and BSAR including detailed survey design and implementation

Ecologist – Soletrader October 2016 – May 2017

- Client liaison;
- Flora and fauna survey;
- Survey and mapping of habitat values, threatened species, noxious weeds and threatened and non-threatened vegetation communities;
- Collation and analysis of field data;
- Use of background research resources such as the NSW Wildlife Atlas, the Commonwealth Protected Matters Search Tool, Department of Planning & Environment Planning Portal, Six Maps and OEH Profiles/Final Determinations.
- Report writing including flora and fauna assessments and Plans of Management;

Field Botanist – Biosis April 2016 – September 2016

- Flora survey using the BBAM and rapid techniques;
- Fauna survey for threatened species including amphibians, mammals and birds;
- Survey and mapping of habitat values, threatened species, noxious weeds and threatened and non-threatened vegetation communities;
- Collation and analysis of field data;
- Use of background research resources such as the NSW Wildlife Atlas, the Commonwealth Protected Matters Search Tool, Department of Planning & Environment Planning Portal, Six Maps
- Pre-clearance survey and clearing supervision;
- Fauna rescue;
- Aquatic monitoring;
- Report writing including advice letters, short reports, flora and fauna assessments, constraints reports, Assessment of Significance, Significant Impact Criteria Assessments, EPBC Act referrals and various Plans of Management;
- Tender and Proposal Writing;
- Internal and external client liaison.

Bush Regeneration Tender/Project Manager. Ecological Consulting Assistant
February 2013 – March 2016

- Accurate assessment of the type and amount of work required to regenerate remnant bushland;
- Monitoring and reporting against a set of Key Performance Indicators;
- Working closely with Local Governments and private land owners to ensure desired outcomes are reached;
- Effective identification of different ecological communities including those listed as endangered
- Correct identification of invasive plant species, including Noxious Weeds and Weeds of National Significance;

Ecological Consulting duties:

- Flora/fauna survey design and implementation;
- Pre-disturbance surveys and translocation of threatened and endangered fauna;
- Night surveys for target threatened and endangered fauna including scribing and organising of equipment;
- Summarising of field data and correct processing of field records;
- Vegetation mapping utilising GIS, data collection and manipulation;
- Background research for a project using internal and external resources;
- Assist in the writing of reports and plans of management;
- Tender and proposal writing.

Additional Qualifications and Skills

- Accredited BAM Assessor (BAAS18155)
- Advanced Plant Identification – Centre for Ecosystem Science
- WHS General Induction for Construction Work in NSW (white card)
- First Aid Training

Mitch Palmer

BSc

Accredited NSW BAM Assessor (BAAS17051)

KEY PROJECTS

NGH Pty Ltd

- Dunedoo Solar Farm
- Wellington Solar Farm
- White Rock Wind Farm
- Sunraysia Solar Farm
- Bodangora Wind Farm
- Flyers Creek Wind Farm
- Wollar Solar Farm
- Silverton Wind Farm baseline bird and bat surveys
- NPWS threatened orchid surveys
- RMS M1 Culvert replacement biodiversity assessment
- RMS M1 slope stabilisation biodiversity assessment
- Manilla Water Treatment Plant biodiversity assessment

North West Local Land Services

- Development of property vegetation plans (PVPs) under Native Vegetation Act 2003
- Regent Honeyeater/Swift Parrot habitat restoration and monitoring program
- Woodland habitat restoration project - Gunnedah Research Centre

Principal Ecologist

Currently employed as the acting Principal Ecologist at NGH Hunter, New England and North Coast office, Mitch has key expertise in the identification of native flora, vegetation communities and avifauna species throughout NSW and Queensland, particularly within the Sydney, Hunter Valley, Central and New England Tablelands, Central West, North West Slopes and NSW North Coast.

Mitch has a diverse project experience, including ecological constraints analyses, ecological impact assessment for renewable energy, residential and infrastructure projects, Biobanking and Major Project assessments, Biodiversity Development and Stewardship Assessment Reports (BDAR and BSAR) in accordance with the NSW Biodiversity Offsets Scheme and Biodiversity Assessment Methodology (BAM), EPBC Referrals, development of offset packages, preparation and implementation of nest box and vegetation management plans, monitoring of offsets and management actions, in addition to project management of pre clearing surveys and clearing operations. Mitch has qualifications in geological and environmental science and is an accredited Biobanking and BAM assessor.

Tertiary Qualification

University of Newcastle, Australia
Bachelor of Science

Professional Experience

Acting Principal Ecologist – NGH Pty Ltd

July 2018 – present

- Provision of strategic advice to at early project stages regarding potential for threatened flora, fauna, ecological communities and targeted survey requirements
- Preparation and review of specialist reports, including Biodiversity Development Assessment Reports and Flora and Fauna Assessments, as part of broader Environmental Impact Statements and Reviews of Environmental Factors for State Significant Developments and infrastructure projects
- Project Management including preparation of fee proposals and client liaison
- Designing, managing and conducting targeted threatened and general flora and fauna surveys for the purpose of impact assessment, including Plant Community Type mapping, BAM plot collection, targeted threatened flora and fauna searches and habitat assessment
- Management and mentoring of NGH Biodiversity team

Regional Ecologist – Local Land Services (Sustainable Land Management)

March 2018 – July 2018

- Assess applications and undertake site assessments for the development of Clearing and Set Aside Certificates under the Local Land Services Amendment Act 2013.
- Provide ecological advice and policy guidance regarding Threatened Ecological Communities and threatened species

Ecologist/Senior Ecologist – NGH Pty Ltd

November 2016 – March 2018

- Undertake environmental impact assessments.
- Undertake ecological assessments.
- Prepare environmental management documents such as VMPs, CEMPs, ESCPs and EMS's.
- Deliver site environmental management services including audits, inspections and specialist advice.
- Liaise with clients and stakeholders, including government agencies.

Senior Land Services Officer: Native Vegetation – North West Local Land Services

January 2014 – November 2016

- Assess applications and undertake site assessments for the development of Property Vegetation Plans (PVPs) under the Native Vegetation Act 2003.
- Undertake flora and fauna assessments including identifying threatened ecological communities and threatened species, for the purpose of assessing eligibility for
- PVPs, voluntary conservation agreements and Biobanking agreements.
- Managing and implementing natural resource and sustainable land management projects including revegetation/restoration projects, targeted threatened species, surveys, riparian protection projects and emerging invasive species projects.

Environmental Officer – Whitehaven Coal

April 2012 – January 2014

- Maintaining and improving environmental performance, providing environmental advice and assistance to management and operation personnel and the requirements of the EMS.
- Liaise with internal and external stakeholders on environmental issues related to coal mining.
- Monitor, evaluate and report on environmental performance.
- Identify, investigate and action environmental risks and issues, including major changes to the EMS.
- Develop and update Environmental Management Plans and Annual Environmental
- Management Reports

Project Officer – McElroy Bryan Geological Services

June 2010 – April 2012

- Coordinating multi rig exploration programs
- Management of all environmental approvals for exploration programs.

Additional Qualifications and Skills

- Accredited BAM Assessor BAAS17051
- Advanced Plant Identification – Centre for Ecosystem Science
- Wildlife survey school - Niche Environmental
- Wildlife immediate care and rescue – Wires
- Koala rescue and rehabilitation
- Assess applications for legislative compliance
- WHS General Induction for Construction Work in NSW (White Card)
- 4wd and defensive driving course
- Senior First Aid