Biodiversity Development Assessment Report (BDAR)

Black Hill Industrial Development, Black Hill

Prepared for

Barr Property & Planning c/- Broaden Management Pty Ltd

Final V4 / June 2021

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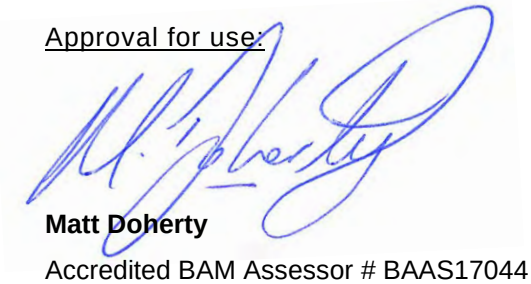
DOCUMENT STATUS

Project Particulars			
Project Name	BDAR: Black Hill Industrial Development, Black Hill		
Job Number	17032		
Client	Barr Property & Planning c/- Broaden Management Pty Ltd		
Status	Final		
Version	Date	Prepared by	Details
V1	19-7-2018	AC/MD	Draft for client review
V2	14-8-2018	AC/MD	Final for client submission
V3	21-06-2019	AC/MD	Final with Council requested information
V4	9-07-2021	CP/MD	Additional area update (John Renshaw Drive)

BOAMS STATUS

BOAMS	Finalised [9-7-2021]
BAM-C	Finalised [9-7-2021]
Accredited Assessor	Matt Doherty – Accreditation # BAAS17044

Approval for use:



Matt Doherty

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9 July 2021

EXECUTIVE SUMMARY

MJD Environmental has been engaged by Barr Property & Planning on behalf of Broaden Management Pty Ltd, to prepare a Biodiversity Development Assessment Report (BDAR) for the construction and operation of the Black Hill Industrial Estate. The BDAR has been prepared and finalised as of June 2019 with additional areas assessed in response to matters raised during Land and Environment Court Proceedings in June 2021. It should be noted that this additional assessment has been included herein however the initial lodgement is still current and therefore no alterations to amended legislation which has occurred within the interim has been made. This BDAR accompanied an Environmental Impact Statement (EIS) seeking consent for the industrial development over part Lot 1131 DP 1057179, Black Hill Rd, Black Hill NSW and the adjoining 2 km length of road corridor along John Renshaw Drive being the subject of this review.

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Biodiversity Assessment Methodology 2017 (BAM) was used as the assessment method, as the current assessment method at the time of lodgement (it has subsequently been superseded by BAM 2020). BAM 2017 was used to establish impacts on threatened species and threatened ecological communities in the locality under the *Biodiversity Conservation Act* 2016.

The proposed development site was part of a planning proposal that received gateway on 11th December 2012 and a Draft LEP was received on 12th December 2016 with gazettal occurring on the 13th April 2017. The planning proposal assessed a land zoning change from RU2 Rural Landscape to IN1 General Industrial and E2 Environmental Conservation. This planning proposal sought to provide opportunity to develop the previously disturbed study area environs for an industrial development whilst conserving higher value native vegetation via appropriate environmental zoning.

The current conditions on site are evidence of the past land uses. The previous use as a commercial poultry farm is evident in large areas of cleared exotic pasture where sheds were once located. Currently the site is continuing to be grazed, limiting native vegetation to re-establish across the central area of the site. While the road corridor surveyed in 2021 is indicative of disturbed roadside vegetation, with some remnant woodland remaining and impacts from the abutting mine rehabilitation site to the north.

Field Assessments carried out as part of the biodiversity assessment identified the following Plant Community Types (PCT):

- 72.83 ha of varying condition PCT 1592: *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter* which is commensurate with the listed Endangered Ecological Community *Lower Hunter Spotted Gum Ironbark Forest of the Sydney Basin*; and
- 0.78 ha of PCT 1584: *White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley*.

Targeted surveys for all flora and fauna candidate species recognised to have potential to occur within the subject site have been carried out by MJD Environmental (2018 & 2019) and have also utilised surveys undertaken by RPS (2017) as part of the works informing this BDAR. The additional roadside area was surveyed for suitable habitat for those species specified during June of 2021 to determine potential use.

The following threatened species were observed or recorded during survey works:

- Grey Crowned Babbler *Pomatostomus temporalis temporalis* (Ecosystem Credit Species)
- Grey-headed Flying Fox *Pteropus poliocephalus* was also observed flying over and foraging on blossom (Dual Credit species) no camp was observed on site; and
- Little Bentwing Bat (*Miniopterus australis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), both are dual Credit Species. The site was assessed as to have no maternity colonises present, so these species were accounted for as Ecosystem Credit Species.
- East-coast Freetail Bat (*Mormopterus norfolkensis*), Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (Ecosystem Credit Species).

- Large-eared Pied Bat (*Chalinolobus dwyeri*) is a species Credit species, however detailed assessment has determined no breeding/ roosting habitat on site for this species;
- Masked Owl (*Tyto novaehollandiae*) (Dual Credit species), this species was not observed to be breeding in the subject site at the time survey thus has only been account for as an Ecosystem Credit Species.

Impact Avoidance & Mitigation

A package of avoidance and mitigation measures have been described in this BDAR associated with the project.

The subject site for development was selected due to the largely cleared or highly degraded lands as a result of past and present land use. All vegetation is to be removed within the subject site with the exception of the south to north reach of an ephemeral riparian corridor situated in the north-west of the site. The alignment will be subject to realigned in areas and rehabilitation as part of the staged development works. (Note: for the purposes of impact assessment, this vegetation has been considered as lost, thus adding to the overall biodiversity liability, notwithstanding that areas of the riparian corridor that are not realigned will be retained).

The current layout of the industrial area has been developed in response to the rezoning of the study area and no further avoidance and mitigation measures have been considered, as the approval granted at the time of rezoning considered the conservation outcomes for the site and the proposed land usage to be sufficient to allow for the rezoning to be approved

All measures have been incorporated into the design (avoidance) in the first instance with mitigation measures assessed for the construction and operational phases of the project.

Impact Analysis

The proposal will result in following impacts and required offsets as calculated using the BAM-C Calculator:

- 68.69 ha of PCT 1592 requiring 1,865 ecosystem credits; and
- 0.78 ha of PCT 1584 requiring 24 ecosystem credits to offset the loss under the NSW Biodiversity Offsets Scheme

There is no requirement to offset:

- 4.14 ha of PCT 1592 that was assessed to have a Vegetation Integrity score <15:
- 105.24 ha of pasture; and
- 4,400m^2 of non-indigenous planting
- 3.17 ha of managed roadside vegetation

The development will be delivered in stages. It is proposed to stage the retirement of credits to achieve the required biodiversity credit liability, were the liability will be scheduled according the Staging and Clearing Plan. The total number of credits to be retired for each stage of the development shall be pro rata based on a credit / ha (of impact) calculation.

The current method to retire credits for the proposal has not been determined and will be dependent on the availability of credits on the open market, viability of establishing a stewardship site in the locality or retirement of credits via payment into the Biodiversity Conservation Fund. It is likely that credit retirement will incorporate a combination of these options as the development is delivered.

A preliminary assessment under the EPBC Act determined the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

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Appendix B Staging and Clearing Plan and Staged Credit Retirement

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Appendix E BAM Calculator Credit Report

Appendix F EPBC Likelihood of Occurrence Table

Appendix G Personnel Qualifications

Appendix H Detailed Project Description

Appendix I Fauna Results (MJD Environmental 2017 &18)

Appendix J RPS Survey Effort Plan & Threatened Fauna Plan (RPS 2017)

Appendix K Anabat Report (EchoEcology)

GLOSSARY OF TERMS AND ABBREVIATIONS

Term/ Abbreviation	Meaning
BAM	Biodiversity Assessment Method 2017
BDAR	Biodiversity Development Assessment Report
BC Act	Biodiversity Conservation Act 2016
BS Act	Biosecurity Act 2016
Council	Cessnock City Council
DoEE	Commonwealth Department of the Environment & Energy
DPE	NSW Department of Planning and Environment
DPI Water	NSW Department of Primary Industries – Water
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ha	hectare
LGA	Local Government Area
LLS Act	Local Land Services Act
NV Act	Native Vegetation Act 1995 (Repealed)
OEH	NSW Office of Environment and Heritage
TSC Act	NSW Threatened Species Conservation Act 1995 (Repealed)

1 Introduction

Management Pty Ltd, to prepare a Biodiversity Development Assessment Report (BDAR) to accompany an Environmental Impact Statement (EIS), seeking consent for an industrial development over part of Lot 1131 DP 1057179, as well as the adjoining road corridor, Black Hill Rd, Black Hill NSW, hereafter referred to as the 'subject site' (**Figure 1**).

1.1 Description of Proposal

The proposed development seeks consent for the subdivision of Part Lot 1131 in Deposited Plan 1057179 to create 39 large industrial lots, as shown on the subdivision plan (Refer to **Appendix A**). Additionally, the proposal includes the remediation of the site to ensure that site is suitable for future occupation for industrial use.

This proposal constitutes stage 2 of a concept development application submitted to Cessnock City Council, pursuant to s.22 of the Environmental Planning and Assessment Act 1979 (refer to section 6.6.1). This stage of the concept development application includes:

- Creation of two signalised intersections to provide suitable access to the subdivision;
- The realignment of the existing watercourse that traverse the western portion of the site;
- Civil earthworks to provide a suitable foundation for future industrial development;
- Extension, augmentation and/ or adaptation of essential services (i.e. water, sewer & telecommunications) to cater for the future tenants of the industrial development;
- Construction of a 132/11kV substation and the relocation of the existing aboveground 132kV high voltage transmission line;
- Remediation of the site to ensure suitable occupation for industrial use;
- Subdivision of Part of Lot 1131 in Deposited Plan 1057179 to create 39- industrial lots and 1 environmental conservation lot; to be delivered in six stages;
- Construction of the ring-road network to provide suitable access to all proposed industrial lots, and
- Infrastructure to capture, detain and treat all stormwater collected on site.
- Road widening of existing road corridor to accommodate a possible dual carriageway

Refer to **Figure 2** for a Site Map and **Appendix A** for a plan of the proposal. **Appendix H** contains a detailed description of the proposal.

1.2 Aims & Objectives

The proposed Black Hill Industrial Development is a designated development under Part 4 of the *Environmental Planning and Assessment Act 1979*.

This Biodiversity Development Assessment Report has been prepared as part of an Environmental Impact Statement (EIS) for the designated development and addresses the Secretary's Environmental Assessment Requirements (SEARs) issued on 28 May 2018.

This BDAR is based on an application of the NSW Biodiversity Assessment Methodology 2017 (BAM), which provides a framework for assessing the developments impact on biodiversity. A two-stage investigation path was performed in accordance with the BAM as listed below:

Stage 1 – Biodiversity Assessment; and

Stage 2 – Impact Assessment.

This report sets out the minimum BAM assessment requirements of the preparation of a BDAR in Appendix 10 of the BAM (2017).

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.3 Site Particulars

The following nomenclature has been used in this report (Refer to **Figure 1**):

- Study Area– Refers to the wider lands assessed as part of the proposal and previous studies
- Subject site – Refers to the development area within the Study Area (Part Lot 1131 DP 1057179). This area includes all matters that form the proposal including construction area, operational area, road widening and servicing.

Locality	The site is located in Black Hill
Land Title	Part Lot 1131 DP 1057179
LGA	Cessnock City Council with an approximate 1.09 ha falling within the Newcastle City Council LGA
Area	The study area is approx. 216.5 ha comprised of the Subject site 184.41 ha (approx.) and northern E2 Environmental Conservation zoned parcel 57.6 ha (approx.).
Zoning	The site is currently zoned IN2 Light Industrial (NSW Planning & Environment 2018).
Boundaries	The site is bound by frontage to E2 Environmental Conservation zone land followed by John Renshaw Dr. To the immediate south, the site is bound by E4 Environmental Living zone land followed by Black Hill Rd. E4 Private parcels of land categorised as Environmental Living zone land bound the site to the west and IN2 Light Industrial zone lands to the east, with a 330 kV electricity line and associated easement running parallel to the eastern edge
Current Land Use	The entire site comprises remnants of an old chicken farm, containing at least 15 individual family farms, each with its own chicken sheds and house dwellings. These former farms and residences within the site have been demolished and the land is now vacant. The site is currently being used to support grazing beef cattle. The subject site is also inclusive of an approximately 2.08 km stretch of John Renshaw Drive which is contains areas of slashed road verge.
Topography	The highest point on the site is approximately 50 m AHD in the extreme southern and south-eastern portion. The lowest point of elevation throughout the site is in the extreme north in relation with Weakleys Flat Creek at an elevation of approximately 20 m AHD. The dominant drainage lines within the site lie in the north-east and consist of two major creeklines separated by a ridgeline, which is also oriented towards the north-east.
Locality	Black Hill

1.4 Qualifications & Licencing

Qualifications

This BDAR has been prepared by Matt Doherty (BAAS #17044) and Adam Cavallaro (BAAS# 18056) accredited BAM Assessors. 2021 updates have been prepared by Coral Pearce [B. A. Sc. (Ecology), M. Sc] under the guidance of Matt Doherty.

Field Work for the BDAR was carried out by Adam Cavallaro, Bret Stewart, Phoebe Smith and Matt Doherty of MJD Environmental Pty Ltd. Field work conducted as part of the 2021 updates were conducted by Chris Spraggon and Coral Pearce of MJD Environmental.

Refer to **Appendix G** for personnel qualifications.

Licencing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101684 (Valid 30 November 2021).
- Animal Research Authority (Trim File No: 16/170) issued by NSW Department of Primary Industries (Valid 8 February 2022).
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 16/170) issued by NSW Department of Primary Industries (Valid 8 February 2022).

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 1: SITE MAP

Legend

- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

N
W E
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Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 1 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

STAGE 1 BIODIVERSITY ASSESSMENT

2 Landscape Context

2.1 Landscape Features

The following section provides a description of the landscape features within the site and surrounding 1,500m buffer as outlined in Section 4 of the BAM (2017)

2.1.1 Interim Biogeographic Regionalisation of Australia (IBRA)

Bioregion

The subject site occurs wholly within the Sydney Basin Bioregion. The Sydney Basin Bioregion comprises of Mesozoic sandstones and shales; dissected plateaus: forest, woodlands and heaths: The soils are primarily skeletal soils, sands and podzolics (Thackway & Cresswell 1995). This Bioregion borders NSW North Coast to east: Nandewar and Brigalow Belt South to the north and the South Eastern Highlands in the south.

Subregion

The Study Area occurs wholly within the Hunter subregion.

2.1.2 Mitchell Landscapes

The Study Area occurs wholly within the Sydney Basin Hunter *Newcastle Coastal Ramp* Mitchell Landscape.

The Newcastle Coastal Ramp Mitchell Landscape occurs as undulating lowlands and low to steep hills on complex patterns of faulted and gently folded Carboniferous conglomerate, lithic sandstone, felspathic sandstone, and mudstone, general elevation 50 to 275m, local relief 40 to 150m. Stony red texture-contrast soils on steep slopes, yellow and brown texture-contrast soils on lower slopes and deep dark clay loams along streams.

Woodland of spotted gum (*Corymbia maculata*), forest red gum (*Eucalyptus tereticornis*), Red ironbark (*Eucalyptus sideroxylon*), white mahogany (*Eucalyptus acmenoides*), large-fruited grey gum (*Eucalyptus canaliculata*), with sub-tropical rainforest elements in sheltered gullies. Similar Eucalypts with Forest Oak (*Allocasuarina torulosa*) and grasses on lower slopes, merging to forest of Smooth-Barked Apple (*Angophora costata*), Red Bloodwood (*Corymbia gummifera*), Blackbutt (*Eucalyptus pilularis*) with Bracken (*Pteridium esculentum*) and grasses nearer the coasts (Mitchell 2002).

2.1.3 Rivers, Streams, Estuaries and Wetlands

The site is located within the Hunter River catchment in the Hunter region. The Site is located 5.74km west of the Hunter River and 10.5km south of the Paterson River.

The hydrology of subject site is typified by a single ephemeral first order stream running in a south to north direction in the western section of the site. The larger study area in which the site is located, includes additional ephemeral first order streams and a second order stream situated in the vegetation to be retained in the north which extends into the road corridor, bisecting the additional 2021 survey area. A third order water runs parallel to the southern boundary within vegetation to be retained.

The site is located approximately 2.7km west of the RAMSAR list wetlands Hexham Swamp and Pambalong Swamp. Both these areas are mapped as Coastal Wetlands under the Coastal Management SEPP.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 2: LOCATION

Legend

- Culvert
- Corridor
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- Subject Site
- Study Area
- Cadastral Boundaries
- 1500m Buffer
- National Parks Estate

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MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 1 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

2.1.4 Connectivity

The wider study area in which the subject site is currently located, facilitates habitat connectivity primarily in the form of dry sclerophyll forest that borders riparian corridors. The subject site consists of patchy vegetation (centrally) with dense areas to the north and south of the subject site. Currently the subject site provides connectivity to large areas of vegetation to the east and west. The study area is bordered to the east by a linear electricity easement that lacks canopy vegetation, just east of this easement (approximately 60 m) is a larger contiguous patch of vegetation that is persistent to the M1 Motorway that severs any further connectivity to the east, for predominantly ground dependent fauna species. Connectivity to the north of the subject site is restricted to highly mobile fauna species due to the major arterially road John Renshaw Drive dissecting the study area from vegetation in the neighbouring Donaldson Coal landholdings. The west of the study area is connected to a large tract of land that stretches west and has further connection in the south and south-west to the northern extent of the Sugarloaf range.

Vegetation is generally contiguous based on canopy cover. The network of vegetation patches allows for movement across the subject site in a north-south and east-west direction. The patchy nature of the subject site is evident of historic land clearing in the area, that currently supports the movement of highly mobile fauna species.

The land to the east has been approved for a large employment lands development as part of the Coal & Allied Lower Hunter Lands – Black Hill site project (Major Project ref: MP10_0093). When developed, connectivity to the east of site will be severed. The neighbouring concept approval seeks to maintain a central north to south connection via a retained riparian zone. Continued east to west connectivity shall occur south of site within the study area to the neighbouring concept approval site.

2.1.5 Areas of Geological significance and soil hazard features

No karsts, caves, crevices or cliffs or other areas of geological significance occur in or adjacent to the subject site.

Soil hazards such as contaminated land has been assessed as part of the Environmental Impact Statement (EIS). Please refer to the Contaminated lands report provided as an appendix to the EIS.

A review of the Acid Sulphate Soils Risk mapping (Naylor et al 1998) records indicate the site has not been assessed for ASS.

2.1.6 Areas of Outstanding Biodiversity Value

There are no Areas of Outstanding Biodiversity Values within the 1,500m buffer or in the general locality of the site.

2.2 Site Context

The site context was assessed for the subject site and wider study area via desktop assessment of previous ecological studies carried out on the subject site, Aerial Photograph Interpretation (API) using GIS Software and initial high-level site visit. Site context considerations included native woody cover and patch size in accordance with section 4.3 of the BAM (2017)

2.2.1 Native Vegetation Cover

The native vegetation cover of the subject site and 1,500m buffer was carried out by API of high quality aerial photography using GIS Software (Map Info), and local vegetation mapping data *Lower Hunter Vegetation Mapping* (Cockerill *et al* 2013) and the *Greater Hunter Valley Mapping* data set (Somerville 2009)

Native vegetation cover has been assessed as >30-70% or 67 %.

Refer to **Figure 3** and **Figure 4**.

2.2.2 Patch Size

A patch is defined in the BAM as:

an area of intact native vegetation that occurs on the subject site. The patch may extend onto adjoining land beyond the footprint of the subject site, and for woody ecosystems, includes native vegetation separated by ≤100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 metres.

Patch size for the site has been assessed using the methods outlined above in Section 3.2.1 and it has been determine that the patch size is greater than 100ha.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 3: NATIVE VEGETATION EXTENT

Legend

- Culvert
- Corridor
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- Subject Site
- Study Area
- Cadastral Boundaries
- 1500m Buffer
- Native Vegetation
- National Parks Estate

N
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Meters

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MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 1 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 4: SITE NATIVE VEGETATION EXTENT

Legend

- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries
- Native Vegetation

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Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 1 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

3 Native Vegetation

3.1 Preliminary Vegetation Review

A desktop analysis of vegetation within the study area, site and its surrounds were informed by large-scale vegetation mapping projects and aerial photography to determine potential Plant Community Types (PCT) occurring on site, they include:

- *Lower Hunter Vegetation Mapping* (Cockerill *et al* 2013)
- *Hunter, Central & Lower North Coast Vegetation Mapping Classification and Mapping Project* (Somerville 2009);
- *Greater Hunter Native Vegetation Mapping Geodatabase Guide V4.0* (Sivertsen et al. 2011;
- RPS (2011). *Ecological Assessment Report – Lower Hunter Lands: Black Hill.* Report prepared for Coal & Allied Industries (for Major Project MP10_0093)
- GIS analysis including - Aerial Photograph Interpretation (API) and consultation of topographic map (Scale 1:25,000) layers for the site; and
- OEH VIS Classification Database

In addition, a review of ecological information associated with previous ecological investigations carried out within the Study Area was undertaken this includes:

- RPS Group (2017a) *Biodiversity Assessment Report: Black Hill Industrial Development.* RPS Group, Broadmeadow, NSW
- RPS Group (2017b) *Black Hill Industrial Development: Biodiversity Inventory Report,* RPS Group, Broadmeadow, NSW

3.2 Methodology: Field Assessment

All vegetation survey methods have been carried in accordance with the following documentation and methods:

- *Biodiversity Assessment Methodology (BAM):* Office of Environment and Heritage (OEH), August 2017;
- *Biodiversity Assessment Method Operational Manual- Stage 1* Office of Environment and Heritage (OEH), May 2018; and
- *NSW Guide to Surveying Threatened Plants* Office of Environment and Heritage (OEH), February 2016

3.2.1 Field Survey

Field assessments of vegetation were carried out within the subject site on 20, 21,22, 26, 27 June and 3 July 2018 by Adam Cavallaro and Phoebe Smith, with additional field assessment conducted on 9 June 2021 by Coral Pearce and Chris Spraggon. The field surveys were carried out in accordance with Biodiversity Assessment Methodology (BAM 2017) with additional assessment methods to assist in gaining an overview of site biodiversity values.

The following methods were used to inform the vegetation survey associated with the BDAR:

- Broad vegetation identification, delineation and stratification into vegetation zones carried out by detailed random meander methods (Cropper 1993);
- Collection of plot/transect based full floristic data as per Section 5 of the BAM, recording the following;
    - Identification of all flora species to genus where identification attributes were present
    - Composition, Structure attributes within 20x20m (400m^2) plot; and

- function attributes within the 20X50m (1,000m^2) plot

- Collection of site landscape attributes that included, landform, aspect, soil type, detailed descriptions of the vegetation condition, current land use and the impacts currently observed on site.

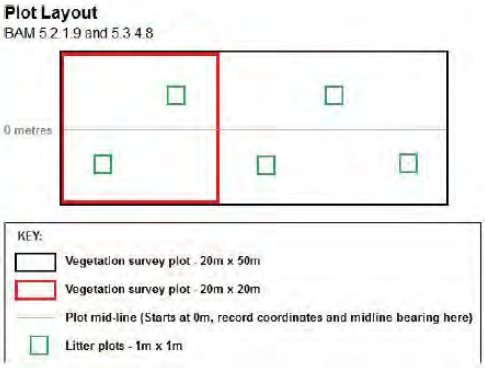

Plate 1: Plot Lay out (BAM Operational Manual 2018d)

3.3 Hollow Bearing Tree Survey

A hollow bearing tree survey was undertaken (Feb – Mar 2019 and June 2021) across the subject site with the following information collected:

- Location (D-GPS);
- Tree species;
- Tree DBH;
- Presences of hollows (including potential hollows) and class;
- Habitat suitability for large Forest Owls; and
- Any observational information.

4 Vegetation Survey Results

4.1 Native Vegetation Extent

The subject site is 184.41 ha in size which includes 73.6 ha of native vegetation and 108.85 ha of cleared land (exotic pasture and tracks), non-indigenous native plantings and managed roadside vegetation. The extent of native vegetation has been interpreted using API and ground truthing during field survey works. (Refer to **Figure 5**).

The vegetation within the subject site has been modified by current and past land uses. Historically the site was used for a commercial poultry farm site, in which many of the cleared areas were once the location of large chicken sheds. Since the decommissioning of the poultry farm, the site has been used for grazing which was evident during the field surveys. The current land use has resulted in the modification of the structure of native vegetation on site to a point that vegetation representative of assigned Plant Community Types is defined generally by canopy and groundcover species. The ground throughout the site is often compacted due to bovines traversing the site and high levels of manure throughout.

The proposed road widening will occur primarily within the existing road corridor containing managed roadside vegetation and remnant native vegetation. The remnant vegetation is currently impacted by edge effects due to the extant road and mine rehabilitation site and works to the north. The managed roadside vegetation contains a high level of exotic grasses with Coolatai grass (*Hyparrhenia hirta*), a HTE dominating. Woody species such as *Lantana camara* and *Acacia* species found throughout.

Identification of PCTs within the subject site were determined using:

- Occurrence within the Sydney IBRA bio-region;
- Vegetation formation and class:
- landscape position; and
- dominant species noted during field data collected from the full floristic plots/transects established in accordance.

Two PCTs were identified within the Subject site:

- **PCT 1592**: *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*; and
- **PCT 1584**: *White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley*

In addition, areas identified not to align with PCTs include Cleared land and Non-indigenous plantings.

4.2 Vegetation Description

PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Plate 2: PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Vegetation Formation	KF_CH5A Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation Class	Hunter-Macleay Dry Sclerophyll Forest
Area	72.83 ha
Vegetation Zone:	Vegetation Zone VZ1:1592_High Vegetation Zone VZ2:1592_Moderate Vegetation Zone VZ3:1592_Low Grassland Vegetation Zone VZ4:1592_Low Vegetation Zone VZ5: 1592_Low Scattered Trees
Description	The Spotted Gum - Red Ironbark – Grey Gum Shrub -Grass open forest of the Lower Hunter is the dominant plant community observed across the subject site. The canopy is dominated by *Corymbia maculata, a*nd *Eucalyptus fibrosa* with various sub-dominant or infrequently occurring canopy species observed pending location and proximity to adjacent plant community type within the landscape. The northern section of the site has a distinct difference in sub-dominant species where species such as *Angophora costata*, *Corymbia gummifera* were observed to be scattered throughout. The central areas are primarily consisting of the dominant two species of the community, with occurrences of *Eucalyptus punctata, E. paniculata*

	and *E. acmenoides.* The occurrence of this community along the southern boundary of the subject site has a very sparse occurrences of E. *moluccana*. A very narrow band of *E. tereticornis* also occurs scattered amongst the *C. maculata* and *E. fibrosa.* The mid-storey and shrub layer is generally sparse across the entire site (due to historic and current land uses) with small patches in which a low diversity of mid-storey and shrub species have persisted. Species observed included *Allocasuarina torulosa, Bursaria spinosa, Daviesia ulicifolia, Breynia oblongifolia, Persoonia linearis* and *Pultenaea spinosa.* The groundcover diversity was dependent on current grazing practices occurring on site, in general the site has a high diversity of groundcover composition, with primarily native grassy and herbaceus species. The groundcover species commonly observed throughout the subject site consisted of *Themeda triandra*, *Aristida vagans*, *Microlaena stipoides*, *Pratia purpurascens, Entolasia stricta Brunoniella australis.* Less common species observed but not limited include *Lepidosperma laterale, Lomandra filiformis* subsp. *filiformis, Glycine clandestina Oplismenus imbecilis.* There are a number of exotic species spread throughout that include *Lantana camara,* and a number of pasture and peri-urban exotic species such as *Ehrharta erecta, Cenchrus clandestinus, Sporobolus africanus, Senecio madagascariensis* and *Axonopus fissifolius.*
Species relied upon for Id of vegetation type	*Corymbia maculata, Eucalyptus fibrosa, Eucalyptus punctata, Daviesia ulicifolia, Bursaria spinosa, Themeda triandra, Microlaena stipoides* and *Aristida vagans*
Threatened Ecological Community	PCT 1592 is commensurate with *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin Bioregion* which is listed as an Endangered Ecological Community under the *Biodiversity Conservation Act 2016*
%cleared of PCT	44% cleared (Bionet 2018)
Justification of assigning PCT	The PCT assignment of 1592 to the vegetation within the subject site is based on the follow key attributes: ▪ Key diagnostic species within the canopy are present within remnant vegetation observed on site. The midstorey is often lacking but where it still persists key species are present: the groundcover does also present with all key diagnostic species. ▪ The site is located predominantly within the Beresfield soil landscape with northern sections located with the Shamrock Hill soil landscape. Both of these landscapes have an association with the lithology noted in the PCT description. ▪ The site is within the Lower Hunter and is located within flats in the landscape.

PCT 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley

Plate 2: PCT 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley

Vegetation Formation	KF_CH2A Wet Sclerophyll Forests (Grassy sub-formation)
Vegetation Class	Northern Hinterland Wet Sclerophyll Forest
Area	0.78ha
Vegetation Zone:	Vegetation Zone VZ6: 1584_High

Description

The White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley is located within a small section of the development site adjacent to the second order stream that dissects the proposed north-western entrance road.

The canopy has a mixed canopy species with *Corymbia maculata, Eucalyptus acmenoides* and *Eucalyptus paniculata* being the dominant species. There are a small number of infrequently occurring canopy species that include *Eucalyptus punctata* and sub-canopy species *Melaleuca stypheloides.*

The native mid-storey and shrub layer is sparse (due to historic and current land uses), and there is dominance of the high threat weed *Lantana camara.* There is a low diversity of mid-storey and shrub species that have persisted. Species observed included *Bursaria spinosa, Breynia oblongifolia, Notelaea longifolia, Pittosporum revolutum* and *Denhamia silvestris.*

The groundcover diversity is generally high with the groundcover composition primarily native grassy and herbaceus species. The groundcover species commonly observed throughout the subject site consisted of *Microlaena stipoides*, *Pratia purpurascens, Oplismenus aemulus, Entolasia stricta* and *Brunoniella australis.* Less common species observed but not limited include *Lomandra*

	filiformis subsp. *filiformis, Tylophora barbata, Glycine clandestina* and *Dichondra repens.* There are a number of exotic species spread throughout that include *Lantana camara,* and a number of pasture and peri-urban exotic species such as *Ehrharta erecta, Senecio madagascariensis* and *Axonopus fissifolius.*
Threatened Ecological Community	Does not form part of a TEC.
%cleared of PCT	42% cleared (Bionet 2018)
Species relied upon for Identification of vegetation type	*Corymbia maculata, Eucalyptus acmenoides, Notelaea longifolia, Breynia oblongifolia, Microlaena stipoides, Plectranthus parviflorus*
Justification of assigning PCT	The PCT assignment of 1584 to the vegetation within the subject site is based on the follow key attributes: ▪ Of the 18 key diagnostic species a total of 11 species were positively identified (61%) ▪ The site is located predominantly within the Shamrock Hill soil landscape. This landscape is part of the Permian Tomago coal measure that includes lithology mudstone, sandstone listed for this PCT; ▪ The site is within the Lower Hunter and the landscape position in which this vegetation occurs is within a gully and lower slopes.

Exotic Pasture

Plate 3: Exotic Pasture

Vegetation Formation	N/A
Vegetation Class	N/A
Area	105.24ha
Vegetation Zone:	All land classified as non- native vegetation
Description	The remaining land that does not constitute native vegetation has been assessed as exotic pasture. These areas are open paddocks, areas of disturbed batters and tracks. that are dominated by exotic pasture grasses and high threat weed species. *Cynodon dactylon* Couch grass is present and although recognised as a native this species is growing in areas that have obvious signs of pasture improvement and is currently behaving in a similar manner as other exotic species Exotic and high threat weed species observed throughout these areas include *Lantana camara, Cenchrus clandestinus, Andropogon virginicus, Sporobolus africanus Senecio madagascariensis* and a number of pasture and peri-urban exotic species such as *Ehrharta erecta,* and *Axonopus fissifolius.*

Non-indigenous Planting

Plate 4: Non-indigenous Planting

Vegetation Formation	N/A
Vegetation Class	N/A
Area	4,400m^2
Vegetation Zone:	Linear non-indigenous planting areas
Description	There are a number of non-indigenous plantings located within the subject site that are located adjacent on sites that previously housed infrastructure. Species found in the plantings are found in the locality but are not associated with the plant community types observed on site. Species include *Casuarina glauca, Eucalyptus robusta* planted in linear rows along disused driveways and where dwellings once previously stood. Vegetation beneath the planting resembles exotic pasture of VZ5*. Cynodon dactylon* Couch grass is present and although recognised as a native this species is growing in areas that have obvious signs of pasture improvement and is currently behaving in a similar manner as other weed species. There are a number of exotic species spread throughout that include *Lantana camara, Cenchrus clandestinus, Andropogon virginicus, Sporobolus africanus Senecio madagascariensis.*

Road Corridor maintained/disturbed vegetation

Plate 5: Managed roadside vegetation

Vegetation Formation	N/A
Vegetation Class	N/A
Area	3.17 ha
Vegetation Zone:	Linear non-indigenous and native grasses and regenerating woody pioneer species
Description	The road corridor to the south of John Renshaw Dr has been managed by TfNSW through regular slashing and the initial clearance required to ensure road safety requires are met. This area extends up to 7 m from the road edge lines and is dominated by exotic grass species. Most notably the HTE Coolatai grass (*Hyparrhenia hirta*). The species is common and widespread within the region becoming localised within distance from the coast. Other grasses recorded commonly within the road corridor were *Eragrostis curvula*, *Lolium perenne, Melinis repens, Elymus repens,* and *Briza minor* as well as number of exotic forbs

such as *Senecio madagascariensis. Verbena bonariensis,* and *Hypochaeris glabra.*

Some regenerating acacia species (*Acacia falcata* and *Acacia elongate*) as well as native shrub species *Breynia oblongifolia* were recorded within the road corridor which are under active management from TfNSW. In addition, woody exotic species such as *Lantana camara, Senna pendula, Solanum mauritianum* and *Gomphocarpus fruticosus* were noted within the road corridor. Endemic grasses and forbs were also present within the road corridor such as *Cheilanthes distans, Epilobium hirtigerum, Cymbopogon refractus, Hydrocotyle sibthorpioides*, and *Entolasia marginate.*

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FIGURE 5: PCT AND TEC LOCATIONS

Legend

- BAM Plot
- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries
- Threatened Ecological Community

Plant Community Types

- 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest
- 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest
- Managed Roadside Vegetation
- Planting

N W E S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 1 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

4.3 Vegetation Integrity Assessment

The vegetation within nominated PCTs have be delineated into broad vegetation zones based on the general condition of vegetation. observation of distinct change or variation in the vegetation based on general attributes such as vegetation age, observable disturbance (past and present), exotic species presences and the any structural difference in the stratum present were used to delineate vegetation into zones.

The site has been delineated into six vegetation zones:

- PCT 1592: five vegetation zones; and
- PCT 1584: one vegetation zone

The following table provides a brief description of each vegetation zone justifying separation into vegetation zones.

A total of 24 full floristic plots/transects were conducted within the six zones. The number of plots carried out are in accordance with the minimum required plots per area as outlined in **Table 1** of the BAM (2017).

4.3.1 Vegetation Zones

Vegetation Zone: VZ1_1592_High			
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter			
Zone Area (ha)	22.13	Survey Effort	8 Quadrats
The vegetation assigned to VZ1 -1592_high is generally observed to have a higher quality variant of the PCT. Vegetation generally had a species richness above 35, a mid-storey present with four or more species and a high threat weed cover of less than 10%. The vegetation was observed to have a predominantly native groundcover and native species represented in all three stratum and all growth forms.			
			

Vegetation Zone: VZ2_1592_Moderate			
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter			
Zone Area (ha)	29.04	Survey Effort	6 Quadrats
The vegetation assigned to VZ2 -1592_moderate was observed to have a predominantly native groundcover and a generally absent native midstorey. Native species richness was observed to be moderate with an average 20-30 species observed. Weed presents was also moderate with an average high treat wee cover of 10-25%. There were significant signs of grazing throughout these areas.			

Vegetation Zone: VZ3_1592_Low Grassland			
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter			
Zone Area (ha)	2.64	Survey Effort	2 Quadrats
The vegetation assigned to VZ3 -1592_Grassland, was a small area in the west of the site where there is a distinct lack of canopy a mid-storey species present, but had a high native groundcover. The vegetation lacked logs, trees and hollows possible due to previous land uses as a thoroughfare.			

Vegetation Zone: VZ4_1592_Low			
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter			
Zone Area (ha)	17.53	Survey Effort	5 Quadrats

The vegetation assigned to VZ4 -1592_Low was generally observed to have a low condition due to the high occurrences of exotic and high threat weed species presences.

The vegetation has an intact canopy with a low density of large trees and a distinct lack of hollows. The mid storey is generally absent with the exception of the occasional patch of *Lantana camara,* which was observed to provide some protection for re-establishing native mid storey (very sparse).

The groundcover is predominantly exotic grassy and herbaceous species with native species persisting in smaller numbers.

Vegetation Zone: VZ5_1592_Low Scattered trees			
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter			
Zone Area (ha)	1.50	Survey Effort	1 Quadrats

The vegetation assigned to VZ5 -1592_Low Scattered Trees describes areas that are small isolated patches of native trees that do not align with the criteria for paddock trees. These patches of trees have been separated from other areas due to the predominantly exotic groundcover, lack of native midstorey. The groundcover consists of exotic pasture with the occasional native grass persisting. The trees are native and are diagnostic species for the PCT nominated. Although this vegetation zone is aligned with the PCT the condition of the vegetation would not constitute the nominated TEC for this PCT. This VZ also occurs within the road corridor of John Renshaw Drive.

Vegetation Zone: VZ6_1584_High			
PCT 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley			
Zone Area (ha)	0.78	Survey Effort	1 Quadrats
The vegetation assigned to VZ7 -1584_high is located within the northern section of the site primarily within the riparian corridor.			

4.3.2 Vegetation Integrity Assessment results

A total of 202 plant species were identified within the 24 plots comprising 171 native species and 31 exotic species. The results of the plot field data and a flora species list can be found in **Appendix C** and **Appendix D**.

The plot data from the vegetation plots were entered into the BAM calculator and the results of the vegetation integrity assessment are summarised in **Table 1** for the vegetation zones that are impacted.

Table 1: Vegetation Integrity Results

Vegetation Zone	No. of Plots	Composition condition Score	Structure Condition Score	Function Condition score	Vegetation Integrity Score (V.I)
VZ1_1592_High	9	84.9	56.6	63.4	67.3
VZ2_1592_Moderate	6	67.4	42.3	43.1	49.7
VZ3_1592_Low Grassland	5	50.6	37	1.8	14.9
VZ4_1592 Low	2	43.6	42.4	50.6	45.4
VZ5_1592_Low_Scattered Trees	1	6.3	26	12.4	12.7
VZ6_1584_High	1	79.7	88.7	79.1	82.4

- As outlined in section 10.3.1 of the BAM biodiversity offset credits are required for native vegetation where the vegetation integrity score:
    - is <15 where the PCT is representative of an endangered or critically endangered ecological community; or

- o is <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community: or
- o is <20 where the PCT is not representative of a TEC or associated with threatened species habitat.

All the above vegetation zones with the except of 1592_low condition Grassland and 1592_Low condition Scattered Trees will require biodiversity offsets as the vegetation integrity score for each zone is >15 for 1592 (commensurate with TEC) and above >17 for 1584 – non-TEC.

All remaining area within the development area has been assessed to be exotic vegetation and no further assessment or offset is required for these areas.

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FIGURE 6: VEGETATION ZONES

Legend

- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

Vegetation Zones

- VZ1
- VZ2
- VZ3
- VZ4
- VZ5
- VZ6

N
W E
S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

5 Threatened Species Assessment

5.1 Desktop Assessment

A review of threatened species information was undertaken to provide context and understanding of biodiversity values occurring within the subject site.

Information reviewed included:

- Online database searches involving a 10-km buffer around the site to provide potentially occurring threatened flora and fauna and migratory species under both the BC Act and EPBC Act:
  - NSW BioNet Atlas (accessed 19 July 2018 and periodically during BDAR production)
  - Commonwealth Protected Matters of National Significance search tool (accessed 19 July 2018).
- BioNet Vegetation Classification – Threatened species associated with known PCTs to occur on site

5.2 Ecosystem Credit Species

The PCT identification tool (BioNet Vegetation Classification) has been used to develop a list of ecosystem credit species associated with the PCTs represented within the Study Area. Ecosystem Credit Species are reliably predicted to occur within the nominated PCTs, and are assumed to occur on site, unless habitat features used by threatened species have been substantially impacted and removed from the study area. These species are presented in **Table 2**.

Table 2 : Ecosystem Credit Species

Scientific Name	Common Name	BC Act	EPBC Act	PCT 1584	PCT 1592
**Anthochaera phrygia*	Regent Honeyeater	CE	CE		x
**Callocephalon fimbriatum*	Gang Gang Cockatoo	V			x
**Calyptorhynchus lathami*	Glossy Black Cockatoo	V			x
Chthonicola sagittata	Speckled Warbler	V			x
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V			x
Daphoenositta chrysoptera	Varied Sittella	V		x	x
Dasyurus maculatus	Spotted-tailed Quoll	V	E	x	x
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V			x
Glossopsitta pusilla	Little Lorikeet	V		x	x
Grantiella picta	Painted Honeyeater	V	V		x
**Haliaeetus leucogaster*	White-bellied Sea-eagle	V			x
**Hieraaetus morphnoides*	Little Eagle	V			x
Hirundapus caudacutus	White-throated Needletail		V	x	x
**Lathamus discolor*	Swift Parrot	E	CE		x

Scientific Name	Common Name	BC Act	EPBC Act	PCT 1584	PCT 1592
**Lophoictinia isura*	Square-tailed Kite	V			x
Melanodryas cucullata cucullata	Hooded Robin	V			x
Melithreptus gularis gularis	Black-chinned Honeyeater	V			x
MIcronomus norfolkensis	Eastern Coastal Free-tailed Bat	V		x	x
**Miniopterus australis*	Little Bentwing-bat	V			x
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		x	x
Neophema pulchella	Turquoise Parrot	V			x
**Ninox connivens*	Barking Owl	V		x	x
**Ninox strenua*	Powerful Owl	V			x
Petaurus australis	Yellow-bellied Glider	V			x
Petroica boodang	Scarlet Robin	V			x
Petroica phoenicea	Flame Robin	V		x	
**Phascolarctos cinereus*	Koala	V	V		x
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V			x
**Pteropus poliocephalus*	Grey-headed Flying-fox	V	V		x
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V			x
Scoteanax rueppellii	Greater Broad-nosed Bat	V			X
Stagonopleura guttata	Diamond Firetail	V			x
**Tyto novaehollandiae*	Masked Owl	V			x

Key:

V = Vulnerable E = Endangered CE = Critically Endangered * Dual Credit Species

The vegetation on site has been assessed to provide suitable habitat for all species listed above thus could not be confidently assessed that these species do not occur. It is therefore assumed that these species may occur within the subject site.

5.3 Species Credit Species

Species Credit Species are species that cannot be reliably predicted to use an area based on habitat surrogates. Species credit species that are likely to occur within the study area must be surveyed to determine presences/absence or provide an expert report. In the absence of either of these the species will be presumed to be present within the study area.

The conditions of vegetation and habitat within the study area can be assessed by an accredited assessor to have sufficient site degradation of the key habitat constraints associated with species credits species, therefore is unlikely to utilise the site and not requiring further assessment. These species are presented in **Table 3** and a habitat assessment for species credit species in **Table 4**.

Table 3 Species Credit Species

Scientific Name	Common Name	BC Act	EPBC Act	Survey Period	Paddock Trees	PCT 1589	PCT 1592
Acacia bynoeana	Bynoe's Wattle	E	V	Sept-March		x	x
Anthochaera phrygia	Regent Honeyeater	CE	CE	Sept-Dec		x	x
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Sept - Nov			x
Burhinus grallarius	Bush Stone-curlew	E		All year	Yes	x	x
Callistemon linearifolius	Netted Bottle Brush	V		Sept-March		x	x
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Oct-Jan		x	x
Calyptorhynchus lathami	Glossy Black Cockatoo	V		Mar- Aug	Yes	x	x
Cercartetus nanus	Eastern Pygmy-possum	V		Oct-March		x	x
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Sept-March		x	x
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Nov-Jan		x	x
Cynanchum elegans	White-flowered Wax Plant	E	E	All year		x	x
Demlar impar	Striped Legless Lizard	V	V	Sept - Dec			x
Diuris praecox	Rough Doubletail	V	V	July-Aug		x	x
Eucalyptus glaucina	Slaty red Gum	V	V	Dec-Jan	Yes	x	x
Eucalyptus parramattensis subsp. decadens	Earp's Gum	V	V	All year	Yes		x
***Eucalyptus pumila*	Pokolbin Mallee	V	V	All year	Yes	x	

Scientific Name	Common Name	BC Act	EPBC Act	Survey Period	Paddock Trees	PCT 1589	PCT 1592
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	All year		x	x
Hoplocephalus bitorquatus	Pale-headed Snake	V		Nov-March	Yes	x	x
Haliaeetus leucogaster	White-bellied Sea-eagle	V		July- Dec (Breeding)	Yes	x	x
Hieraaetus morphnoides	Little Eagle	V		Aug- Sept (Breeding)	Yes	x	x
Lathamus discolor	Swift Parrot	E	CE	May-August	Yes	x	x
***Leionema lamprophyllum subsp. obovatum* – endangered population in the Hunter Catchment		E		Oct-March			
Litoria aurea	Green and Golden Bell Frog	E	V	Nov-March		x	x
Litoria brevipalmata	Green-thighed Frog	V		Oct-March		x	x
Lophoictinia isura	Square-tailed Kite	V		Sept -Jan		x	x
Melaleuca biconvexa	Biconvex Paperbark	V	V	All year	Yes	x	
Miniopterus australis	Little Bentwing-bat	V		Dec-Feb		x	x
Minopterus orianae oceanensis – previously *Miniopterus schreibersii oceanensis*	Large Bent-winged Bat – previously Eastern Bentwing-bat			Jan-Feb & Dec		x	x
Myotis macropus	Southern Myotis	V		Nov-March	Yes	x	x
Ninox connivens	Barking Owl	V		May-Dec	Yes	x	x
Ninox strenua	Powerful Owl	V		May- August		x	x
Persoonia pauciflora	North Rothbury Persoonia	CE	CE	All year			x
Petauroidea volans	Greater glider		V	All year			x

Scientific Name	Common Name	BC Act	EPBC Act	Survey Period	Paddock Trees	PCT 1589	PCT 1592
***Petaurus norfolcensis*	Squirrel Glider	V		All year	Yes	x	
Petrogale penicillata	Brush-tailed Rock wallaby	E	V	All year		x	x
Phascolarctos cinereus	Koala	V	V	All year	Yes	x	x
Phascogale tapoatafa	Brush-tailed Phascogale	V		All year	Yes	x	x
Planigale maculata	Common Planigale	V		All year			x
Pomaderris queenslandica	Scant Pomaderris	E		All year			x
Prostanthera cineolifera	Singleton Mint Bush	V	V	All year		x	x
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Oct-Dec (Breeding)		x	x
Pterostylis chaetophora		V		Sept-Nov			x
Rhodamnia rubescens	Scrub Turpentine	CE		All year		x	
Rhodomyrtus psidioides	Native Guava	CE		All year		x	
Rutidosis heterogama	Heath Wrinklewort	V	V	All year		x	x
Tetratheca juncea	Black-eyed Susan	V	V	July-Dec		x	x
Thesium australe	Austral toadflax	V	V	Nov-Feb			x
Tyto novaehollandiae	Masked Owl	V		May-Aug (Breeding)	Yes	x	x
Vespadelus troughtoni	Eastern Cave Bat	V		Nov-Jan		x	x

Key: V = Vulnerable E = Endangered CE = Critically Endangered

**Has been delisted or is no longer associated with the PCTs present post 2018 preparation

Table 4 Species Credit Species Habitat Assessment

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Flora				
Acacia bynoeana	Bynoe's Wattle	This species occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include *Corymbia gummifera, Eucalyptus haemastoma, Eucalyptus parramattensis*, *Banksia serrata* and *Angophora bakeri.* The vegetation within the subject site is a dry sclerophyll forest formation, in which only one of the listed over-storey species associated with the threatened species occurs (*Corymbia gummifera*). The site is located within the Beresfield soil landscape in which soils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. This species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, substantially degrading the understorey native vegetation. This land management practice has limited the likelihood of this species being detected within the subject site.	Unlikely	No
Callistemon linearifolius	Netted Bottle Brush	This species grows in dry sclerophyll forest in sheltered locations on the coast and on adjacent ranges. This species is recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. It has also been recorded in Yengo National Park. There are a small number of records for this species in the locality and the vegetation is regarded as suitable habitat for this species. It is on this basis that further survey is required to determine presences/absences of this species.	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Cryptostylis hunteriana	Leafless Tongue Orchid	This species is known to be extremely cryptic as it does not flower each year. Known to occur within a wide range of habitats including woodlands to swamp heaths. Within the Hunter region larger populations have been typically found in woodland dominated by *Eucalyptus haemastoma* (Scribbly Gum) and it prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedge land, or moist to dry clay loams in coastal forests. This species is known to occur in association with *C. subulata* and *C. erecta.* The vegetation within the subject site is a dry sclerophyll forest formation, in which only one of the listed over-storey species associated with the threatened species occurs (*Corymbia gummifera*). The site is located within the Beresfield soil landscape in which soils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. This species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, resulting in a substantially degraded understorey vegetation and compacted soils. This land management practice has limited the likelihood of this species being detected within the subject site.	Unlikely	No
Cynanchum elegans	White-flowered Wax Plant	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation and other associated vegetation types such as littoral rainforest; coastal scrub and open forest and woodland. Species associated include; 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 Honey myrtle *Melaleuca armillaris* scrub to open scrub. The study area vegetation does provide marginal habitat in the form of Spotted Gum aligned open forest and woodland. The current grazing pressures and historic disturbance associated with the subject site indicate that it is likely to reduce the potential occurrence of this species within the study area, though	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		cannot be ruled out on this attribute alone. On this basis further survey is required.		
Diuris praecox	Rough Doubletail	The habitat of this species is generally on hills and slopes of near coastal districts in open forests which have a grassy to fairly dense understorey. This species grows on well-drained sandy soils (DoEE 2008). The vegetation within the subject site is a dry sclerophyll forest formation. The site is located within the Beresfield soil landscape in which soils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. The site is approximately 16 -18km away from the coastal fringe (Glenrock SCA & Worimi Conservation Lands) of which this species is recorded. In addition, the site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, resulting in a substantially degraded understorey vegetation and compacted soils. This land management practice has limited the likelihood of this species being detected within the subject site	Unlikely	No
Eucalyptus glaucina	Slaty Red Gum	This species grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils. This species is found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, and west of Maitland (DoEE 2008). The site is east of its known distribution with the closest recorded (Bionet) being 10km west of the site. The Soils that occur on site predominantly a black loam, are consistent with the moderately fertile and well-watered soils this species is generally aligned, providing opportunity for this species to persist. On this basis further survey is required.	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Eucalyptus parramattensis subsp. decadens	Earp's Gum	This species generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. Only two separate meta-populations are recorded, one of which is in the Kurri Kurri area. The site is within the Beresfield soil landscape in which soils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. Furthermore, this species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely	No
***Eucalyptus pumila*	Pokolbin Mallee	This species is currently known only from a single population west of Pokolbin in the Hunter Valley. Historical records also exist for Wybong and Sandy Hollow, however, has not been recorded recently in these areas. The single known population occupies north-west-facing slopes derived from sandstone. 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.* The site is located outside of its known restricted geographic distribution and as such no records exist on site or within the locality	Unlikely	No
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	This species is sporadically distributed throughout the Sydney Basin with sizeable populations in the Hunter and in the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast. This species grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Occurs in a range of vegetation types from heath and shrubby woodland to open forest, the Hunter in Kurri Sand Swamp Woodland and is also known to occur in *C. maculata- A. costata* open forest. Associated species in the Kurri Sand Swamp Woodland include *Eucalyptus parramattensis* subsp. *decadens*, *Angophora bakeri* and *E. fibrosa* with *Acacia elongata*, *Dillwynia*	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		parvifolia, *Melaleuca thymifolia*, *Grevillea montana*, *Eragrostis brownii* and *Aristida vagans*. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Hunter occurrences are usually 30-70m ASL, while the southern Sydney occurrences are typically at 100-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks. Similar vegetation occurs on site in the formation of dry sclerophyll forest and in particular in the northern edge of the study area where it transitions into *C. maculata – A. costata* open forest. One record exists as defined on the OEH Bionet using a 10km search of the locality. On this basis further survey is required.		
***Leionema lamprophyllum subsp. obovatum – endangered population*	*Leionema lamprophyllum subsp. obovatum* population in the Hunter Catchment	The Hunter Catchment population occurs near Pokolbin, where it is found on a rocky cliff line in a dry eucalypt forest. No suitable habitat occurs within the study area and the site is located outside of its known geographic distribution	Unlikely	No
Melaleuca biconvexa	Biconvex Paperbark	This species generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. This species is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. The vegetation within the subject site is predominantly a dry sclerophyll forest formation of which is not associated with this species. The watercourse is severely disturbed with large thickets of *Lantana camara* due to erosion from cattle grazing and past land disturbance. No records exist as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Persoonia pauciflora	North Rothbury Persoonia	This species has an extremely restricted distribution; all but one of the plants which make up the only known population occur within a 2.5 km radius of the original specimen at North Rothbury in the Cessnock local government area. Within this range, there are three main sub-populations which comprise approximately 90% of the total population. The other 10% of the population occurs as scattered individuals in what is a relatively disturbed landscape. The site is located outside of its restricted geographic distribution.	Unlikely	No
Pomaderris queenslandica	Scant Pomaderris	This species is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. The vegetation within the subject site is a dry sclerophyll forest formation. Due to the current grazing pressures and historic disturbance associated with the subject site, this indicates that it is likely to reduce the occurrence of this species within the study area due to a major loss in shrubby understorey.	Unlikely	No
Prostanthera cineolifera	Singleton Mint Bush	This species grows in open woodlands on exposed sandstone ridges and is usually found in association with shallow or skeletal sands. This species is restricted to only a few localities near Scone, Cessnock and St Albans. The vegetation within the subject site is similar with a dry sclerophyll forest formation. However, the site is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. Furthermore, the site is located outside of its known geographic distribution	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Pterostylis chaetophora		The species prefers habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. The most commonly observed habitat is vegetation characterised by grassy open forests or derived native grasslands of *Eucalyptus amplifolia* and *Eucalyptus moluccana* on gentle flats, or that are dominated by *Corymbia maculata* with any of *Eucalyptus fibrosa*, *Eucalyptus sideroploia* or *Eucalyptus crebra.* Highly cryptic species; Flowers from September to November. Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually. Fails to flower in dry seasons. Plants are deciduous and die back to the large, underground tubers after seed release. New rosettes are produced following soaking autumn and winter rains. Flowers are pollinated by fungus gnats (family Keroplatidae). The species is associated with PCT 1592; dry sclerophyll forest formation inclusive of *Corymbia maculata* and *Eucalyptus fibrosa.* Despite this association, the species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, resulting in a substantially degraded understorey vegetation and compacted soils. This land management practice has limited the likelihood of this species being detected within the subject site.	Unlikely	No
Rhodamnia rubescens	Scrub Turpentine	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts. The subject site is within the species known range and the site contains an area of wet sclerophyll formation (PCT 1584). This species has been recorded within	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		the locality as defined on the OEH BioNet Atlas using a 10km search. Within 1500 m one record occurs; from 1998. This historic record is approximately 1.4 km to the north of the subject site and occurs within a patch which is discontinuous with the subject site driven by the works of Donaldson Coal landholdings, an open cut coal mine.		
Rhodomyrtus psidioides	Native Guava	Populations of the species are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts. The subject site is within the species known range and PCT1584 is classified as a wet sclerophyll forest. This species has been recorded within the locality as defined on the OEH BioNet Atlas using a 10km search. Within 1500 m two records occur; from 1998 and 2013. The 2013 record is from 835 m north of the subject site, though connected by continuous vegetation to the roadside component of the subject site, the species associated PCT is disconnected by John Renshaw Drive. Given that there are no records south of the road the species is unlikely to persist within the patch of 1584 due to the lack of connectivity to other suitable patches.	Unlikely	No
Rutidosis heterogama	Heath Wrinklewort	This species grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides. This species has been recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. Potential habitat is present in the study area, however the site is in a highly disturbed state due to current cattle grazing and historic understorey management. Although the current grazing pressures and historic disturbance associated with the subject site indicates that it is likely to reduce the occurrence of this species within the study area due to a major loss in shrubby understorey, similar vegetation occurs on site and it is located within its known geographic	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		distribution. This species has been recorded within the locality as defined on the OEH BioNet Atlas using a 10km search. On this basis further survey is required.		
Tetratheca juncea	Black-eyed Susan	Locally this species is usually found in low open forest/woodland with an undisturbed mixed shrubby understorey and grassy groundcover often in association with the Awaba Soil Landscape. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. Current grazing pressures and historic disturbance on site has resulted in a modified landscape with a loss in shrubby understorey which has reduced the likelihood of occurrence of this species on site. RPS (2017) undertook targeted surveys for this species during its optimal flowering time (Sept-Oct) and was not recorded. However, due to this species inconsistent flowering events, the presence of potential habitat present in the north west corner of the study area, and records existing in the locality. The need for further survey cannot be ruled out.	Likely	Yes
Thesium austral	Austral toadflax	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis).* A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. Species may be perennial below ground and	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		ephemeral above ground. Species can occur within un-treed native grassland or heterogeneous native/exotic grassland if host flora for parasitisation are present. The species is associated with PCT 1592 though there are no records of the species within the locality as defined on the OEH BioNet Atlas using a 10km search. Of the 34 BAM plots conducted 12 contained *Themeda triandra* though the species was not dominant. Despite the presence of associated species likelihood of occurrence is low as a result of the subject site's land use history. The site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, resulting in a substantially degraded understorey vegetation and compacted soils.		
Birds				
Anthochaera phrygia	Regent Honeyeater	This species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-Oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example, the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark *Eucalyptus eugenioides* and other Stringybark species, and Broad-leaved Ironbark *E. fibrosa* can also contribute important nectar flows at times. The site comprises suitable winter foraging habitat such as Spotted Gum. Surveys	Likely (foraging)	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		Additionally, the authors have been advised by John Seidel (OEH) the site is located outside important habitat areas (Breeding) that have been developed by OEH (2018).		
Burhinus grallarius	Bushstone Curlew	This species inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Nest on the ground in a scrape or small bare patch.	Likely	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	This species is usually found in spring and summer, in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. This species favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. The site comprises similar associated vegetation and habitat in the form of dry sclerophyll forest for this species, in particular box-gum and drier eucalypt woodlands and forest. Additionally, suitable nesting habitat is present on site. On this basis further survey is required.	Likely	Yes
Calyptorhynchus lathami	Glossy Black Cockatoo	The species is uncommon although widespread throughout suitable forest and woodland habitats. Inhabits open forest and woodlands of the coast where stands of She-oak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species). This species is dependent on large hollow-bearing eucalypts for nest sites. Suitable foraging habitat occurs on site in the form of *A. torulosa* and *A. littoralis*, additionally suitable nesting habitat is also present. Further survey is required.	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Haliaeetus leucogaster	White-bellied Sea-eagle	In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. The site does not comprise of suitable breeding or foraging habitat near large waterbodies, rivers, lake or ocean	Unlikely (foraging /breeding)	No
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. The site comprises suitable roosting habitat in the formation of dry sclerophyll forest, and records exist as defined on the OEH Bionet using a 10km search radius of the locality. On this basis further survey is required.	Likely (Breeding)	Yes
Lathamus discolor	Swift Parrot	This species migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. The study area comprises suitable foraging habitat, and this species may seasonally use resources within the study area opportunistically or during migration.	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		Additionally, the authors have been advised by John Seidel (OEH) the site is located outside important habitat areas (breeding) that have been developed by OEH (2018).		
Lophoictinia isura	Square-tailed Kite	This species is found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. This species is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. The site comprises suitable habitat in the formation of dry sclerophyll forest, and records exist as defined on the OEH BioNet Atlas using a 10km search radius of the locality. On this basis further survey is required.	Likely	Yes
Ninox connivens	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. The site comprises suitable habitat in the formation of dry sclerophyll forest, and partly cleared farmland in a fragmented landscape. Records exist as defined on the OEH BioNet Atlas using a 10km search radius of the locality. On this basis further survey is required.	Likely	Yes
Ninox strenua	Powerful Owl	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. This species requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		Allocasuarina littoralis, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. The site comprises suitable habitat in the formation of dry sclerophyll forest in a fragmented landscape. Records exist as defined on the OEH Bionet using a 10km search radius of the locality. On this basis further survey is required.		
Tyto novaehollandiae	Masked Owl	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. The typical diet consists of tree-dwelling and ground mammals, especially rats. Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW. Pairs have a large home-range of 500 to 1000 hectares. The site comprises suitable habitat in the formation of dry sclerophyll forest with forest edges. Records exist as defined on the OEH Bionet using a 10km search radius of the locality. On this basis further survey is required.	Likely	Yes
Bats				
Chalinolobus dwyeri	Large-eared Pied Bat	Found mainly in areas with extensive cliffs and caves. This species 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. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. No caves are present on site. A review of aerial photography and topographic features didn't identify any significant caves, cliffs or old mine entrances within 2km of the subject site. An operational quarry does exist to the south-west (within 2km of the subject site) which was not considered to suitable habitat for the microbat to roost or breed based on the quarry currently operating in the locality. It was determined no potential breeding habitat occurs within 2kms of the subject site. No further survey is required.		
Miniopterus australis	Little Bentwing-bat	Inhabits moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Only five nursery sites /maternity colonies are known in Australia. The site comprises sparse juvenile dry sclerophyll forest with no naturally occurring caves. The site does not comprise a known nursery or maternity colony. There are three abandon structures that are located within the subject site, that have potential to be used for breeding opportunities as well as one culvert structure.	Possible (Breeding)	Yes
Miniopterus orianae oceanensis previously *Miniopterus schreibersii oceanensis*	Large Bent-winged Bat, previously Eastern Bentwing-bat	The species occurs along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other man-made structures. The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. The site comprises primarily moderate aged dry sclerophyll forest with scattered large old trees, there are no naturally occurring caves. The site does not comprise a known nursery or maternity colony. There are three abandon	Possible (Breeding)	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		structures that are located within the subject site, that have potential to be used for breeding opportunities as well as one culvert structure.		
Myotis macropus	Southern Myotis	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. The site comprises suitable foraging habitat, and hollow bearing trees which could potentially be used for roosting habitat. Further survey is required.	Possible	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	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. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The site comprises dry sclerophyll forest which does not align with the associated vegetation for this species. Furthermore, no known roosting colonies are present on the subject site.	Unlikely (Breeding)	No
Vespadelus troughtoni	Eastern Cave Bat	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. The site comprises sparse juvenile dry sclerophyll forest with no naturally occurring caves. The site does not comprise a known roosting colony.	Unlikely (Breeding)	No
Reptiles				

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Aprasia parapulchella	Pink-tailed Legless Lizard	The cryptic species is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. 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. The subject site is within the current mapped known range for the species however is does not represent the known stronghold for the species. The subject site does not contain suitable habitat for the species as rocky outcrops or areas of partially-buried rocks were not recorded and where rocks were noted they were investigated as part of targeted searches for *Hoplocephalus bitorguatus.* There are no records of the species within the locality as defined on the OEH BioNet Atlas using a 10km search.	Unlikely	No
Delmar impar	Striped Legless Lizard	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. The species is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat for the species is where grassland is dominated by perennial, tussock-forming grasses though sometimes present in modified grasslands with a significant content of exotic grasses.	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		The subject site is within the current mapped known range for the species. The subject site does not contain suitable habitat for the species in the form of grassland and Box-Gum Woodland. This species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning, the site has been routinely grazed, resulting in a substantially degraded understorey vegetation and compacted soils. This land management practice would likely prevent the use of the use of the subject site by this species.		
Hoplocephalus bitorquatus	Pale-headed Snake	The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The site comprises suitable habitat in the form of dry sclerophyll forest. This coupled with its cryptic nature its likelihood of occurrence cannot be ruled out. Further survey is required.	Likely	Yes
Amphibians				
Litoria aurea	Green and Golden Bell Frog	Inhabits marshes, dams and stream-sides, particularly those containing bull rushes (*Typha* spp.) or spike rushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The site does not contain permanent water bodies with suitable vegetation in the form of bull-rushes and spike-rushes.	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Litoria brevipalmata	Green-thighed Frog	Occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range but extends into drier forests in northern NSW and southern Queensland. This species is thought to forage in leaf-litter. Suitable vegetation is present on site in the form of young dry sclerophyll forest, however the site has a history of disturbance and intense cattle grazing reducing the likelihood of its occurrence. Furthermore, minimal leaf litter is also present on site and no records exist as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely	No
Marsupials				
Cercartetus nanus	Eastern Pygmy - Possum	This species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests etc. Tree hollows are favoured. The site comprises very little suitable vegetation in the form of dry sclerophyll forest with a moderate to dense understorey. There are no records as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely	No
Petauroidea volans	Greater glider	The species is listed federally though does not have a listing under the BC Act. However, it is listed as a species credit species within the TBDC as is therefore considered here. The species is known to occur within the Sydney Basin subregion and occurs across the eastern coast of the state. The species is associated with PCT 1592. There are eight records as defined on the OEH Bionet using a 10km search radius of the locality, two of which occur within 1500 m of the subject site. Both	Unlikely	No

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
		of these records are from 1998 and therefore persistence of the species within the subject site is unlikely. In addition, field survey targeting arboreal mammals (*Petaurus norfolcensis* and *Phascogale tapoatafa*) did not detect the species.		
***Petaurus norfolcensis*	Squirrel Glider	Inhabits mature or old growth Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. The site comprises suitable habitat in the form of dry sclerophyll forest with records existing on the OEH BioNet Atlas using a 10km search radius of the locality. On this basis further survey is required.	Likely	Yes
Petrogale penicillata	Brush-tailed Rock wallaby	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Generally, browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. The site comprises no suitable habitat in the form of rocky landscape characteristics and no records exist as defined on the OEH BioNet Atlas using a 10km search radius of the locality.	Unlikely	No
Phascogale tapoatafa	Brush-tailed Phascogale	This species prefers dry sclerophyll open forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. The site comprises suitable habitat in the form of dry sclerophyll forest with a sparse groundcover. Further survey is required	Likely	Yes

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Phascolarctos cinereus	Koala	Inhabit eucalypt woodlands and forests in a fragmented distribution throughout eastern Australia. In NSW this species mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range but have been recorded in the southern tablelands. This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. This species may be an occasional visitor to the study area, but habitat similar to the study area is widely distributed in the local area, indicating the species is not dependent on the available habitat within the impacted area for breeding or important life cycle periods. Past field surveys did record the presence of low numbers of *Eucalyptus tereticornis* (Koala Feed Tree). At no point was this species observed at >15% cover triggering the need for a SEPP 44 assessment. RPS (2017) recorded no Koalas in their targeted surveys.	Unlikely	No
Planigale maculata	Common Planigale	Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. Although current grazing and past historic disturbance has a caused a major loss in shrubby/grassy understorey, the site comprises marginal suitable habitat in the form of dry sclerophyll eucalypt forest, with grasslands and a grassy understorey. On this basis further survey is required.	Likely	Yes

**Has been delisted or is no longer associated with the PCTs present post 2018 preparation

5.4 Candidate Species Surveys

5.4.1 Targeted Species Survey Methodology

RPS Australia (2017)

The subject site has been surveyed for threatened species by RPS Australia during 2012, 2013 (Planning Proposal) and 2017.

RPS Australia were commissioned by the previous landowners to produce a Biodiversity Inventory Assessment to inform the Biodiversity Assessment Report (BAR) under the former BBAM (2014) Methodology for the Black Hill Industrial Development. In accordance with the provisions set out in the Biodiversity Conservation Act (Savings and Transitions) Regulation 2017, surveys (and results) undertaken by or under the supervision of accredited assessors can be used in place of onsite surveys if the surveys have been carried out in accordance with current survey methods and within five years of the lodgement date of the BDAR. As such, fauna survey work carried out by RPS using accepted fauna survey methods, had been relied upon to inform the BDAR (Final V2 August 2018).

Flora surveys carried out by RPS (2017) were used to inform preliminary desktop analysis of the vegetation that occurs on site. The flora survey has been contemporised in accordance with the BAM (2017), and requirements for threatened flora surveys in line with the OEH Threatened Flora guidelines (2016).

MJD Environmental Fauna Survey Update (2019 & 2021)

It is acknowledged that the original RPS fauna surveys that were relied upon (for Version 2 BDAR 2018), to satisfy the required targeted surveys for candidate species were carried out in early 2013. Survey results that are more than five years old can only be used to inform the assessment process but cannot be used in place of a targeted species survey (OEH 2018d). At the time of submission (November 2018) the surveys were assessed to be out of date and could not be utilised for target surveys. To ensure compliance with the BAM all candidate species requiring targeted surveys have been undertaken as part of this updated BDAR Version 3 (2019)

In addition, at the time of compiling the BDAR (V2 August 2018) and prior to submission (November 2018), The NSW Office of Environment and Heritage released "*Species credit" threatened bats and habitats: NSW Survey guide for the Biodiversity Assessment Method.* This updated survey guideline was released in September 2018, after the completion of fieldworks but prior to submission. To ensure microbat surveys are compliant with the new survey guidelines, addition survey for microbats that are candidate species with potential habitat to occur on the subject site have been undertaken as part of the updated BDAR.

During June 2021 assessment of the additional road corridor, the area was assessed for suitable habitat for associate candidate species. This was inclusive of a hollow-bearing and habitat tree survey and inspection of existing culverts to determine use/suitability by microbats.

5.4.2 Targeted Flora Survey

Targeted threatened flora surveys were carried out on 4 & 5 July, 28 & 29 August 2018 targeting flora species that could not be conclusively ruled out from occurring on site due to suitable habitat occurring on site. They included:

- *Callistemon linearifolius* Netted Bottle Brush
- *Eucalyptus glaucina* Slaty Red Gum
- *Cynanchum elegans* White-flowered Wax Plant
- *Diuris praecox* Rough Double-tail
- *Grevillea parviflora* subsp. *parviflora* Small-flower Grevillea
- *Rutidosis heterogama* Heath Wrinklewort

- *Tetratheca juncea* Black-eyed Susan

Threatened flora surveys were undertaken in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). The following techniques were employed:

- Parallel field-transverse survey technique. Two ecologists walking parallel at distance of between 5-10m depending on density of the vegetation was at time of survey.
- Surveys conducted in suitable habitat for each of the targeted species
- Transects were recorded using a hand-held GPS unit

During the additional surveys conducted in June of 2021, threatened flora was searched for, with two ecologists traverse thing entirety of the 5 – 15 m wide vegetated areas of the linear road corridor. Though this is outside of the prescribed survey periods for some species, larger less cryptic species such as *Callistemon linearifolius* would be detected if present due to the ease of identification from other characteristics.

The following **Table 5** provides the survey schedule for each species. Refer to **Figure 7** for survey transects.

Table 5 Targeted Flora survey timeframes

Species	Survey Period	Survey Carried out	Presence/ Absence	Comment
Callistemon linearifolius	Sept-March	4-5 July 2018 & 9th June 2021	Not recorded	Undertaken outside of survey period. This survey was undertaken outside the survey period, due to the reliability of identification of this species all year round and the lack of midstorey, increasing visibility during survey works
Eucalyptus glaucina	All year	4-5 July 2018 & 9th June 2021	Not recorded	
Cynanchum elegans	All year	4-5 July 2018 & 9th June 2021	Not recorded	
Diuris praecox	July-Aug	28-29th August 2018 (MJD)	Not recorded	Species ruled out based on habitat (Refer to **Table 4**). Notwithstanding surveys conducted by RPS (2017). Surveys by MJD Environmental to ensure coverage per OEH (2016) guideline. Voucher population at Adamstown Heights was observed flowering prior to site survey 25th August 2018.
Grevillea parviflora subsp. parviflora	All year	4-5 July 2018 & 9th June 2021	Not recorded	

Species	Survey Period	Survey Carried out	Presence/ Absence	Comment
Rutidosis heterogama	All year	4-5 July 2018 & 9th June 2021	Not recorded	
Tetratheca juncea	July-Dec	Nov-Dec 2012 (RPS) 28-29th August 2018 (MJD)	Not Recorded	Species ruled out based on habitat (Refer to **Table 4**). Notwithstanding surveys conducted by RPS (2017). Surveys by MJD Environmental to ensure coverage per OEH (2016) guideline. Voucher population was observed flowering prior to site survey 25th August 2018.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 7: TARGETED FLORA SURVEY

Legend

- Transect
- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

N
W E
S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

5.4.3 Targeted Fauna Survey Methods

Threatened fauna surveys were carried out targeting the following fauna species that could not be conclusively ruled out from occurring on site due to suitable habitat occurring within the subject site.

All fauna surveys have been carried out in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for development and activities* (DECC 2004). The survey methodology used for this project was modified to incorporate modern survey techniques and equipment.

In addition, targeted microbat surveys were undertaken in accordance with "*Species credit" threatened bats and habitats: NSW Survey guide for the Biodiversity Assessment Method* (OEH 2018e).

Refer to **Figure 8** for all targeted fauna surveys.

Birds

- Bush Stone Curlew *Burhinus grallarius*
- Glossy Black Cockatoo *Calyptorhynchus lathami*
- Major Mitchell's Cockatoo *Lophochroa leadbeateri*
- Little Eagle *Hieraaetus morphnoides*
- Square-tailed Kite *Lophoictinia isura*
- Swift Parrot *Lathamus discolor*
- Regent Honeyeater *Anthochaera phrygia*
- Masked Owl *Tyto novaehollandiae*
- Powerful Owl *Ninox strenua*

Bats

- Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*
- Little Bentwing-bat *Miniopterus australis*
- Southern Myotis *Myotis macropus*

Marsupials

- Squirrel Glider *Petaurus norfolcensis*
- Brush-tailed Phascogale *Phascogale tapoatafa*
- Common Planigale *Planigale maculata*

Reptiles

- Pale-headed Snake *Hoplocephalus bitorquatus*

The following table (**Table 6**) outlines the fauna survey methods utilised for the targeted candidate species. In addition, The fauna surveys carried out by RPS Australia have been used to inform the BDAR. Refer to **Appendix J** for RPS survey effort table, survey plan and threatened fauna plan.

Table 6 Fauna Survey Effort (MJD 2018-21)

Fauna Group	Target species	Survey method	Survey effort	Date
Herpetofauna	*Hoplocephalus bitorquatus* (Pale-headed Snake)	▪ **Herpetofauna surveys** targeting areas of appropriate habitat - Targeted habitat searches/habitat surveys - Opportunistic surveys	- Inspecting rock crevices - Raking leaf litter and turning logs, rocks and other debris during Hollow bearing tree survey	25th Feb, 1st, 2nd March 2019, 9th June 2021
Terrestrial	*Planigale maculata (*Common Planigale)	▪ **Remote Wildlife Cameras** - Scout Guard wildlife trail cameras were mounted in appropriate terrestrial habitat within the subject site, designed to take photographs when triggered by motion. - Bait stations were utilised to attract fauna to camera trap. bait containing a mixture of oats, honey, and peanut butter, bait station was sprayed with an attractant of honey / sugar water to increase the chance of arboreal fauna. - Cameras were used to detect both diurnal and nocturnal faunal movement	- Five Scout Guard trail cameras were utilised during field surveys - A total of 80 camera trap nights were undertaken.	15th, 16th, 22nd May 2019
		▪ **Spotlighting** - 75-Watt hand-held spotlight and head torch whilst driving and walking over the subject site. - Areas of bush were targeted, as well as tracks entering and entering the subject site.	- A total of 4 person hours of spotlighting was conducted over 3 nights.	15th, 16th, 22nd May 2019
Arboreal	*Petaurus norfolcensis* (Squirrel Glider) *Phascogale tapoatafa* (Brush-tailed Phascogale)	▪ **Remote Wildlife Cameras** - Scout Guard wildlife trail cameras were mounted in appropriate terrestrial habitat within the subject site, designed to take photographs when triggered by motion. - Bait stations were utilised to attract fauna to camera trap. bait containing a mixture of oats, honey, and peanut butter, bait station was sprayed with an attractant of honey / sugar water to increase the chance of arboreal fauna. - Cameras were used to detect both diurnal and nocturnal faunal movement	- Eight Scout Guard trail cameras were utilised during field surveys - A total of 176 camera trap nights were undertaken.	25th Feb – 14th Mar 2019
		▪ **Spotlighting** - Spotlighting was undertaken with the use of a Lightforce Enforcer 140mm LED (376m @ 1 LUX) hand-held spotlight and head torch whilst traversing subject site. ▪ Areas of bush were targeted, as well as tracks entering and entering the subject site.	- A total of 4 person hours of spotlighting was conducted over 3 nights.	15th, 16th, 22nd May 2019

Fauna Group	Target species	Survey method	Survey effort	Date
Diurnal Avifauna	*Species Credit-Avifauna*	▪ **Systematic diurnal census and opportunistic observations** - Via direct visual observation or by recognition of calls or distinctive features such as nests, feathers and owl regurgitation pellets ▪ **Targeted survey (RPS 2017)**: Targeted surveys for nectar dependant species were performed during the Spotted Gum (*Corymbia maculata*) flowering period (May to October 2017) to specifically target the Regent Honeyeater and Swift Parrot. Conditions suitable for performing targeted surveys for the Regent Honeyeater were examined on 10 separate days in this period. Conditions observed during the targeted surveys were typified by spot flowering by Spotted Gum.	- Opportunistically and during field work - Hollow utilisation for Gang-Gang Cockatoo and Glossy Black Cockatoo - Utilisation of canopy trees for nesting :Little Eagle and Square-tailed Kite.	Jun, July, Aug, 2018. Feb, Mar, May 2019, 9th June 2021
Nocturnal Avifauna (Owls)	*Ninox connivens* (Barking Owl) *Ninox strenua* (Powerful Owl) *Tyto novaehollandiae* (Masked Owl)	▪ **Stag watch:** any tree identified as possible owl tree ▪ **Call play back:** Aural recognition of threatened owls. Pre-recorded calls of owls with the potential to occur within the subject site were broadcast to elicit vocal responses or to attract nocturnal fauna to the playback site. - Calls were broadcast through an amplification system (loud hailer 25w) designed to project the sound for at least 1 km under still night conditions	- Stag watch possible owl trees prior to dusk and for half hour after dusk. - The call of each candidate species was broadcast for at least five minutes, followed by five minutes of listening, the area was then spotlighted on foot (5 nights) - Opportunistically and during field work	15th, 16th, 22nd May 12th 14th June 2019
Micro-Chiropteran Bats	*Myotis macropus* (Southern Myotis)	▪ **Anabat II Detector and CF ZCAIM units** - Microbat echolocation calls were recorded for the entire night (from 6pm to 6am) - Bat call analysis was undertaken by Anna McConville who is experienced in the analysis of bat echolocation calls. ▪ **Harp Traps** - Designed to catch microbats, allowing for visual identification. - Any microbats caught were identified early the following morning and kept in small cloth bag which was kept in a cool dark environment until they could be released prior to sun up or nightfall within the subject site of capture. ▪ **Roost Search:** Inspection of old buildings within the subject Site	- Two anabats used over eight consecutive nights of sampling, with emphasis placed on those areas deemed likely to provide potential foraging and flyway sites for Myotis (creekline or lowland areas. - Utilised two harp traps within creekline for a total of 16 trap nights - Roost search included roof cavities, holes in walls and any evidence of Bat utilisation	25th Feb – 14th Mar 2019
	Miniopterus schreibersii oceanensis	▪ **Harp Traps** - Designed to catch microbats, allowing for visual identification. - Any microbats caught were identified early the following morning and kept in small cloth bag which was kept in a cool dark	- Utilised four harp traps adjacent to entry of old buildings within the subject site for a total of 24 trap	25th Feb – 14th Mar 2019

Fauna Group	Target species	Survey method	Survey effort	Date
	(Eastern Bentwing-bat) *Miniopterus australis* (Little bentwing-bat)	environment until they could be released prior to sun up or nightfall within the subject site of capture. ▪ **Roost Search:** Inspection of old buildings within the subject site	nights. (two traps for two nights per structure and repeated two weeks later) - Roost search including roof cavities, holes in walls and any evidence of Bat utilisation	

Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals;
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;
- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna; and
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, and diggings).

5.4.4 Limitations

Limitations associated with this assessment report are presented herewith. The limitations have been taken into account specifically in relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; whereby 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant and scientifically justified to ensure a holistic assessment.

Seasonality & Conditions

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence, threatened species may be absent from some areas where potential habitat exists for extended periods and this might be the case for nomadic and opportunistic species.

Data Availability & Accuracy

The collated threatened flora and fauna species records provided by NSW Bionet are known to vary in accuracy and reliability. This is usually due to the reliability of information provided to the National Parks and Wildlife Service (NPWS) for collation and/or the need to protect specific threatened species locations. During the review of threatened species records sourced from OEH Atlas of NSW Wildlife, consideration has been given to the date and accuracy of each threatened species record in addition to an assessment of habitat suitability within the study area.

Similarly, EPBC Protected Matters Searches provide a list of threatened species and communities that have been recorded within 10 km of the study area, or which have suitable habitat within the wider area, and are subject to the same inherent inaccuracy issues as the State derived databases.

In order to address these limitations in respect to data accuracy, threatened species records have only been used to provide a guide to the types of species that occur within the locality of the study area. Consequently, BAM assessment and the results of surveys conducted within the study area and surrounds have been used to assess the likelihood of occurrence of threatened species, populations and ecological communities to occur therein.

5.4.5 Weather Conditions

Field surveys were undertaken by MJD Environmental between the 20th June 2018 and 20th July 2018, 25th and 14th March, 15th and 22nd May, 12th and 14th June 2019 and then again over a single day on 9th June 2021. The prevailing weather conditions during the survey are presented in a **Table 7** below.

Table 7 Prevailing Weather Conditions

Date	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)	Wind (km/h) 9am / 3pm	Sunrise-Sunset
20 Jun 2018	9.8	18.5	24.8	W 11 to SSE 15	0656-1655
21 Jun 2018	10.5	16.3	0.4	WNW 11 to N 2	0656-1655
22 Jun 2018	7.5	15.4	0.2	WNW 11 to WNW 4	0656-1655
26 Jun 2018	1.3	18.2	0.0	WNW 15 to E 9	0657-1656
27 Jun 2018	4.1	17.8	0.2	SW 7 to E 20	0657-1656
03 Jul 2018	6.9	17.0	0	WNW 11 to NNE 9	0657-1659
04 Jul 2018	6.1	20.0	0.2	E 6 to ENE 6	0657-1659
05 Jul 2018	8.8	23.4	0.2	WNW 9 to NNE 11	0657-1700
18 Jul 2018	9.3	22.0	0.0	WNW 13 to WNW 24	0653-1707
20 Jul 2018	0.3	21.4	0.0	WSW 17 to W 30	0652-1708
25 Feb 2019	13.9	27.4	0.0	Calm to SE 24	0638-1935
26 Feb 2019	12.5	30.7	0.0	NW 9 to ESE 13	0639-1934
27 Feb 2019	14.5	31.0	0.0	SE 7 to ESE 22	0640-1932
28 Feb 2019	13.9	30.5	0.0	Calm to ESE 17	0641-1931
1 Mar 2019	16.1	31.3	0.0	WSW 9 to SE 28	0642-1930
2 Mar 2019	16.8	30.9	0.0	E 11 to SE 22	0643-1929
3 Mar 2019	17.6	32.1	0.0	E 11 to ESE 22	0643-1928
4 Mar 2019	15.2	34.3	0.0	Calm to SE 13	0644-1926
5 Mar 2019	14.8	35.9	0.0	SSW 6 to WNW 9	0645-1925
6 Mar 2019	18.1	38.0	0.0	N 9 to WNW 22	0646-1924
7 Mar 2019	20.4	22.3	0.6	ESE 11 to ESE 20	0647-1923
8 Mar 2019	17.3	34.0	0.0	E 7 to N 9	0647-1921
9 Mar 2019	19.5	34.8	0.0	WSW 7 to ESE 24	0648-1920
10 Mar 2019	20.5	33.3	42.4	Calm to NW 13	0649-1919
11 Mar 2019	19.7	32.2	0.0	S 6 to E 20	0650-1918
12 Mar 2019	20.1	36.0	0.0	WNW 13 to WNW 19	0650-1916
13 Mar 2019	20.6	27.5	0.0	SSE 9 to ESE 24	0651-1915
14 Mar 2019	21.6	31.4	0.0	ENE 20 to ESE 13	0652-1914
15 May 2019	19.3	27.4	0.0	S 9 to SSE 22	0653-1913
16 May 2019	18.3	22.4	0.0	WNW 11 to WSW 19	0653-1911
22 May 2019	18.6	28.8	0.2	Calm to ESE 15	0658-1903
12 June 2019	11.2	22.8	0.0	Calm	0652 -1653
14 June 2019	8.2	19.9	0.0	Calm	0653 -1653
09 June 2021	9.4	13.5	9.0	WNW 35 to WNW 31	0652 -1658

Sources: http://www.bom.gov.au/climate/dwo/201806/html/IDCJDW2079.201806.shtml; http://www.bom.gov.au/climate/dwo/IDCJDW2079.latest.shtml; http://www.ga.gov.au/bin/geodesy/run/sunrisenset

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FIGURE 8: FAUNA SURVEY LOCATIONS

Legend

- Anabat
- Call Playback
- Camera (Arboreal)
- Camera (Terrestrial)
- Harp Trap
- Listen Survey
- ReptileSurvey
- SpotlightSurvey
- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

N W E S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

6 Targeted Threatened Species Survey Results

6.1 Flora Species Results

No flora candidate species were detected during the targeted surveys undertaken by MJD Environmental during July and August 2018 or during June 2021.

6.2 Hollow Bearing Tree Survey

A total of 91 (confirmed and potential) hollow bearing trees were identified within the subject site, of which 18 were considered to be of appropriate size and orientation to be utilised by large Forest Owls.

Characteristics used to determine a potential hollow suitable for a Forest Owl included hollow greater than 20cm, unimpeded entry to hollow, no evidence of mud present, straight down hollows often preferred by the Masked Owl (pers com. M. Murray 2018).

Figure 9 shows all hollow bearing trees observed (including potential hollow bearing trees) and the location of hollows that are greater than 20cm suitable for large Forest Owls.

6.3 Fauna Species Results

The following fauna survey results have been collated from MJD Environmental surveys during 2018-19 and targeted avifauna surveys undertaken by RPS (2017) within the last two years.

A total of 71 fauna species where detected within the subject site, this total included 37 avifauna, 28 mammals (three exotic species), four reptiles and two amphibians. Of the fauna species detected a total of eight were threatened species: three ecosystem species, one specie credit species and four dual credit species.

A complete list of fauna detected during field surveys has been provided in **Appendix I.** All threatened fauna species detected have been present in **Figure 10.**

Mammals

Targeted survey results for threatened terrestrial and arboreal mammals only detected common species often associated with disturbed environments that lack structure. No threatened mammal species where observed during the survey period. Species detected included Brown Antechinus (*Antechinus stuartii*), Common Dunnart (*Sminthopsis murina*), Sugar Glider (*Petaurus* breviceps), Black Rat (*Rattus rattus*), Common Brushtail Possum (*Trichosurus vulpecula*), Eastern Grey Kangaroo (*Macropus giganteus*), Red-necked Wallaby (*Macropus rufogriseus*) and Exotic species such as Cattle (*Bos taurus*), European Rabbit (*Oryctolagus cuniculus*)Red Fox (*Vulpes vulpes*).

Grey-headed Flying Fox (*Pteropus poliocephalus*) was observed flying over and sporadically foraging within the subject site on *Eucalyptus moluccana* (March 2019).

Microchiropterans Bats

A total of 13 microbat species were detected via the use of the Anabat express echo-location call recorder, with three species captured in harp traps.

Of the recorded species, five are listed as Vulnerable under the BC Act (all detected via the Anabat Echo locator Unit),

- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Little Bent-wing Bat (*Miniopterus australis*);
- Eastern Bent-winged Bat (*Miniopterus schreibersii oceanensis*);
- Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*); and

- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*).

The remaining microbats positively identified were the Eastern White-stripped Free-tailed Bat (*Austronomus* australis), Gould's Wattled Bat (*Chalinolobus gouldii*) (Harp trap and Anabat) , Chocolate Wattled Bat (*Chalinolobus morio*) (Harp trap and Anabat) and Ride's Free-tail Bat (*Mormopterus ridei*), Gould's Long-eared Bat (*Nyctophilus gouldii*), Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), Eastern Forest Bat (*Vespadelus pumilus*) and Little Forest Bat (*Vespadelus vulturnus*) are all known common species.

Additionally, the following bat species had potential to occur (detected using the Anabat) within the subject site, but could not be confidently identified:

- Eastern Falsistrelle (*Falsistrellus tasmaniensis*) (Vulnerable under the BC Act);
- Large-footed Myotis (*Myotis macropus*) (Vulnerable under the BC Act);
- Lesser long-eared Bat (*Nyctophilus geoffroyi*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern Broad-nosed Bat (*Scotorepens orion*)
- Large Forest Bat (*Vespadelus darlingtoni*);
- Southern Forest Bat (*Vespadelus regulus*); and
- Eastern Cave Bat (*Vespadelus troughtoni*) (Vulnerable under the BC Act)

Refer to **Appendix I** for a detailed list of recorded species and **Appendix K** for the Anabat Call Recording reports.

Targeted surveys focused on three candidate species which suitable habitat was determined to occur within the subject site.

The two Bent-wing bats *Miniopterus australis* and *Miniopterus schreibersii oceanensis* are listed as candidate species for breeding habitat only. The presences of two old derelict buildings remaining from the commercial chicken farm and an old farm shed were determined to provide marginal breeding habitat for the two species. An inspection of the buildings was carried out prior to establishing traps to observe if the buildings were being utilised by microbats. Roof cavities, cracks in walls, dark cupboards and old industrial size refrigerators were inspected for any signs of utilisation. There was very minor occurrence of microbat guano in the laboratory found in the south west corner of the site. No bats were observed roosting in the buildings during these building inspections. The culvert which allow passage of the watercourses which crosses John Renshaw Drive was inspected for appropriateness of microbat use and any evidence thereof.

Harp traps were set up at all three buildings with a focus on entry points to the structures. A harp trap was also set up adjacent to the laboratory where an obvious fly way was present.

The survey for the two target Bent-winged bats was undertaken at the end of the prescribed survey period (Dec – Feb) and was completed during early March. The environmental conditions during March were similar to February with significantly hot days and warm nights. There was no change in environmental condition from the end of February to early March that would change potential breeding capacity of the targeted species. That is, climatic summer like conditions persisted beyond the prescribed survey period in the 2019 survey season.

No targeted threatened microbats were captured during the harp trap surveys with only common microbats detected. The two Bent-winged species were detected on site using the Anabat echo-location call recorders away from the structures.

The riparian areas within the subject site often hold pools of water that may be regarded as suitable habitat for *Myotis macropus*.

During the survey period these creeks were completely dry due to the extended dry period in the Hunter region. Survey for the *Myotis* was still undertaken during the prescribed survey period. Surveys involved the establishment of four harp traps placed within creeklines, two Anabat recorders were also located within the creeklines.

The target species *Myotis macropus* was not captured in the harp traps and was not confidently identified by the Anabat recordings, thus this species cannot be confirmed to be present on site.

The candidate species *Chalinolobus dwyeri* was detected during targeted surveys for the *Myotis macropus.* This species was not formally targeted as part of the surveys as it was determined that the subject site does not contain breeding habitat such as caves, mine shafts or cliff faces. It was also determined during a desktop assessment that there was no suitable breeding habitat within a 2km radius of the subject site, thus not requiring survey in accordance with the OEH Threatened bats guideline (2018).

This species was recorded using an Anabat ultrasonic detector in the southwest corner of the subject site. A total of two individual calls over two evenings were recorded for this species during the nine nights of survey.

This species has potential to utilise the vegetation found within the subject site as a potential area of forage as part of a wider home range. The vegetation observed within the site is floristically similar to much of the vegetation in the locality surrounding the subject site and provides space that lacks vegetation clutter which this species is known to forage (Williams and Thomson 2018).

This species is known to forage close to roosting sites generally within two kilometres of its roost or breeding habitat. During the habitat suitability assessment an in-depth desktop assessment was carried out to ensure potential breeding and roosting habitat in the form of caves, cliffs, scarps or mine shafts was undertaken. It was concluded that no distinctive features as described to be breeding or roosting habitat were within a 2km radius of the subject site therefore the likelihood of this species being present was low and therefore there are no formal requirements to survey for this species. Notably the species has been recorded incidentally during targeted surveys for other microbats.

The dry sclerophyll forest found within the site is represented throughout the locality and is protected in the National Park Estate in the nearby Sugarloaf range (where likely roosting/ breeding habitat exists) and mine company offset sites that occur just west of the subject site.

Avifauna

A total of 37 native bird species in the subject site through systematic and opportunistic surveys. Frequently recorded species during diurnal bird censuses primarily consisted of common woodland species such as the Willie Wagtail (*Rhipidura leucophrys*), Australian Magpie (*Cracticus tibicen*), Laughing Kookaburra (*Dacelo novaeguineae*), White Winged Cough (*Corcorax melanorhamphos*), and Black-faced Cuckoo-shrike (*Coracina novaehollandiae*).

One threatened bird species was observed on multiply days during MJD environmental flora and fauna surveys. The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) was observed foraging throughout the vegetation on site primarily in the northern and eastern vegetated areas. Nest were also observed in these areas.

Nocturnal Avifauna

A total of three nocturnal birds were recorded during formal nocturnal surveys. Call play-back, listening surveys, stag-watching and spotlighting were carried out for the three target Forest Owls, over five nights during May and June 2019.

Prior to commencement of the Owl breeding period (May- August) a hollow bearing tree survey of the subject sites was carried out to identify any trees that maybe suitable for large Forest Owl breeding or roosting activities. In accordance with the OEH Threatened Biodiversity Data Collection (TBDC) all trees observed to exhibit breeding tree attributes of a hollow greater than 20cm in diameter were considered to be potential Owl breeding/roosting trees. Additionally, information was gathered at the time of assessment that included the configuration of the hollow entrance, evidence of utilisation such as whitewash or remains often observed in owl pellets, and the presents of mud in hollows (if visible) that would restrict utilisation by Owl species.

A total of 18 hollow bearing trees exhibited a hollow greater than 20cm in size, an entrance to the hollow that would be accessible for an Owl species and no other attributes that may limit the utilisation of the tree for roosting or breeding proposes. All large hollows (>30cm) observed were a particular focus for further investigation in particular hollows that were straight down as these are often used as Owl roosting and breeding trees (M. Murray pers comm. 2018)

The afternoon prior to commencing formal Owl surveys, all trees with attributes suitable to support a breeding Owl were visually inspected for any recent utilisation. No trees exhibited any recent usage.

Each night of survey commenced with a listening period and stag watch from dusk for approximately one hour. No calls were heard during the listening period on each of the survey nights. At the completion of the listening period, a call play-back session commenced where each of the three Forest Owl species calls were played and followed by a listening period.

On the third evening of the survey period approximately 30 minutes after the call playback session had ceased, a Masked Owl was heard calling west of the call play back site. Spotlighting in the vicinity of the area begun and a second call was heard adjacent to the call play back site. At this point a bird that appeared to look like a Mask Owl was seen flying away from the site.

Further inspections of the subject site after the initial detection of the Owl occurred to try and identify if the Owl was breeding or roosting on the subject or if the Owl had been attracted by the call play back from outside the area. No further detection of the species occurred during the survey period including Owls duetting or utilisation of the area. It was determined that although the Owl was positively identified by call, there was no evidence of the Owl breeding within the subject site and the individual was called in as a response to call playback surveys.

No other threatened Owl species were heard responding to call backs played during the survey effort.

An additional two nocturnal bird species were observed during the survey period namely the Australian Owlet Nightjar (*Aegotheles cristatus*), Tawny Frog mouth (*Podargus strigoides*) these two species were heard and observed on a single occasion during spotlighting.

Swift Parrot and Regent Honeyeater

Targeted surveys for nectar dependant species were performed (by RPS) during the Spotted Gum (*Corymbia maculata*) flowering period (May to October 2017) to specifically target the Regent Honeyeater and Swift Parrot. Conditions suitable for performing targeted surveys for the Regent Honeyeater were examined on 10 separate days in this period. Conditions observed during the targeted surveys were typified by spot flowering by Spotted Gum.

Regent Honeyeater and Swift Parrot surveys performed throughout the study area failed to detect any occurrence of these species. In the same period, Regent Honeyeater and Swift Parrot observations within the locality and region, as represented in the 'recent sightings' log of 'Birdline New South Wales' (http://www.eremaea.com/BirdlineArchive.aspx?Birdline=2&From=20170415&To=20171020), are summarised in **Table 8**. This summary provides an indication of Regent Honeyeater and Swift Parrot activity during the survey period.

Table 8 Regent Honeyeater and Swift Parrot observations in the Hunter Region (May to October 2017)

Observation Date	Location
8 May 2017	Hunter Economic Zone. Regent Honeyeater and Swift Parrot feeding on Spotted Gum.
9 May 2017	Werakata National Park (Kitchener). Swift Parrots observed and no Regent Honeyeaters.
16 May 2017	Werakata SCA (Pelton). Swift Parrot feeding on Spotted Gum.
24 May 2017	Quorrobolong. Regent Honeyeater feeding on Spotted Gum.
25 May 2017	Ellalong. Swift Parrots observed and no Regent Honeyeaters.
26 May 2017	Werakata SCA (Pelton). Swift Parrots observed and no Regent Honeyeaters.
30 May 2017	Singleton Military Area. Swift Parrots observed.
13 June 2017	Quorrobolong. Regent Honeyeater feeding on Spotted Gum.
28 June 2017	Hunter Economic Zone. Swift Parrot feeding on Spotted Gum.
29 July 2017	Hunter Economic Zone. Swift Parrot feeding on Grey Gum.
1 August 2017	Quorrobolong and Paxton. Regent Honeyeater and Swift Parrot feeding on Spotted Gum.
3 August 2017	Quorrobolong and Paxton. Regent Honeyeater feeding on Spotted Gum.
24 September 2017	Capertee Valley. Regent Honeyeater feeding on Yellow Box.
28 September 2017	Capertee Cottage. Regent Honeyeater feeding on mistletoe in River Sheoak.

4 October 2017	Glen Alice, Capertee Valley. Regent Honeyeater feeding on Mugga Ironbark and Yellow Box.

The location of recent Regent Honeyeater and Swift Parrot sightings in the lower Hunter, as outlined in **Table 8**, are consistent with the modelled area of high value habitat within this region (i.e. the Quorrobolong – Paxton – Kitchener – Kurri Kurri area) (Birdlife Australia 2013). The same habitat modelling indicates the Black Hill area as being located within an area of low to moderate value for the Regent Honeyeater and Swift Parrot.

Since 2017 there are have been two additional records of Swift Parrots (both within 2018) and three of Regent Honeyeaters (all within 2018) within 10 km of the subject site based on verified BioNet sighting records.

The site is not mapped on the important areas mapping for the Swift Parrot or Regent Honeyeater.

Herpetofauna

Four reptiles and two amphibians were detected within the subject site. All species observed were common species that included: Lace Monitor (*Varanus varius*), Red-bellied Black-snake (*Pseudechis porphyriacus)*, Bearded Dragon (*Pogona barbata*), Eastern Water Dragon (*Intellagama lesueurii*), Common Eastern Toadlet (*Crinia signifera*) and Stripped Marsh Frog (*Limnodynastes peronii).*

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FIGURE 9: HOLLOW BEARING TREE SURVEY

Legend

- Hollow Bearing Tree
- Hollow >20cm (Refer to Section 6.2)
- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

N
W E
S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

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FIGURE 10: FAUNA SURVEY RESULTS

Legend

- Grey-Crowned Babbler
- Masked Owl
- Bats: Large-eared Pied, Little Bent-winged, Eastern Bent-winged, Eastern Coastal Free-tailed, Yellow-bellied Sheath-tailed
- Bats: Little Bent-winged, Eastern Bent-winged, Eastern Coastal Free-tailed, Yellow-bellied Sheath-tailed
- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries

N
W E
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0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

7 Matters of National Environmental Significance

An EPBC Act Protected Matters Search (accessed 19-07-2018) was undertaken to generate a list of those Matters of National Environmental Significance (MNES) from within 10 km of the Site. An assessment of those MNES relevant to biodiversity has been undertaken in accordance within EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (DoE, 2013). The Matters of National Environmental Significance protected under national environment law include:

- Listed threatened species and communities;
- Listed migratory species;
- Ramsar wetlands of international importance;
- Commonwealth marine environment;
- World heritage properties;
- National heritage places;
- The Great Barrier Reef Marine Park;
- Nuclear actions; and
- A water resource, in relation to coal seam gas development and large coal mining development.

Listed Threatened Species and Communities:

A total of 73 threatened species and 5 threatened ecological communities listed under the EPBC Act have been recorded on the protected matters search. A likelihood of occurrence assessment for these MNES has been completed in **Appendix F**.

Threatened Species

Fifteen threatened birds, eight mammals, one reptile, five frogs, and twenty-one plants were recorded on the protected matters search. Of these, eight species were considered to have the potential to utilise the habitats within the development site:

- *Anthochaera phrygia* (Regent Honeyeater)
- *Lathamus discolor* (Swift Parrot)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Cynanchum elegans* (White-flowered Wax Plant)
- *Eucalyptus glaucina* (Slaty Red Gum)
- *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
- *Rutidosis heterogama* (Heath Wrinklewort)
- *Tetratheca juncea* (Black-eyed Susan)

Formal targeted surveys carried out as part of the BAM methodology and in accordance with the DEWHA (2010) *Survey Guidelines for Australia's threatened birds* specifically the Regent honeyeater and Swift Parrot, did not record any of the above species, and no habitat on the study area is critical to their survival.

This assessment concluded that the proposal is unlikely to impact the listed threatened species.

No Threatened Ecological Communities listed under the EPBC Act have been recorded within the study area.

Listed Migratory Species:

The protected matters search nominated 30 migratory species or species habitat that may occur with the 10km site buffer search area. No listed migratory species were observed on site. The assessment contained in **Appendix F** concluded that, no habitat on the study area is critical to their survival. Therefore, it is unlikely that the proposal over the study area will impact migratory species.

Wetlands of International Significance (declared Ramsar wetlands):

The site is not a wetland of international significance or declared Ramsar wetland. The protected matters search nominates the following wetland of international importance:

- Pambalong Wetland

The Pambalong Wetland is approximately 3 km from the study area. The wetland forms part of the Hexham Swamp and is an integral part of a chain of wetland reserves that includes the internationally significant Ramsar-listed Hunter Estuary Wetlands. Several threatened bird species visit the reserve, including the black-necked stork, magpie goose, freckled duck, painted snipe and comb-crested jacana. Migratory wader species listed under international treaties have also been recorded on the reserve (NSW NPWS 2006).

- Hunter Estuary Wetlands

The Hunter Estuary Wetland Ramsar site is approximately 13 km from the study area. The wetlands supports 112 species of waterbirds and 45 species of migratory birds listed under international agreements, including the white-bellied sea-eagle (*Haliaeetus leucogaster*), and the green and golden bell frog (*Litoria aurea*) listed as vulnerable under the EPBC Act. The Hunter Estuary wetlands also provide refuge for waterbirds such as ducks and herons during periods of inland drought. The wetland supports 1% of the population of the eastern curlew (*Numenius madagascariensis*) and the red-necked avocet (*Recurvirostra novaehollandiae*).

Commonwealth Marine Areas:

The site is not part of a Commonwealth Marine Area and is not in close proximity to any such area.

World Heritage Properties:

The site is not a World Heritage area and is not in close proximity to any such area.

National Heritage Places:

The site is not a National Heritage area and is not in close proximity to any such area.

Great Barrier Reef Marine Parks:

The site is not part of or within close proximity to any Great Barrier Reef Marine Park.

Nuclear Actions:

The proposal over the site is not and does not form part of a Nuclear action.

Water Resources in relation to Coal Mining and CSG:

The proposal over the site is related to residential development and as such is not or does not form part of a coal mining and/or CSG proposal.

Summary - In summary, the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment. Notwithstanding a referral will be made for the proposal under the EPBC Act.

8 SEPP 44 -Koala Habitat Protection

Assessment of potential koala habitat under SEPP 44 requires the following steps be undertaken:

(a) Identification of 'potential Koala habitat' within the site area to be impacted; if the total tree cover contains 15% or more of the Koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be 'potential Koala habitat'. Identification of 'potential Koala habitat requires the determination of the presence of 'core Koala habitat';

(b) Identification of 'core Koala habitat' within the area to be impacted. 'Core Koala habitat' is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;

(c) Identification of 'core Koala habitat' will require that a plan of management must accompany the application;

(d) If the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

Two tree species listed in Schedule 2 of the SEPP as a 'Koala Feed Tree Species' occurs on the site, being *Eucalyptus punctata* (Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum).

At no point where Koala feed trees persist on site do they represent 15% or more of the total tree cover. Additionally, investigations did not detect Koalas or signs of Koalas within the study area. Therefore, the vegetation on the site does not constitute Potential or Core Koala Habitat.

Determination of SEPP (Koala Habitat Protection)

At the time of Development Application submission (August 2018) of the development application for the site, SEPP No.44 – Koala Habitat Protection was in force. There have been multiple iterations of this SEPP (Koala Habitat Protection) in the recent years. The following text investigates the appropriate SEPP version for the assessment of the site with respect to the Koala.

The SEPP 44 – Koala Habitat Protection commenced on 13th February 1995 and was the original legislation for the protection of Koala Habitat.

The SEPP (Koala Habitat Protection) 2019 commenced on 1st March 2020. At that time of gazettal, SEPP 44 – Koala Habitat protection was repealed under Part 5 of SEPP (Koala Habitat Protection) 2019.

The SEPP (Koala Habitat Protection) 2020 commenced on 30th November 2020. At that time of gazettal SEPP (Koala Habitat protection) 2019 was repealed under Part 5 of SEPP (Koala Habitat Protection) 2020.

The SEPP (Koala Habitat Protection) 2021 commenced on 17 March 2021. Part 4 of the SEPP introduced savings and transition arrangements and amendments to SEPP (Koala Habitat Protection) 2020 were made by Schedule 3.

With regard to the savings and transition arrangements of SEPP (Koala Habitat Protection) 2021, for development consent under Part 4 of the EP&A Act, the following criteria apply to the site:

- Part 4, Section 18 Existing development applications - A development application made in relation to land, but not finally determined before this Policy applied to the land, must be determined as if this Policy had not commenced in its application to the land; and
- SEPP (Koala Habitat Protection) 2021 applied from the 17th March 2021.

On this basis, SEPP (Koala Habitat Protection) 2021 does not apply to the current development application over the site as it was lodged prior to 17th March 2021, specifically August 2018. Therefore, the development application is to be assessed under the provisions of SEPP (Koala Habitat protection) 2020.

Evaluation of Original Koala Assessment Against SEPP (Koala Habitat Protection) 2020

SEPP (Koala Habitat Protection) 2020 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. It replicates the objectives and provisions of SEPP 44, which was in force from 1995 through to 2019.

Assessment of potential koala habitat under the Koala SEPP 2020 requires the following steps be undertaken:

> *Step 1) Identification of 'Potential Koala Habitat' within the site area to be impacted; if the total tree cover contains 15% or more of the Koala food tree species listed in Schedule 2 of SEPP (Koala Habitat Protection) 2020 then it is deemed to be 'Potential Koala Habitat'. Identification of 'Potential Koala Habitat' requires the determination of the presence of 'Core Koala Habitat'; and*
>
> *Step 2) Identification of 'Core Koala Habitat' within the area to be impacted. 'Core Koala Habitat' is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population.*

The assessment of the site for the initial BDAR was assessed against the provisions of SEPP 44 – Koala Habitat Protection as detailed above. This assessment determined:

Two tree species listed in Schedule 2 of the SEPP as a 'Koala Feed Tree Species' occurs on the site, being Eucalyptus punctata (Grey Gum) and Eucalyptus tereticornis (Forest Red Gum).

At no point were Koala feed trees persist on site do they represent 15% or more of the total tree cover. Additionally, investigations did not detect Koalas or signs of Koalas within the study area. Therefore, the vegetation on the site does not constitute Potential or Core Koala Habitat.

Therefore no further provisions of this policy apply to the site.

Summary

SEPP (Koala Habitat Protection) 2020 replicates the objectives and provisions put in place by SEPP 44, and carries the same provisions for the assessment of Koala Habitat.

The above assessment that initially informed the BDAR, assessed the site as not constituting Potential or Core Koala Habitat in accordance with the provisions of SEPP 44.

The assessment of Koala Habitat for the site has met the conditions of SEPP (Koala Habitat Protection) 2020 in reviewing Koala Habitat and remains valid for the assessment for the development application.

STAGE 2 - IMPACT ASSESSMENT

9 Avoid and Minimise Impacts

9.1 Biodiversity Values

Site Selection

The subject site was part of a planning proposal that received gateway on 11th December 2012 and a Draft LEP was received on 12th December 2016 with gazettal occurring on the 13th April 2017. The planning proposal assessed a land zoning change from RU2 Rural Landscape to IN1 General Industrial and E2 Environmental Conservation. This planning proposal sought to provide opportunity to develop the previously disturbed study area environs for an industrial development whilst conserving higher value native vegetation via appropriate environmental zoning.

The approved rezoning resulted in the study area being zoned and divided into:

- IN2 Light Industrial (177.79 ha)
- E2 Environmental conservation (57.6 ha)
- E4 Environmental Living (81.39 ha)

Note that the subject site also contains 8.32 ha of SP2 Special purpose inclusive of the existing infrastructure (John Renshaw Drive).

The flora and fauna assessment that informed the rezoning application (RPS 2013) provided an assessment of biodiversity values within the study area. This included an understanding of the locations of significant vegetation that were rezoned for conservation in perpetuity (E2 & E4).

The retained vegetation zoned E2 in the north of the site, includes Lower Hunter Spotted Gum Ironbark Forest (EEC) and Tall Alluvial Moist Forest that is regarded as riparian vegetation along Weakleys Flats Creek. This patch of vegetation and associated creek lines will provide a northern corridor for fauna movement, although John Renshaw Drive presents a hostile connection for many terrestrial and arboreal mammals continuing north. The retained vegetation in the south of the study area has been rezoned E4 and will result in further retention of Lower Hunter Spotted Gum Ironbark Forest (EEC) and Tall Alluvial Moist Forest. In addition, it will provide a corridor for fauna movement that links to vegetation in the northern areas of the Sugarloaf range.

Notably, the land to the east has been approved for a large employment lands development as part of the Coal & Allied Lower Hunter Lands – Black Hill site project (Major Project ref: MP10_0093). When developed, connectivity to the east of site will be severed. The neighbouring concept approval seeks to maintain a central north to south connection via a retained riparian zone. Continued east to west connectivity shall occur south of site within the Study Area to the neighbouring concept approval site.

The subject site for development was selected due to the largely cleared or highly degraded lands as a result of past and present land use. All vegetation is to be removed within the subject site with the exception of the south to north reach of an ephemeral riparian corridor situated in the north-west of the site. The alignment will be subject to realigned in areas and rehabilitation as part of the staged development works. (Note: for the purposes of impact assessment, this vegetation has been considered as lost, thus adding to the overall biodiversity liability, notwithstanding that areas of the riparian corridor that are not realigned will be retained).

The current layout of the industrial area has been developed in response to the rezoning of the study area and no further avoidance and mitigation measures have been considered, as the approval granted at the time of rezoning considered the conservation outcomes for the site and the proposed land usage to be sufficient to allow for the rezoning to be approved.

Refer to **Figure 11** showing the Development Footprint.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 11: DEVELOPMENT FOOTPRINT

Legend

- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries
- Development Footprint

N
W E
S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

9.2 Prescribed Biodiversity Impacts

The avoidance and minimising of impacts on prescribed biodiversity is a critical component of the BAM, as many of these biodiversity values are difficult to quantify, replace or offset.

The BC regulation (clause 6.1) identified actions that are prescribed as impacts to be assessed under the biodiversity offset scheme. Where these actions have been identified within the subject site and efforts have been made to avoid and minimise impacts, they have been addressed below:

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 of the Industrial zoned parcel of land was designed to avoid impacts to larger higher quality patches of vegetation in the north and south of the study area during the planning proposal assessment process. The retention of these two parcels within the wider lands will provide connectivity across the landscape by facilitating movement for primarily highly mobile threatened species. Currently the vegetation to be retained in the north and south provides connection in an east-west direction. The southern parcel will continue to facilitate movement to adjacent vegetation that connects to the northern areas of the Sugarloaf Range. The connectivity in the northern parcel of retained vegetation will be restricted to highly mobile species with the construction and operation of the main entrance road to the development dividing the area into two areas. A culvert will be constructed over the 2nd order stream to allow for restricted terrestrial movements within the retained patch which will connect the western vegetation to the east and north via a second existing culvert under John Renshaw Drive.

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

During the rezoning assessment consideration was given to all water courses and the associated riparian corridors known to occur on the site, and an importance placed on the retention of these areas as part of the environmental conservation outcomes of the proposed rezoning. The gazetted LEP amendment has resulted in E2 lands to the north conserving the 2nd order water course - Weakleys Flats Creek and two ephemeral 1st order streams. In addition, the south to north reach of an ephemeral riparian corridor situated in the north-west of the site will be partially retained as part of the development with rehabilitation and re-alignment works to be carried out.

The southern E4 land that is part of the wider study area has additional watercourses retained that include a third order stream and associated riparian forest.

The two existing culverts which allow the passage of water across John Renshaw Drive by the one mapped Strahler 2nd order watercourse and one unmapped drainage lines (see **Figure 3**). These culverts will not be removed during the proposed road widening associated with the proposal, though the culverts may be impacted temporarily. Hydrological processes of the road corridor will not be impacted by the proposed works.

10 Unavoidable Impacts

The following section outlines potential direct and indirect impacts on biodiversity values and prescribed impacts associated with the proposal.

10.1 Direct Impacts

The construction and operation of the Black Hill Industrial Estate will result in the following direct impacts:

Removal of Native Vegetation

A total of 73.61 ha of native vegetation will be removed as part of the proposal (a total of 77.22 ha inclusive of managed roadside vegetation and planting not included in calculations). The following table provides a breakdown of area to be cleared by vegetation zone and the current and future vegetation integrity score (V.I).

Note: All vegetation is to be removed within the subject site with the exception of the south to north reach of an ephemeral riparian corridor situated in the north-west of the site. The alignment will be subject to realigned in areas and rehabilitation as part of the staged development works. (Note: for the purposes of impact assessment, this vegetation has been considered as lost, thus adding to the overall biodiversity liability, notwithstanding that areas of the riparian corridor that are not realigned will be retained).

Table 8 Direct Impacts on Native Vegetation

Vegetation Zone	Condition	Threatened Ecological Community	Area (ha)	Current V.I Score	Future V.I Score
1592: *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*					
VZ1	1592_High	Commensurate with *Lower Hunter Spotted Gum Ironbark Forest of the Sydney Bioregion* EEC.	22.13	67.3	0
VZ2	1592_Moderate	Commensurate with *Lower Hunter Spotted Gum Ironbark Forest of the Sydney Bioregion* EEC.	29.04	49.7	0
VZ3	1592_Low Grassland	No	2.64	14.9	0
VZ4	1592_Low	Commensurate with *Lower Hunter Spotted Gum Ironbark Forest of the Sydney Bioregion* EEC.	17.53	45.4	0
VZ5	1592_Low Scattered Trees	No	1.50	12.7	0
1584: *White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley*					
VZ6	1584_High	No	0.78	82.4	0

Candidate Species Credit Species and SAII

As part of the biodiversity assessment, it has been determined the proposal will:

- not impact any threatened species or ecological communities listed as a candidate Serious and Irreversible Impact entity in accordance with *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017b); and
- will not impact candidate Species Credit Species as no observations of these species were recorded during formal surveys within the subject site.

10.2 Indirect Impacts

The construction and operation of the Black Hill Industrial Development may result in the following indirect impacts described in **Table 9**.

Table 9 Potential Indirect Impacts

Impact	Extent	Frequency/duration	Duration	Threatened species or TEC likely to be affected	Consequence of the impact on bioregional persistence of the threatened species, TEC and/or habitat
Inadvertent impacts on adjacent habitat or vegetation	Limited	Unlikely – construction stage	During construction of each stage of development	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC) ▪ Hollow bearing trees used by threatened species such as Forest Owls, birds and arboreal mammals (potential to occur) ▪ Grey Crowned Babbler (known to occur)	▪ Minor risk of disturbance of genetic exchange between flora species ▪ Minor risk of disturbance to retained vegetation ▪ Minor risk of loss/disturbance to fauna habitat (hollows, nests, ground timber, foraging habitat) ▪ Minor risk of injury or mortality of fauna during clearing adjacent development site
Reduced viability of adjacent habitat due to edge effects	Limited	Unlikely – construction stage	Operational stage	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC) ▪ Grey crown Babbler (known to occur)	▪ The adjacent vegetation to the development site has already been impacted by weed incursion due to historic clearing and current land management practices. The likelihood of the vegetation reducing in viability will be minor at best, due to impacts currently associated with edge effect such as weeds, these will include: ▪ Minor disturbance to native flora and fauna habitat along the boundary of retained vegetation and development site; ▪ Increase degradation to the edge of the known EEC. ▪ Increased edge effect may have a minor impact on accessibility to native vegetation for Grey Crown Babbler

Impact	Extent	Frequency/duration	Duration	Threatened species or TEC likely to be affected	Consequence of the impact on bioregional persistence of the threatened species, TEC and/or habitat
Reduced viability of adjacent habitat due to noise, dust or light spill	Immediate surrounds	On-going	On-going during construction and operational stages	▪ Forest Owls (foraging) ▪ Arboreal mammals (foraging) ▪ Grey-crowned Babbler ▪ Microbats ▪ All potential threatened avifauna that may forage in the adjacent habitat	▪ Alter fauna behaviour (breeding, roosting and movement) in the immediate locality ▪ Dust cover may impact function of flora species in adjacent vegetation ▪ Increased light in the locality impacting on nocturnal fauna movements.
Transport of weeds and pathogens from the site to adjacent vegetation	Immediate surrounds	On-going	During construction particularly adjacent to the boundary	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC) ▪ Grey Crowned Babbler	▪ Mortality and degradation of adjacent vegetation from disease ▪ Minor increase in weed presences, that will restrict native flora establishment and colonisation and native fauna movements; ▪ Minor risk of establishment of high threat weed that would degrade EEC ▪ Loss of fauna habitat
Increased risk of starvation, exposure and loss of shade or shelter	Immediate surrounds	Initial development stages	Construction stage only	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC) ▪ Microbats ▪ Grey Crowned Babbler	▪ Minor impact on EEC during construction by exposing edges of vegetation that were not accustom to loss of shade or direct environmental factors (increased wind, sunlight)
Loss of breeding habitat	unknown	Infrequent	During construction	▪ Grey Crown Babbler ▪ Microbats ▪ Any threatened entity that may utilise hollows	▪ Temporary loss of breeding habitat such as hollows and nests
Increase in pest animal populations	Unknown	Infrequent	During construction	▪ Lower Hunter Spotted Gum Ironbark Forest	▪ Minor increase in mortality of threatened fauna species due to pest animal presences.

Impact	Extent	Frequency/duration	Duration	Threatened species or TEC likely to be affected	Consequence of the impact on bioregional persistence of the threatened species, TEC and/or habitat
			and operation	▪ Grey Crowned Babbler ▪ All threatened species that may forage in the adjacent vegetation	▪ Minor increase in EEC degradation associated with pest animals foraging on native flora species, ground disturbance and ▪ Moderate risk of increasing weed presences within the EEC by acting as a vector of weed species. ▪ Risk of pest animal population excluding threatened fauna due to favourable modification of vegetation (clearing)
Rubbish Dumping	Unknown	Unknown	Construction and Operational	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC)	▪ Moderate increase in rubbish dump into EEC due the industrial estate being public roads allowing 24hr access.
Erosion and sediment impacts to adjacent vegetation	Unknown	Infrequent pending mitigation measures	Construction and Operational	▪ Lower Hunter Spotted Gum Ironbark Forest (EEC)	▪ Erosion and sedimentation impacts on EEC and riparian areas due to failed mitigation measures
Exposure of known soil contamination from development site into adjacent lands	Unknown	Infrequent	During construction	▪ Lower Hunter Spotted Gum Ironbark Forest EEC	▪ Risk of contamination exposure impacting health of EEC reducing extent and quality; Note: A RAP (per SEPP 55) with independent auditor forms part of the project. The RAP will clean up all known contamination across the subject site.

10.3 Prescribed Biodiversity Impacts

The construction and operation of the Black Hill Industrial Estate may result in the following prescribed biodiversity impacts described below:

Occurrences of karst, caves, crevices and cliffs

There are no occurrences of karst, caves, crevices or cliffs within the subject site.

Occurrences of rock

There were no observed occurrences of rock outcrops within the subject site.

There are minor areas of surface rock present within the subject site adjacent to the northern boundary and adjacent to the southern boundary. These areas are minor and provided little habitat opportunity for threatened species predicted to occur on site.

Occurrence of Non-native vegetation

The subject site does contain non-native vegetation in the form of exotic pasture, the occasional exotic tree and non-indigenous planting works carried out as part of landscaping works around where dwellings were located. The non-native vegetation plantings may provide minor forage of blossom for highly mobile species such as Grey-headed Flying Fox.

Within the road corridor a perimeter of managed road verge exists which is dominated by exotic grasses and some regenerating endemic pioneer species (such as acacia species). This zone is unlikely to provide habitat for threatened flora and fauna species beyond those which are proliferated by disturbance.

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

The proposed development will result in the removal of three human-made structures during the construction phase of the development. Each structure will be removed as part of the development of the associated stage the structure is located.

The human-made structures include: an abandoned laboratory in the south-west corner, a farm shed adjacent to the southern boundary and a house towards the north-west boundary. All structures are derelict and may provide habitat for roosting cave dwelling bats in the locality.

There are two listed threatened cave dwelling bats known to occur within the subject site, they are the Little Bentwing Bat (*Miniopterus australis*) and Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*). These two species are both known to roost in man-made structures such as those observed on the site.

These species have breeding requirements that include their maternity colonies requiring specific temperature and humidity. Such is this specific requirement, there are only 5 nursery sites/maternity colonies known in Australia for the Eastern Bent-wing Bat (OEH 2018c).

The targeted survey did not detect either of the Cave -dwelling bats utilising the human-made structures as maternity colonies, therefore records of this species in the locality are most likely in relation to foraging and roosting in the nearby area.

All impacts associated with the development on these structures will be limited to the immediate removal at the time of construction. Appropriate mitigation measures will be in place to ensure any utilisation of the structures prior to removal has been assessed and appropriate pre-clearance works are undertaken (Refer to **Section 13**). It is unlikely the proposal will have a significant impact on breeding and roosting habitat for these species in the locality.

Within the road corridor, all culverts were searched during the June 2021 survey. One of the culverts were found to not be suitable for microbat species based on the size and presence of obstructions to their entrances. The larger culvert allowing the movement of the mapped Strahler 2nd order watercourse, Weakleys Flat Creek, did not contain such obstructions and would be suitable for use by microbat species such as the BC Act listed vulnerable Southern Myotis (*Myotis Macropus*). However not signs of current use by microbats were observed and the absence of crevices within the culvert used during roosting noted. There are no records of the species occurring within the riparian zone of the watercourse or adjoining tributaries. Nor was the species recorded during targeted surveys of connecting watercourses. Therefore, it is unlikely that the species utilises the watercourse and the associated culvert structure.

All impacts to the culverts will be isolated to the time of development where the culverts will either be temporarily impacted by works but retained or alternately culvert works may be required if the road widening extends past the current road alignment. In which case the culverts will be extended rather than lost. Appropriate mitigation measures will be in place to ensure any utilisation of the structures prior to removal has been assessed and appropriate pre-clearance works are undertaken (Refer to **Section 13**). Therefore, it is unlikely that the proposal will significantly impact this species as suitable habitat will be retained.

Assessment of the 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 construction and operation of the Black Hill Industrial Development will result in the removal of 77.22 ha of native vegetation which will reduce connectivity between areas of habitat surrounding the subject site. The site in its current form provides corridors for linking contiguous patches of vegetation in the west and south to patches of vegetation to the east and north of John Renshaw Drive.

The proposed removal of vegetation will impact on connectivity of habitat across the central area of the wider study area, with movement being restricted retained vegetation to the north and south of the subject site.

The northern patch of vegetation which is to be retained as E2 zoned lands is identified as a corridor for movement from the west to eastern and northern patches of vegetation in the locality. This area will be impacted by the construction and operation of the developments entrance road that will connect John Renshaw Dr to the development site by dissecting the retained vegetation. The road will require the construction of culverts over the 2nd order stream that will retain limited connectivity for terrestrial fauna movements across the site. This culvert is expected to be used by potential terrestrial fauna in the same manner as the existing culvert (Weakleys Flat Creek) under John Renshaw Drive.

The on-going operation of the road may increase impacts on the movement of highly mobile species such as birds and microbats, although it must be considered the high volume of traffic that currently utilise John Renshaw Drive would present an existing baseline risk to these species and their movements. The introduction of a lower speed road (entrance road) would be a minor increase on the potential impacts to these species.

Any connectivity for arboreal species is restricted in the northern vegetation with the connection severed by John Renshaw Drive which runs parallel to the northern boundary.

The eastern boundary has a hostile connection (for arboreal mammals) due to the high voltage power line that runs in a north-south direction, this connection to the east is present in the form of lower growing native and exotic vegetation for a width of approximately 50m. Furthermore, vegetation east of the powerline is the location of an approved sub-division that will result in the loss of all vegetation through to the M1 motorway, severing full eastern connectivity adjacent to subject site.

To the south, connectivity is via retained vegetation within land zoned E4 that was sub-divided from the subject site during the rezoning process for the wider study area. To the west is a large contiguous patch of vegetation that provides connection from the subject site to northern areas of the Sugarloaf Range.

The hostile connection to the north and further east of the site (the M1 motorway), currently restrict connectivity and movement to different areas of habitat to highly mobile threatened species. This restriction to connectivity will be increased by the required widening of the portion of the extant road between the western and eastern limits of the site (John Renshaw Drive). The impacts to connectivity within a landscape are anticipated to be negligible as continuous wooded vegetation will be retained immediately north of the site (within the road corridor) ensuring movement of fauna (such as arboreal mammals) across the landscape is not prevented by the loss of habitat.

During the survey effort carried out within the subject site, only the Grey Crowned Babbler was recorded: This species was recorded during RPS surveys and incidental observations by MJD Environmental. There was a notable lack of threatened species observed within the subject site particularly highly mobile threatened species, that would often utilise vegetation as foraging habitat at the very least.

It is recognised that the site vegetation would support highly mobile species moving across the landscape in particularly fauna species foraging on winter blossom species such as the dominant *Corymbia maculata* (Spotted Gum). Fauna that potentially would use the site in times of high

blossom include threatened species such as the Regent Honeyeater, Swift Parrot, and the Grey-headed Flying-fox. In addition, a number of other predicted threatened species would potentially use this site as a stepping-stone across the landscape for forage and roosting purposes. These species would include but not limited to large Forest Owls, woodland birds and Microchiropteran bats.

The development of the industrial estate will be a staged process thus reducing impacts upfront by staggering vegetation removal, providing fauna opportunity to progressively alter movement patterns across the landscape.

The rezoning of lands to the north and south of the subject site will continue to provide corridors that will facilitate movement for highly mobile threatened species across the wider study area during construction and operation of the industrial estate. Thus, it is unlikely the proposal will have a significant impact on connectivity of areas of habitat for highly mobile threatened species in the locality.

Assessment of the impacts of the development on movement of threatened species that maintain their life cycle

The proposed development will result in the removal of 77.22 ha of native vegetation that may be relied upon by threatened species to maintain their life cycle. Any threatened species that were assessed to potentially use the site due to habitat suitability (primarily foraging) are generally highly mobile species, that will utilise corridors in the locality through retained vegetation to the north and south of the subject site. Thus, it is unlikely the proposal will have a significant impact on movement of highly mobile threatened species that maintain their life cycle in the locality.

Assessment of the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

The proposed development of the subject site will result in the part-removal of an ephemeral first order stream and the realignment and rehabilitation of the northern portion of the stream. The removal and modification works proposed are not expected to substantially alter hydrological processes on threatened species or threatened ecological communities that may utilise the stream within or outside of the subject site.

Any works proposed adjacent to or within the stream will be carried in a manner that will limit any pollutants or sediments from entering the catchment by implementing sediment and erosion control protocols, that will be developed as part of an approved Construction and Environmental Management Plan (CEMP). Therefore it is unlikely the proposal will have a significant impact on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.

Assessment of the impacts of vehicle strikes on threatened species of animals or on animals that part of a TEC

The proposed development will increase vehicle movements within the subject site, due to the proposed usage as an industrial development hub. The western entrance road to the site passes through the retained vegetation corridor in the north. The entrance will become a high use area, and due to the operational hours extending into the evening, this road could potentially increase vehicle strike for threatened diurnal and nocturnal fauna that may use the corridor as a place to forage and roost during movements through the locality. The complete removal of vegetation within the industrial estate will limit any potential for vehicle strikes, as there will be no vegetation to facilitate movement coupled with the estate being illuminated by street and building lights during evening.

The site is adjacent to high traffic artillery roads such as John Renshaw Dr and the begin of the M1 Motorway, therefore the construction and operation of the industrial estate will not substantially increase the risk of vehicle strike on threatened species. Coupled with the implementation of mitigation measures that may reduce the chance of vehicle strike appropriate speed limits, it is unlikely the proposal will have a significant impact on highly mobile threatened species in the locality.

11 Impact Mitigation and Minimisation Measures

The following section outlines general mitigation measures required to manage impacts associated with the construction and operation of the Black Hill Industrial Estate. All mitigation measures propose to manage impacts that include techniques, timing, frequency and responsibility for implementing each measure.

Table 10 Mitigation Measures

Mitigation Measures	Responsibility	Action	Timing
Direct Impacts			
Human Made Structure			
Pre-clearance and supervision of structure removal for microbats.	Project Ecologist	An experienced ecologist is to undertake the following tasks prior to and during removal of structures on site: ▪ Pre-clearance survey of the structures within 7 days of their removal to determine if any microbats are within the structures; ▪ Where microbats are observed, measures restrict bats re-entering the buildings following departure for evening foraging to be employed prior to clearing of structures; ▪ Structures to be inspected on the morning of demolition occurring. ▪ Ecological supervision to be provided during removal of primary habitat areas including the roof and roof void. ▪ Ecologist to be on-call and available for immediate mobilisation if additional microbats detected during demolition. Works to cease and ecologist direction sought.	Prior to and during the removal of structures
Relocate resident fauna (except Microbats) in structures	Project Ecologist	A pre-clearance survey of all structures proposed to be removed for any resident fauna species	The day of structure removal.
Vegetation Clearing (Staged)			
Demarcate stage clearing boundary	Surveyor	Installation of flicker tape along boundary, and any tree protection zones that may be required.	Prior to clearing works within the stage to be cleared

Mitigation Measures	Responsibility	Action	Timing
Vegetation removal works are to occur outside core breeding periods for species known to use habitat on site wherever possible	Project ecologist in consultation with project manager	Construction Environmental Management Plan (EMP) to include a schedule for tree clearing during optimal months	Spring to Summer (Avoid late winter and early spring).
Identification of habitat and relocation of resident fauna	Project Ecologist	Tree pre-clearance survey completed up to 7-days prior to removal; No breeding fauna observed at time of clearing; If breeding threatened fauna observed stop works until breeding has been completed.	Prior to commencement of works for each stage
Identify and mark habitat trees	Project Ecologist	All habitat trees marked appropriately and determine fauna presences (utilisation)	Prior to commencement of woks for each stage Spring to Summer
Under scrubbing of vegetation and removal of non-habitat trees to occur in a sequence to allow for resident fauna to move to adjacent areas of habitat	Project ecologist and Project manager	CEMP to be developed to outline clearing plan for each stage, that includes fauna management	Prior to commencement of works for each stage
Habitat Tree Removal			
Hollow-bearing and habitat tree removal/clearing	Contractor and Project ecologist.	Supervision of habitat tree removal by qualified ecologist; Trees soft-felled or sectionally dismantled; All hollows to be visually inspected as each habitat trees is placed on ground and area safe to enter. Fauna welfare managed in accordance with ethics licencing.	During clearing works
Felled trees left in situ before stockpiling to allow for any fauna to move on	Contractors and Project ecologist	Trees left for a minimum of one night after felling, stockpiled within clearing boundary	After felling of hollow-bearing and habitat trees, prior to stockpiling

Mitigation Measures	Responsibility	Action	Timing
Retention of hollow tree resource	Contractors and Project ecologist	Wherever possible retain hollow-bearing tree resources as directed by site ecologist for reuse as terrestrial habitat in northern conservation zoned area.	During clearing works.
Indirect Impacts			
Retained Vegetation			
Establish Tree Protection Zones (TPZ) around retained habitat trees on the boundary of the development area	Contractor in consultation with project ecologist	TPZ is to 12xDBH in accordance with Australian Standards AS4970-2009 No go zone signs Fencing to include high vis bunting and star pickets Note : where encroachment of TPZ is required, an arborist should be consulted to determine individual structural root zone (SRZ) setbacks.	Prior to construction
Limit inadvertent impacts on retained vegetation in E2 and E4 lands	Contractor in consultation with project ecologist	Establish temporary fencing along interface of retained vegetation and development that will restrict impacts on retained vegetation	Fence to be installed prior to construction of each stage
Weeds, disease and edge effects			
Develop a weed management protocol to be included in Construction Environment Management Plan (CEMP) for constructions period to limit degradation of interface of development and retained vegetation	Ecologist	Approved CEMP (Inc. weed management protocols) prior to construction of each stage	Prior to construction of each stage adjacent to retained vegetation
Equipment and vehicles entering Site are cleaned of foreign soil and seed prior to entering the site	Contractors	Best practice hygiene protocols followed, No visible foreign material, certification available upon request	Prior to machinery arriving on Site
Noise and light Impacts			
Limit construction works to daylight hours to reduce impacts from light and noise	Construction contractor	No construction works to occur from dusk till dawn, unless required by other authorities such as RMS for road construction activities related to John Renshaw Drive and intersection works.	During construction works
All machinery is correctly maintained and operator as per operation manual	Construction contractor	No excessive noise of machinery due to poor maintenance or faulty parts	During construction works

Mitigation Measures	Responsibility	Action	Timing
Vehicles/machinery to observe 20km/h speed limit on Site	Contractors	No excessive dust	For the duration of Site works
Usage of water carters in dry periods to limit dust movement.	Construction contractor	No excessive dust is to cover retained adjacent vegetation	During construction
Pest animal			
Pest animal protocol to control any increases in pest animal population that may impact retained vegetation	Pest Animal contractor	Protocol approved as part of CEMP approval	During construction
Construction Period			
Erosion and sediment controls enacted in accordance with construction environment management plan (CEMP) to limit impacts on retained vegetation or riparian zones	Construction Contractor	CEMP followed & modified as needed	Prior to commencement of works, for duration of Site works
Establish Speed limits during construction and operation of the proposed development	Project Manager and Contractor	Low speed limits set to minimise vehicle strikes in particular the entrance road that dissects the northern retained vegetation corridor,	Prior to construction
Development of a Vegetation Management Plan to limit impacts to water course proposed to be retained in the development site (assessed as lost), this is to include vegetation impacts, water quality and rehabilitation schedule associated with the realignment and improvement works.	Project ecologist	Approved VMP (DPI Water NRAR)	Prior to construction or as required within approval documentation.
Biodiversity Management (Operation Period)			
Development of Vegetation management Plan for retained vegetation in the north of the subject site	Project Ecologist	Development of Vegetation and Habitat Management Plan (VHMP) for the Management of biodiversity attributes within the site. VHMP is to include sections that address re-establishment of vegetation, weed control, on-going management, habitat augmentation and monitoring.	Approved by council prior to commencement of construction works

Mitigation Measures	Responsibility	Action	Timing
Re-establish vegetation on entrance road batters for future fauna movement	Project Ecologist	Development of VHMP (retained vegetation) with specifications that include: Tree re-establishment to decrease the distance between retained vegetation that in future will allow for arboreal movements across the entrance road (trees installation on batters must be approved by engineer). Vegetation re-establishment in accordance with appropriate PCT identified on site and proposed VHMP species list.	At the completion of entrance road construction
Establish periodically dry movement corridors within culverts to allow for terrestrial fauna movement	Civil contractor and Project Ecologist	During the design of under road culverts the establishment of terrestrial movement corridors should be considered to allow for terrestrial fauna movements from the west to the east through the culvert.	Included during the design of road culvert.
Evaluate the distance between canopies on either side of the entrance road to establish if post-clearing works would still allow for arboreal movements from west to east.	Project Ecologist	Determine the distance between appropriate trees and their canopy spread that would facilitate movement over the entrance road. If it is determined that the permanent distance following rehabilitation is greater than 35m, it is proposed to establish “fauna poles” for movement across the corridor. Rope ladders are not proposed. Specification should be in accordance with the RMS *Fauna Pole Specification* and an appropriate section included in the VHMP.	At the completion of the entrance road
Evaluate the number of hollows to be removed and ascertain an appropriate number of artificial hollows to install in northern vegetation	Project Ecologist	The project ecologist will determine the number of hollows to be replaced for hollow bearing trees and roosting structures based on an assessment of hollow bearing trees identified in the retained vegetation to the north. It is advised that hollow re-establishment should only occur in this vegetation if the current hollow density is low. Where possible repurposed hollows and logs from the development site should be utilised. Where this is not possible artificial nest boxes are to be used. A fauna habitat management section outlining hollow re-establishment will be included in the VHMP.	Assessment and VHMP to be approved prior to the commencement of clearing works.
Fauna exclusion from operational lands	Landowner	Fence between the development and retained vegetation will be a 2.4m (total height) chain mesh fence with a three-strand plain wire top or similar.	Installation at commencement of individual DA commencement.

12 Offset Requirements for Unavoidable Impacts

A summary of offset liabilities for the development of the Black Hill Industrial Estate on native vegetation are provided below:

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

- a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or
- 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
- 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.

12.1 Ecosystem Credits

Table 11 Ecosystem Credits

Vegetation Zone	PCT ID	Area (ha)	Vegetation Integrity Score (V.I)	Vegetation Integrity Score (V.I) loss	Ecosystem Credits Required
VZ1_1592_High	1592	22.13	67.3	0	745
VZ2_1592_Moderate	1592	29.07	49.7	0	722
VZ3_1592_Low Grassland	1592	2.63	14.9	0	N/A
VZ4_1592_Low	1592	17.53	45.4	0	398
VZ5_1592_Low_Scattered Trees	1592	1.5	12.7	0	N/A
VZ6_1584_High	1584	0.78	82.4	0	24

12.2 Species Credit

Based on assessment within this BDAR, no Species Credits are required.

12.3 Areas not requiring Offsets

There is 105.68ha of exotic pasture and non-indigenous native plantings, as well as 3.17 ha of managed roadside vegetation, that will be impacted by the proposal. As this vegetation does not align with native vegetation and therefore PCT determination, they do not require offsetting or further assessment.

12.4 Credit Summary

The following **Table 12** displays the required Biodiversity Offset Liability based on the BAM-Calculator, and **Figure 12** depicts offset requirements.

Table 12 Biodiversity Liability Credit Summary

Ecosystem Credits	Offset Credits required
PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	1,865
PCT 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	24

12.5 Staged Credit Retirement

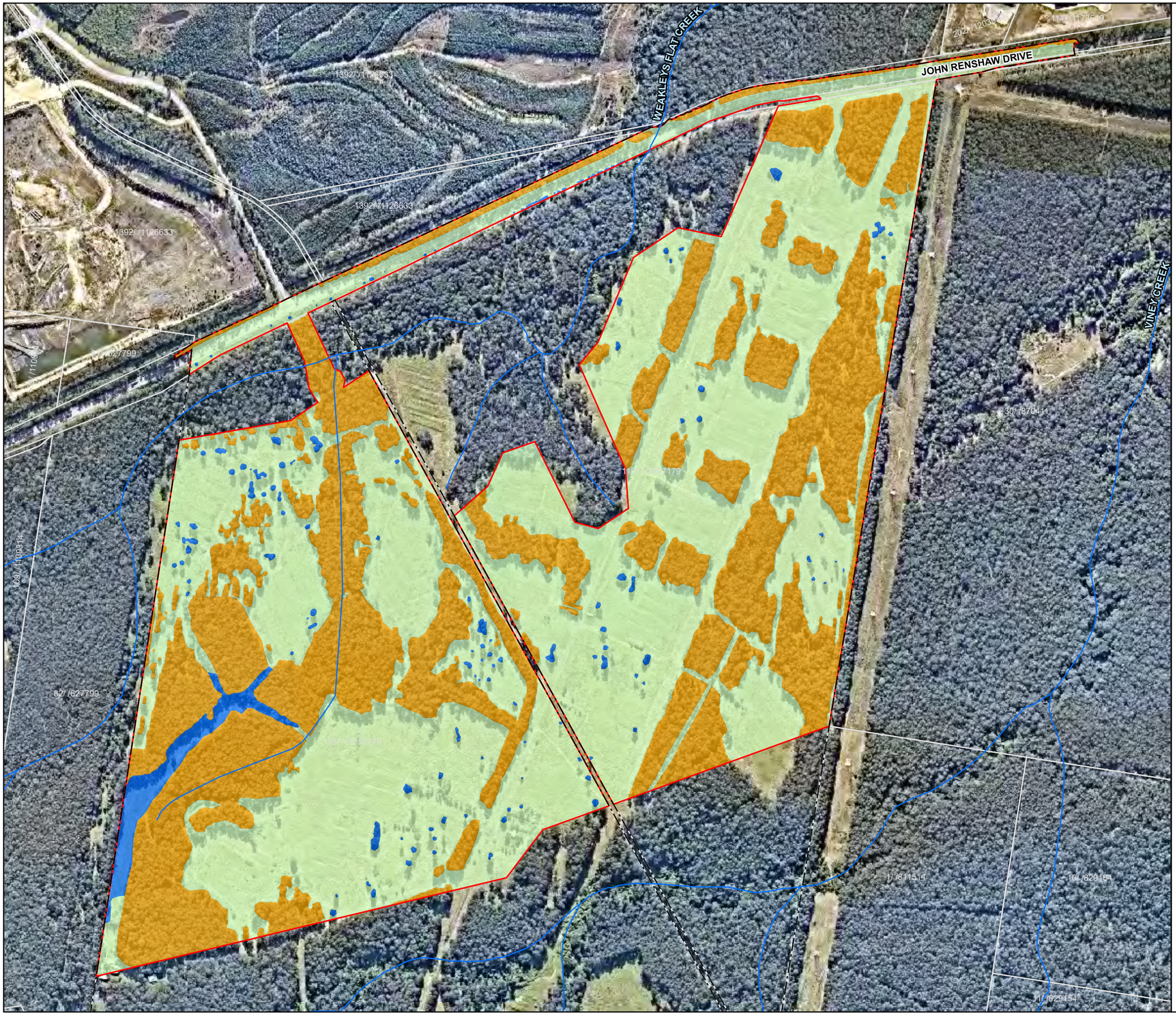
The development will be delivered in stages. It is proposed to stage the retirement of credits to achieve the required biodiversity credit liability, where the liability will be scheduled according to the Staging and Clearing Plan (**Appendix B**). The total number of credits to be retired for each stage of the development shall be pro rata based on a credit / ha (of impact) calculation.

To ensure sufficient credits are retired for each stage of development, credit liability has been rounded to the nearest whole number where credit totals are for a portion of a credit. Due to the rounding up of PCT 1592 credits per stage of development, there will be a shortfall of 1 credit if each stage is retired as per the above table. The last stage (Roadside JRD) of the development will require an additional credit to be retired to ensure the total biodiversity offset liability of 1865 credits for PCT1592 are retired (Refer **to Appendix B**).

The current method to retire credits for the proposal has not been determined and will be dependent on the availability of credits on the open market, viability of establishing a stewardship site in the locality or retirement of credits via payment into the Biodiversity Conservation Fund. It is likely that credit retirement will incorporate a combination of these options as the development is delivered.

BLACK HILL INDUSTRIAL DEVELOPMENT, BLACK HILL

FIGURE 12: OFFSET REQUIREMENTS



Legend

- Watercourse
- Subject Site
- Study Area
- Cadastral Boundaries
- Areas Not Requiring Assessment
- Impacts Not Requiring Offsets
- Impacts Requiring Offsets

N
W E
S

0 125 250 500

Meters

1:7,500

MJD Environmental

Aerial: Nearmap (2021) | Data: MJD Environmental, ADW Johnson (2021), LPI (2019) | Datum/Projection: GDA 1994 MGA Zone 56 | Date: 23/06/2021 | Version 2 | GIS\17032 - Lot 1131 DP 1057179 Black Hill Road, Black Hill\5. GIS | This plan should not be relied upon for critical design dimensions.

13 Conclusion

MJD Environmental has been engaged by Barr Property & Planning on behalf of Broaden Management Pty Ltd, to prepare a Biodiversity Development Assessment Report (BDAR) for the construction and operation of the Black Hill Industrial Estate. The BDAR has been prepared and finalised as of June 2019 with additional areas assessed in response to matters raised during Land and Environment Court Proceedings in June 2021. It should be noted that this additional assessment has been included herein however the initial lodgement is still current and therefore no alterations to amended legislation which has occurred within the interim has been made. This BDAR accompanied an Environmental Impact Statement (EIS) seeking consent for the industrial development over part Lot 1131 DP 1057179, Black Hill Rd, Black Hill NSW and the adjoining 2 km length of road corridor along John Renshaw Drive being the subject of this review.

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Biodiversity Assessment Methodology 2017 (BAM) was used as the assessment method, as the current assessment method at the time of lodgement (it has subsequently been superseded by BAM 2020). BAM 2017 was used to establish impacts on threatened species and threatened ecological communities in the locality under the *Biodiversity Conservation Act* 2016.

The proposed development site was part of a planning proposal that received gateway on 11th December 2012 and a Draft LEP was received on 12th December 2016 with gazettal occurring on the 13th April 2017. The planning proposal assessed a land zoning change from RU2 Rural Landscape to IN1 General Industrial and E2 Environmental Conservation. This planning proposal sought to provide opportunity to develop the previously disturbed study area environs for an industrial development whilst conserving higher value native vegetation via appropriate environmental zoning.

The current conditions on site are evidence of the past land uses. The previous use as a commercial poultry farm is evident in large areas of cleared exotic pasture where sheds were once located. Currently the site is continuing to be grazed limiting native vegetation to re-establish across the central area of the site.

Field Assessments carried out as part of the biodiversity assessment identified the following Plant Community Types (PCT):

- 72ha of varying condition PCT 1592: *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter* which is commensurate with the listed Endangered Ecological Community *Lower Hunter Spotted Gum Ironbark Forest of the Sydney Basin*; and
- 7,800m^2 of PCT 1584: *White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley*.

Targeted surveys for all flora and fauna candidate species recognised to have potential to occur within the subject site have been carried out by MJD Environmental (2018 & 2019) and have also utilised surveys undertaken by RPS (2017) as part of the works informing this BDAR.

The following threatened species were observed or recorded during survey works:

- Grey Crowned Babbler *Pomatostomus temporalis temporalis* (Ecosystem Credit Species)
- Grey-headed Flying Fox *Pteropus poliocephalus* was also observed flying over and foraging on blossom (Dual Credit species) no camp was observed on site; and
- Little Bentwing Bat (*Miniopterus australis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), both are dual Credit Species. The site was assessed as to have no maternity colonises present, so these species were accounted for as Ecosystem Credit Species.
- East-coast Freetail Bat (*Mormopterus norfolkensis*), Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (Ecosystem Credit Species).

- Large-eared Pied Bat (*Chalinolobus dwyeri*) is a species Credit Species, however detailed assessment has determined no breeding/ roosting habitat on site for this species;
- Masked Owl (*Tyto novaehollandiae*) (Dual Credit species), this species was not observed to be breeding in the subject site at the time survey thus has only been account for as an Ecosystem Credit Species.

Impact Avoidance & Mitigation

A package of avoidance and mitigation measures have been described in this BDAR associated with the project.

The subject site for development was selected due to the largely cleared or highly degraded lands as a result of past and present land use. All vegetation is to be removed within the subject site with the exception of the south to north reach of an ephemeral riparian corridor situated in the north-west of the site. The alignment will be subject to realigned in areas and rehabilitation as part of the staged development works. (Note: for the purposes of impact assessment, this vegetation has been considered as lost, thus adding to the overall biodiversity liability, notwithstanding that areas of the riparian corridor that are not realigned will be retained).

The current layout of the industrial area has been developed in response to the rezoning of the study area and no further avoidance and mitigation measures have been considered, as the approval granted at the time of rezoning considered the conservation outcomes for the site and the proposed land usage to be sufficient to allow for the rezoning to be approved

All measures have been incorporated into the design (avoidance) in the first instance with mitigation measures assessed for the construction and operational phases of the project.

Impact Analysis

The proposal will result in following impacts and required offsets as calculated using the BAM-C Calculator:

- 67.28ha of PCT 1592 requiring 1,865 ecosystem credits; and
- 0.78 ha of PCT 1584 requiring 24 ecosystem credits to offset the loss under the NSW Biodiversity Offsets Scheme

There is no requirement to offset:

- 4.14 ha of PCT 1592 that was assessed to have a Vegetation Integrity score <15:
- 105.24 ha of pasture; and
- 4,400m^2 of non-indigenous planting
- 3.17 ha of managed roadside vegetation

The development will be delivered in stages. It is proposed to stage the retirement of credits to achieve the required biodiversity credit liability, were the liability will be scheduled according the Staging and Clearing Plan. The total number of credits to be retired for each stage of the development shall be pro rata based on a credit / ha (of impact) calculation.

The current method to retire credits for the proposal has not been determined and will be dependent on the availability of credits on the open market, viability of establishing a stewardship site in the locality or retirement of credits via payment into the Biodiversity Conservation Fund. It is likely that credit retirement will incorporate a combination of these options as the development is delivered.

A preliminary assessment under the EPBC Act determined the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

14 Bibliography

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Appendix A Plan of Proposal

239590(1)-CENG-003(C)

LEGEND

- EXISTING LOT BOUNDARY
- SUBJECT LOT BOUNDARY
- 18 EXISTING SURFACE CONTOUR
- WATERCOURSE
- E2 ENVIRONMENTAL CONSERVATION ZONE
- VEGETATED RIPARIAN ZONE (VPZ) NOMINALLY 25 WIDE

CONTOUR INTERVAL = 0.5m

MGA

DIAL1100 BEFORE YOU DIG

Lot 1 D.P.957782
Lot 2 D.P.883324
Lot 82 D.P.627799
Lot 81 D.P.627799
Lot 119 D.P.1154904
Lot 2 D.P.123949
Lot 70 D.P.755260
Lot 684 D.P.619758
Lot 1 D.P.214493
Lot 685 D.P.619758
Lot 2 D.P.214493
Lot 1 D.P.1154371
Lot 21 D.P.1043285
Lot 10 D.P.837813
Lot 1 D.P.811514
Lot 30 D.P.870411
Lot 1392 D.P.1126633

RETAINING WALL CRIBLOCK OR SIMILAR

REFER TO SHEET 006 FOR CONCEPT INTERSECTION LAYOUT

JOHN RENSHAW DRIVE

REINFORCED CONCRETE BOX CULVERT

ROAD MC03

ROAD MC04

ROAD MC01

ROAD MC05

ROAD MC06

5 LOT SUBDIVISION SUBJECT TO DA 8/2018/101/1

ELECTRICAL EASEMENT TO BE RELOCATED

PROPOSED EASEMENT FOR ELECTRICAL SERVICES (30 WIDE)

LOT 119 D.P.1154904 (HWC)

REFER TO SHEET 008 FOR CONCEPT INTERSECTION LAYOUT

603	5.1Ha	602	4.1Ha	601	5.2Ha	506	5.3Ha
505	5.4Ha	504	5.3Ha	503	5.3Ha	303	6.2Ha
302	6.3Ha	307	1.2Ha	301	5.6Ha	604	5.7Ha
606	5.0Ha	404	5.0Ha	405	5.0Ha	406	5.0Ha
605	3.0Ha	502	3.0Ha	403	5.1Ha	401	4.9Ha
501	2.9Ha	306	3.1Ha	305	3.1Ha	304	4.2Ha
402	5.1Ha	701	40.8Ha	701	40.8Ha	207	8.4Ha
208	5.2Ha	104	4.6Ha	206	4.0Ha	203	2.6Ha
202	2.4Ha	103	2.4Ha	105	1.8Ha	106	2.2Ha
205	2.3Ha	204	2.5Ha	201	2.4Ha	102	2.4Ha
101	3.2Ha						

PLAN
SCALE 1:4000

PRELIMINARY ISSUE

REV.	DATE	AMENDMENT	DRAWN	CHECK	DESIGN	VERIFY
A	03.08.2018	INITIAL ISSUE	E.G.	R.K.	Z.J.	R.K.
B	10.08.2018	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	14.08.2018	AMENDMENTS PER INSTRUCTION	E.G.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

DESIGN FILE N:\239590\Design\12D\

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Fax: (02) 4978 5199
email: hunter@adwjohnson.com.au
www.adwjohnson.com.au
ABN 62 129 445 398

CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson
DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS
PLAN TITLE: PROPOSED SITE PLAN

PROJECT No.	DISCIPLINE	NUMBER	REV.
239590(1)	CENG	003	C

100mm AT FULL SIZE

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239590(1)-CENG-004(C)

Lot 1 D.P.957782
Lot 2 D.P.883324
Lot 82 D.P.627799
Lot 81 D.P.627799
Lot 119 D.P.1154904
Lot 2 D.P.123949
Lot 70 D.P.755260
Lot 684 D.P.619758
Lot 1392 D.P.1126633
Lot 1 D.P.214493
Lot 685 D.P.619758
Lot 2 D.P.214493
BLACKHILL ROAD
JOHN RENSHAW DRIVE
5 LOT SUBDIVISION SUBJECT TO DA 8/2018/101/1
Lot 1 D.P.1154371
Lot 21 D.P.1043285
Lot 10 D.P.837813
LOT 1119 D.P.1154904 (HWC)
Lot 1 D.P.811514
Lot 30 D.P.870411

603 5.1Ha
604 5.7Ha
1059 5.0Ha
404 5.0Ha
405 5.0Ha
406 5.0Ha
701
602 4.1Ha
601 5.2Ha
605 3.0Ha
506 5.3Ha
502 3.0Ha
401 4.9Ha
403 5.1Ha
505 5.4Ha
501 2.9Ha
504 5.3Ha
402 5.1Ha
503 5.3Ha
306 3.1Ha
305 3.1Ha
303 6.2Ha
304 4.2Ha
302 6.4Ha
307 1.2Ha
301 5.6Ha
701 40.85Ha
1079 8.4Ha
1080 5.2Ha
104 4.6Ha
105 1.8Ha
206 4.0Ha
203 2.6Ha
202 2.4Ha
103 2.4Ha
106 2.2Ha
205 2.3Ha
204 2.6Ha
201 2.4Ha
102 2.4Ha
101 3.3Ha

PROPOSED RIGHT OF ACCESS & EASEMENT FOR SERVICES (23 WIDE)
PROPOSED RIGHT OF ACCESS & EASEMENT FOR SERVICES (23 WIDE)
PROPOSED EASEMENT TO DRAIN WATER (10 WIDE)
ELECTRICAL EASEMENT TO BE RELOCATED
PROPOSED EASEMENT FOR ELECTRICAL SERVICES (30 WIDE)
SUBSTATION LOT
PROPOSED EASEMENT FOR ACCESS (6 WIDE)
PROPOSED EASEMENT FOR ELECTRICAL SERVICES (30 WIDE)
PROPOSED SUBDIVISION (BY OTHERS)

MGA

LEGEND

- EXISTING LOT BOUNDARY
- PROPOSED LOT BOUNDARY
- WATERCOURSE
- E2 ENVIRONMENTAL CONSERVATION ZONE

- STAGE 1 (6 LOTS)
- STAGE 2 (8 LOTS)
- STAGE 3 (6 LOTS)
- STAGE 4 (6 LOTS)
- STAGE 5 (6 LOTS)
- STAGE 6 (6 LOTS)
- E2 ENVIRONMENTAL CONSERVATION ZONE
- EXISTING EASEMENT
- PROPOSED RIGHT OF ACCESS AND EASEMENT FOR ACCESS TO CONSTRUCT ROAD DRAINAGE AND SERVICE INFRASTRUCTURE BENEFITING LOT 30 D.P.870411 UNT DEDICATION OF LAND AS PUBLIC ROAD

PLAN
SCALE 1:4000

PRELIMINARY ISSUE

100mm AT FULL SIZE

REV.	DATE	AMENDMENT	DRAWN	CHECK	DESIGN	VERIFY
A	03.08.2018	INITIAL ISSUE	E.G.	R.K.	Z.J.	R.K.
B	10.08.2018	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	14.08.2018	AMENDMENTS PER INSTRUCTION	E.G.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

DESIGN FILE N:\239590\Design\12D\

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ABN 62 129 445 398

CLIENT: F & F PROPERTIES

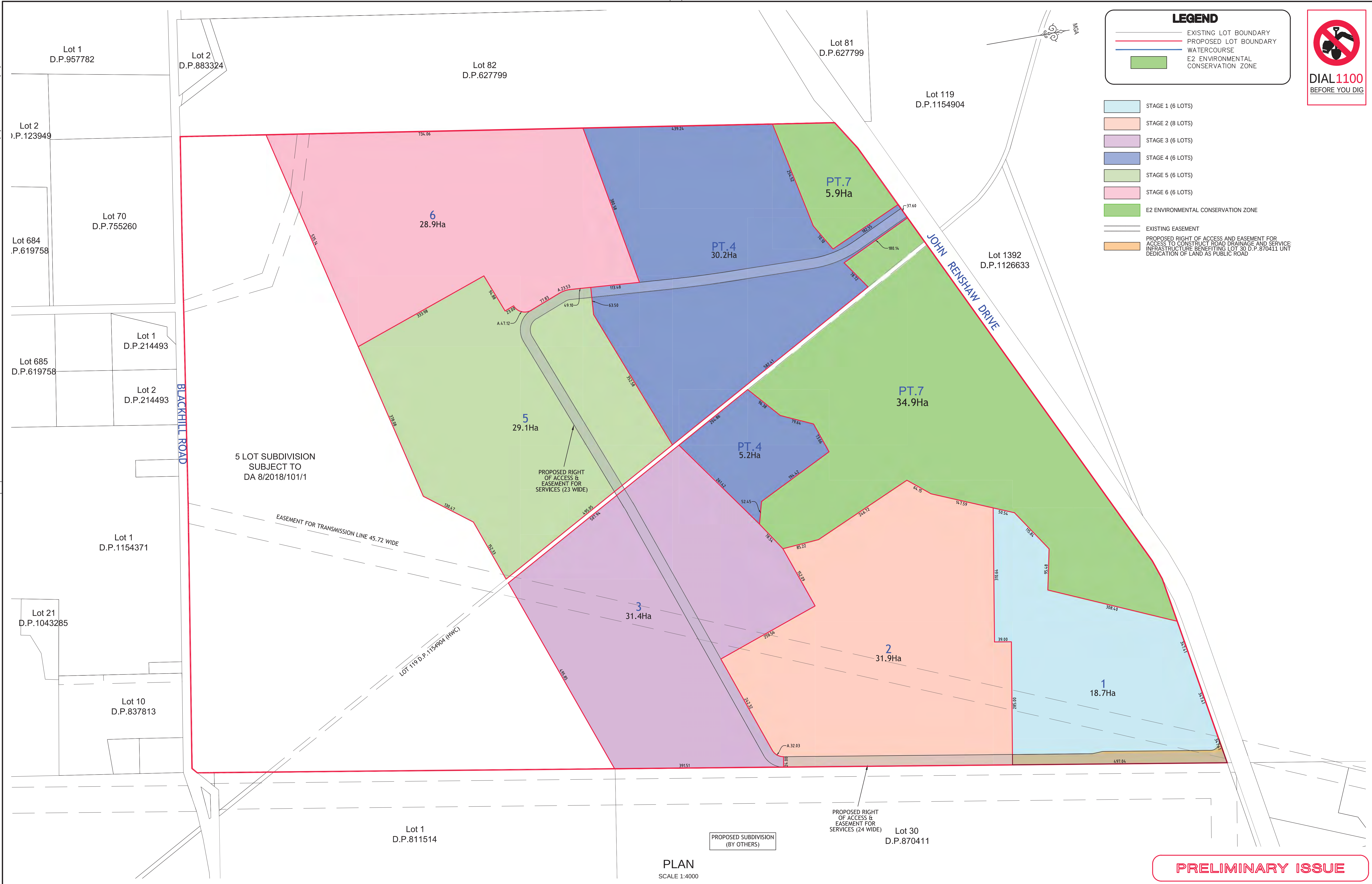
PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson
DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS
PLAN TITLE: STAGING PLAN

PROJECT No.	DISCIPLINE	NUMBER	REV.
239590(1)	CENG	004	C

Plotted By: elizabethg Plot Date: 14/08/18 – 17:01 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590(1)-CENG-004(C).dwg



239590(1)-CENG-005(C)
LEGEND
EXISTING LOT BOUNDARY
PROPOSED LOT BOUNDARY
WATERCOURSE
E2 ENVIRONMENTAL CONSERVATION ZONE
STAGE 1 (6 LOTS)
STAGE 2 (8 LOTS)
STAGE 3 (6 LOTS)
STAGE 4 (6 LOTS)
STAGE 5 (6 LOTS)
STAGE 6 (6 LOTS)
E2 ENVIRONMENTAL CONSERVATION ZONE
EXISTING EASEMENT
PROPOSED RIGHT OF ACCESS AND EASEMENT FOR ACCESS TO CONSTRUCT ROAD DRAINAGE AND SERVICE INFRASTRUCTURE BENEFITING LOT 30 D.P.870411 UNT DEDICATION OF LAND AS PUBLIC ROAD
DIAL 1100 BEFORE YOU DIG
MGA
Lot 1 D.P.957782
Lot 2 D.P.883324
Lot 82 D.P.627799
Lot 81 D.P.627799
Lot 119 D.P.1154904
Lot 2 D.P.123949
Lot 70 D.P.755260
Lot 684 D.P.619758
Lot 1 D.P.214493
Lot 685 D.P.619758
Lot 2 D.P.214493
Lot 1392 D.P.1126633
Lot 1 D.P.1154371
Lot 21 D.P.1043285
Lot 10 D.P.837813
Lot 1 D.P.811514
Lot 30 D.P.870411
BLACKHILL ROAD
JOHN RENSHAW DRIVE
6 28.9Ha
PT.4 30.2Ha
PT.7 5.9Ha
5 29.1Ha
PT.7 34.9Ha
PT.4 5.2Ha
3 31.4Ha
2 31.9Ha
1 18.7Ha
5 LOT SUBDIVISION SUBJECT TO DA 8/2018/101/1
PROPOSED RIGHT OF ACCESS & EASEMENT FOR SERVICES (23 WIDE)
PROPOSED RIGHT OF ACCESS & EASEMENT FOR SERVICES (24 WIDE)
EASEMENT FOR TRANSMISSION LINE 45.72 WIDE
LOT 119 D.P.1154904 (HWC)
PROPOSED SUBDIVISION (BY OTHERS)
PLAN
SCALE 1:4000
PRELIMINARY ISSUE
100mm AT FULL SIZE

REV.	DATE	AMENDMENT	DRAWN	CHECK	DESIGN	VERIFY
A	03.08.2018	INITIAL ISSUE	E.G.	R.K.	Z.J.	R.K.
B	10.08.2018	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
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www.adwjohnson.com.au
ABN 62 129 445 398

CLIENT
F & F PROPERTIES

PROPERTY DESCRIPTION
BLACK HILL
INDUSTRIAL SUBDIVISION
LOT 1131 D.P.1057179
JOHN RENSHAW DRIVE, BLACK HILL
DEVELOPMENT APPLICATION

SURVEYED ADW Johnson
DATUM A.H.D.

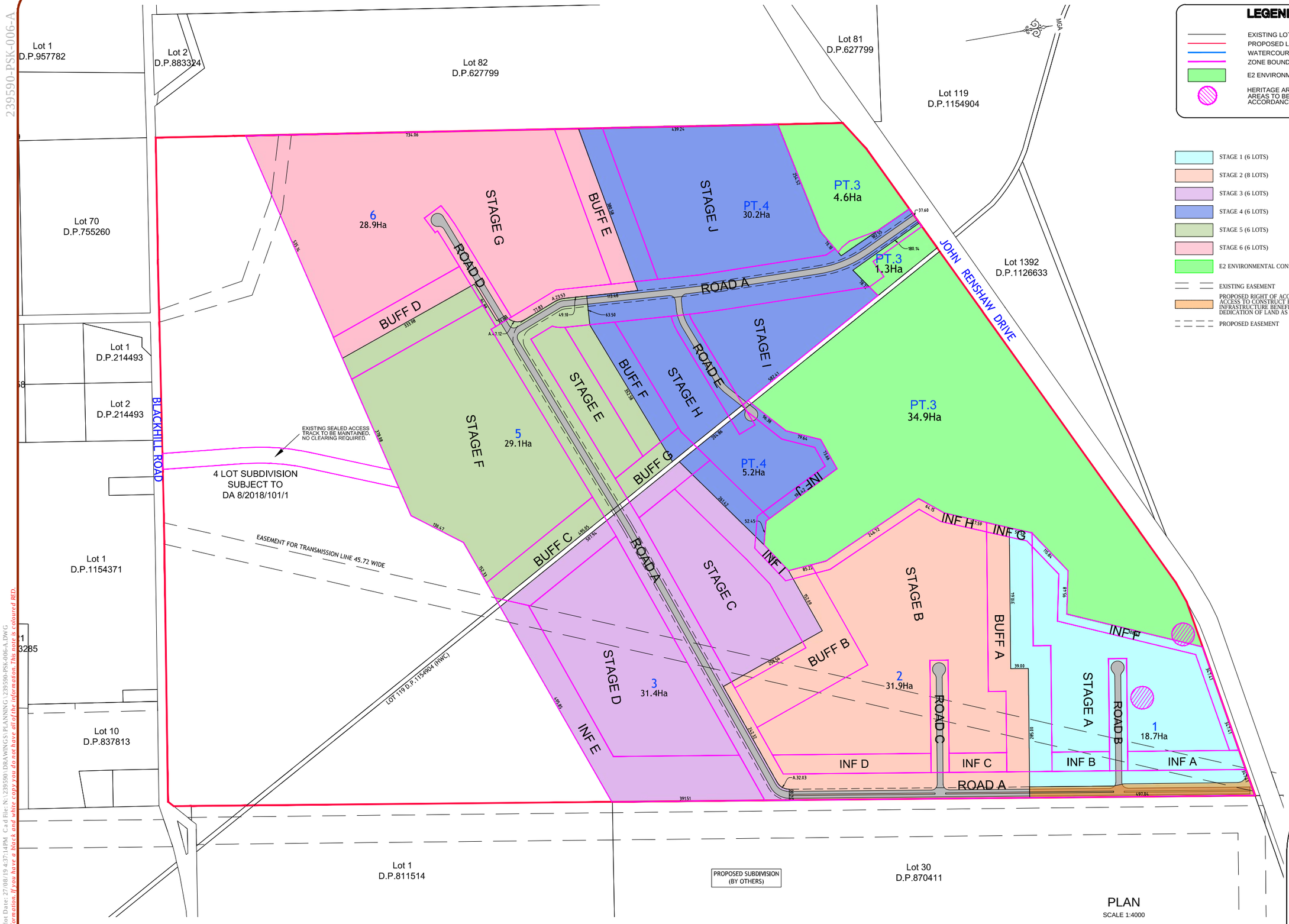
PROJECT
BLACK HILL CONCEPT PLANS

PLAN TITLE
SUBDIVISION PLAN

PROJECT No. 239590(1) – DISCIPLINE CENG – NUMBER 005 REV. C

Plotted By: elizabethg Plot Date: 14/08/18 – 17:01 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590(1)-CENG-005(C).dwg

Appendix B Staging and Clearing Plan and Staged Credit Retirement



LEGEND

- EXISTING LOT BOUNDARY
- PROPOSED LOT BOUNDARY
- WATERCOURSE
- ZONE BOUNDARY
- E2 ENVIRONMENTAL CONSERVATION ZONE
- HERITAGE ARTEFACT. CLEARING IN THESE AREAS TO BE CARRIED OUT IN ACCORDANCE WITH AN APPROVED AHIP

- STAGE 1 (6 LOTS)
- STAGE 2 (8 LOTS)
- STAGE 3 (6 LOTS)
- STAGE 4 (6 LOTS)
- STAGE 5 (6 LOTS)
- STAGE 6 (6 LOTS)
- E2 ENVIRONMENTAL CONSERVATION ZONE
- EXISTING EASEMENT
- PROPOSED RIGHT OF ACCESS AND EASEMENT FOR ACCESS TO CONSTRUCT ROAD DRAINAGE AND SERVICE INFRASTRUCTURE BENEFITING LOT 30 D.P.870411 UNT DEDICATION OF LAND AS PUBLIC ROAD
- PROPOSED EASEMENT

PLAN
SCALE 1:4000

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
A	27/08/19	INITIAL ISSUE	RC	RK	DATUM: N/A CONTOUR INTERVAL: N/A	0 100 200m SCALE: 1:4000 (FULL)	

drawing title: Zones shown on Current Stage Boundaries

location: John Renshaw Drive, Black Hill

council: Newcastle

dwg ref: 239590-PSK-006-A

client: F & F PROPERTIES

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PCT 1592			
Proposed Clearing	**Total Clearing Area (ha)**	**Total Credit req'd to retire (**	**Total Credit req'd to retire (Rnd)**
Road A	20.94	218.42	218
Road B	0.99	10.33	10
Road C	0.99	10.33	10
Road D	1.18	12.31	12
Road E	1.17	12.20	12
Inf A	1.07	11.16	11
Inf B	0.54	5.63	6
Inf C	0.54	5.63	6
Inf D	1.43	14.92	15
Inf E	5.5	57.37	57
Inf F	1.49	15.54	16
Inf G	0.21	2.19	2
Inf H	0.87	9.07	9
Inf I	0.45	4.69	5
Inf J	0.85	8.87	9
Buff A	5.55	57.89	58
Buff B	6.46	67.38	67
Buff C	2.83	29.52	30
Buff D	3.26	34.00	34
Buff E	3.6	37.55	38
Buff F	3.02	31.50	32
Buff G	1.89	19.71	20
Stage A	8.97	93.56	94
Stage B	17.57	183.27	183
Stage C	6.85	71.45	71
Stage D	11.36	118.49	118
Stage E	2.72	28.37	28
Stage F	17.08	178.16	178
Stage G	23.8	248.25	248
Stage H	6.22	64.88	65
Stage I	4.83	50.38	50
Stage J	12.34	128.71	129
Roadside (JRD)	2.23	23.26035	24
Total	**181.97**		**1865**

PCT 1584			
Proposed Clearing	**Total Clearing Area (ha)**	**Total Credit**	**Total Credit (Rnd Up)**
Road A	0.78	24	24
Total	**0.78**	**24**	**24**

*Road A totals 20.94ha. Credits to be retired for the construction of Road A has been divided into the two PCTs as Road A has all the required PCT 1584 credits (24) to be retired.

** Due to the rounding up of PCT 1592 credits per stage of development, there will be a shortfall of 1 credit if each stage is retired as per the above table. The last stage (Roadside JRD) of the development will require an additional credit to be retired to ensure the total biodiversity offset liability of 1865 credits for PCT1592 are retired.

Appendix C BAM Plot Data

Plot Info							Composition							Structure						Function										
Plot	PCT	Condition Class	Zone	Easting	Northing	Bearing	Tree	Shrub	Grass	Forbs	Ferns	Other	Tree	Shrub	Grass	Forbs	Ferns	Other	Lge Tree	Hollows	Litter Cover	Logs	Tree Stem 5-10	Tree stem 10 - 20	Tree Stem 20 to 30	Tree Stem 30 to 50	Tree Stem 50 to 80	Tree Regen	H.T.E
B01	1592	1592_High	56	370865	6368063	5	8	5	15	7	1	2	71.1	3.7	49.3	2.4	1.0	0.2	0	1	59.0	40.0	1	1	1	1	1	0	3.0
B02	1592	1592_Mod	56	370885	6367617	170	4	2	7	8	1	5	52.0	2.0	8.8	5.7	0.5	0.6	0	0	87.0	6.0	1	1	1	1	1	1	12.1
B03	1592	1592_Low_Native_Canopy	56	370488	6367748	190	2	2	8	5	0	1	20.0	5.5	33.9	3.3	0.0	0.1	1	0	27.0	19.0	1	1	1	1	1	1	43.2
B04	1592	1592_Low_Native_Canopy	56	370493	6367184	295	2	1	5	7	0	2	35.0	0.1	15.5	1.6	0.0	0.2	0	0	56.0	7.0	1	1	1	1	1	1	41.8
B05	1592	1592_High	56	369438	6366388	330	3	4	12	15	1	10	30.1	0.5	11.3	6.2	0.1	1.5	0	0	69.0	26.0	1	1	1	1	1	1	15.3
B06	1592	1592_High	56	369380	6366855	30	3	4	14	10	1	4	45.0	3.8	13.5	3.4	0.1	0.4	1	0	66.0	36.0	1	1	1	1	1	1	0.9
B07	1592	1592_High	56	369426	6366768	120	4	4	12	11	1	7	45.0	5.4	12.1	3.2	0.1	0.7	0	0	67.0	43.0	1	1	1	1	0	1	6.1
B08	1592	1592_Low_Grassland	56	369510	6366895	220	1	3	13	11	1	2	0.1	0.3	13.0	1.4	0.1	0.2	0	0	17.0	0.0	0	0	0	0	0	0	0.4
B09	1592	1592_Mod	56	369534	6366814	130	4	3	11	11	1	4	45.0	5.2	4.2	1.1	0.1	0.5	0	0	88.6	29.0	1	1	1	1	0	1	0.2
B10	1592	1592_High	56	369477	6367031	310	2	4	15	11	0	4	50.0	2.4	13.9	3.1	0.0	0.8	1	1	76.0	53.0	1	1	1	1	1	0	1.4
B11	1592	1592_Low_Native_Canopy	56	369533	6367192	250	2	0	5	7	0	1	55.0	0.0	9.1	0.7	0.0	0.1	0	0	50.0	24.0	1	1	1	1	1	1	61.8
B12	1592	1592_Mod	56	369699	6367259	340	2	1	7	11	0	1	35.0	0.1	20.5	1.3	0.0	0.1	0	0	39.0	18.0	1	1	1	1	1	0	30.2
B13	1592	1592_Mod	56	369739	6367077	170	3	1	10	11	0	3	36.0	0.1	14.2	3.2	0.0	0.4	0	0	69.0	31.0	0	1	1	1	1	0	10.4
B14	1592	1592_Mod	56	369796	6366949	355	2	2	8	12	0	1	50.0	0.3	37.4	1.4	0.0	0.1	0	0	67.0	17.0	0	1	1	1	1	0	10.6
B15	1592	1592_Low_Native_Canopy	56	370107	6367235	110	3	1	4	8	0	1	27.1	1.0	35.2	1.4	0.0	0.1	0	0	68.0	16.0	0	1	1	1	0	0	50.5
B16	1592	1592_Low_Grassland	56	369264	6366496	355	1	0	11	5	1	0	0.1	0.0	14.5	0.9	0.1	0.1	0	0	15.0	0.0	0	0	0	0	0	0	15.9
B17	1589	1589_high	56	369703	6367575	305	6	4	9	15	1	9	66.5	11.3	82.6	7.9	0.5	2.7	1	1	29	11	1	1	1	1	1	1	36
B18	1592	1592_High	56	370680	6368123	80	3	4	16	11	1	4	40.0	0.9	70.3	1.5	0.1	0.4	0	0	67.0	42.0	1	1	1	1	0	0	1.9
B19	1592	1592_Low_Native_Canopy	56	370671	6367606	290	3	2	5	8	0	3	45.1	0.2	20.7	1.1	0.0	0.5	0	0	61.0	19.0	0	1	1	1	0	0	10.9
B20	1592	1592_Mod	56	370750	6366993	110	6	1	15	16	1	5	36.2	0.1	17.8	13.6	0.1	1.3	1	0	57.0	14.0	1	1	1	1	0	0	30.5
B21	1592	1592_High	56	370458	6366717	15	7	6	8	16	0	9	67.2	1.9	2.1	7.8	0.0	3.5	1	2	64.0	45.0	1	1	1	1	1	1	55.1
B22	1592	1592_low	56	370259	6366741	20	2	0	1	2	0	0	35.0	0.0	10.0	0.3	0.0	0.0	1	1	1.2	11.0	0	0	0	0	1	0	90.0
B23	1592	1592_High	56	369584	6367724	240	8	12	10	4	2	5	42.6	63.5	80.5	5.7	6.0	1.0	1	1	48.0	4.0	1	1	1	1	1	1	16.6
B101	1592	1592_High	56	370654	6368211.0	270	4	8	12	6	0	7	42.1	1.9	23.1	0.6	0.0	1.7	0	0	94.0	13.0	1	1	1	1	1	1	0.2

Family	Scientific Name	Common Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B101
Acanthaceae	*Brunoniella australis*	Blue Trumpet	X				X	X	X	X	X	X			X				X	X		X	X			X
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower																	X			X				
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed													X	X										
Anthericaceae	*Caesia parviflora*	Pale Grass-lily		X			X	X	X	X	X	X		X	X	X			X			X	X			
Apocynaceae	*Parsonsia straminea*	Common Silk Pod		X		X	X		X		X	X							X							X
Apocynaceae	*Tylophora barbata*	Bearded Tylophora																	X							
Araliaceae	*Polyscias sambucifolia* Subsp. *sambucifolia*	Elderberry Panax																							X	
Asphodelaceae	*Geitonoplesium cymosum*	Scrambling Lilly					X												X				X			
Asteraceae	*Bidens pilosa**	Cobblers Pegs													X										X	
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy					X		X														X			
Asteraceae	*Cassinia uncata*									X		X								X					X	
Asteraceae	*Chrysocephalm apiculatum*	Common Everlasting								X								X								
Asteraceae	*Conyza* spp.	Fleabane										X	X	X											X	
Asteraceae	*Cotula australis*	Common Cotula												X										X		
Asteraceae	*Cotula* spp.*																X	X		X	X	X				
Asteraceae	*Cirsium vulgare**	Spear Thistle											X									X		X		
Asteraceae	*Euchiton involucratus*	Star Cudweed							X			X						X								
Asteraceae	*Hypochaeris glabra**	Smooth Catsear													X											
Asteraceae	*Hypochaeris radicata**	Cats Ears	X						X	X			X	X	X	X	X	X	X	X	X		X	X	X	X
Asteraceae	*Senecio madagascariensis**	Fireweed				X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		
Asteraceae	*Senecio* spp.			X	X	X															X					
Asteraceae	*Sigesbeckia orientalis*	Indian-weed																	X				X			
Asteraceae	*Solenogyne bellioides*		X				X				X												X			
Asteraceae	*Sonchus* spp.				X								X				X									
Asteraceae	*Ozothamnus diosmifolius*																									X
Asteraceae	*Vernonia cinerea var. cinerea*		X	X			X	X	X			X							X	X			X			
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine		X			X	X	X			X							X		X		X			
Boriginaceae	*Heliotropium amplexicaule**	Blue Heliotrope											X					X								
Brassicaceae	*Cardamine* spp.												X		X											
Brassicaceae	*Lepidium bonariense*												X													
Cactaceae	*Opuntia* spp.*																X									
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell																				X				
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell								X					X	X				X						
Caryophyllaceae	*Paronychia brasiliana**	Chilean Whitlow Wort											X	X	X		X									
Casuarinaceae	*Allocasuarina littoralis*	Black She Oak																							X	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak													X											
Celastraceae	*Denhamia silvestris*	Narrow-leaved Orangebark					X		X										X		X		X			
Chenopodiaceae	*Altriplex semibaccata*	Creeping Saltbush														X										
Chenopodiaceae	*Einadia hastata*	Berry Saltbush		X	X	X	X	X			X		X	X		X	X			X	X	X	X			
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush				X						X	X									X				
Chenopodiaceae	*Einadia trigonos*	Fishweed														X	X				X		X			
Commelinaceae	*Murdannia graminea*	Grass Lily		X																						

Family	Scientific Name	Common Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B10 1
Convolvulaceae	*Commelina cyanea*	Commelina		X	X	X						X	X	X	X	X	X		X	X	X	X	X			
Convolvulaceae	*Dichondra repens*	Kidney Weed		X			X							X	X	X			X			X	X			
Cyperaceae	*Cyperus eragrostis**	Dirty Dora								X		X			X	X										
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X			
Cyperaceae	*Cyperus* spp.																			X						
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	X				X	X	X					X	X					X						
Cyperaceae	*Gahnia clarkei*																									X
Cyperaceae	*Lepidosperma laterale*						X	X												X					X	
Cyperaceae	*Ptilothrix deusta*		X																	X						
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower																	X						X	
Dioscoreaceae	*Dioscorea transversa*	Native Yam																	X							
Ericaceae	*Leucopogon juniperites*							X																		
Ericaceae	*Lissanthe strigosa subsp. subulata*	Peach Heath																								X
Euphorbiaceae	*Euphorbia* spp.*																					X				
Fabaceae	*Acacia elongata*	Swamp Wattle	X					X				X											X		X	X
Fabaceae	*Acacia falcata*	Hickory Wood																		X					X	X
Fabaceae	*Acacia fimbriata*	Fringed Wattle					X		X		X	X				X										
Fabaceae	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle																							X	
Fabaceae	*Acacia ulicifolia*	Prickly Moses																							X	
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea																		X					X	X
Fabaceae	*Desmodium rhytidophyllum*																		X							
Fabaceae	*Desmodium varians*			X			X		X		X				X				X		X	X	X			
Fabaceae	*Dillwynia retorta*									X	X															
Fabaceae	*Glycine clandestina*	Glycine						X	X	X		X	X		X				X	X	X	X	X		X	
Fabaceae	*Glycine microphylla*						X													X						
Fabaceae	*Glycine tabacina*			X	X	X	X	X	X	X				X		X						X				X
Fabaceae	*Hardenbergia violacea*	False Sarsaparilla	X	X			X	X	X		X	X					X		X	X		X	X		X	X
Fabaceae	*Indigofera australis*	Australian indigo							X						X							X	X			
Fabaceae	*Kennedia prostrata*	Running Postman	X								X											X				
Fabaceae	*Pultenaea euchila*	Orange Pultenaea																		X						
Fabaceae	*Pultenaea paleacea*	Chaffy Bush-pea	X																							
Fabaceae	*Pultenaea spinosa*	Spiny-bush Pea						X																		
Fabaceae	*Pultenaea spp.*																									X
Fabaceae	*Trifolium repens*	White Clover												X												
Geraniaceae	*Geranium homeanum*													X	X				X							
Goodeniaceae	*Goodenia hederacea*	Forest Goodenia					X			X	X	X								X						X
Goodeniaceae	*Goodenia heterophylla Subsp.heterophylla*	Variable-leaved Goodenia						X			X															
Haloragaceae	*Gonocarpus tetragynus*									X															X	
Haloragaceae	*Gonocarpus teucrioides*	Raspwort	X																							
Hypericaceae	*Hypericum gramineum*	Small St John's Wort								X																
Juncaceae	*Juncus homalocaulis*														X			X								
Juncaceae	*Juncus usitatus*						X	X		X		X		X	X				X	X		X		X		

Family	Scientific Name	Common Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B101
Lamiaceae	*Plectranthus parviflorus*	Cockspur flower		X			X		X						X	X			X		X	X	X			
Lauraceae	*Cassytha glabella*																									X
Lauraceae	*Cassytha pubescens*						X																			
Lobeliaceae	*Pratia purpurascens*	Whiteroot	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Lomandraceae	*Lomandra confertifolia*							X	X		X	X										X	X			
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*		X				X		X						X	X										
Lomandraceae	*Lomandra filiformis subsp. filiformis*	Wattle Mat-rush	X	X					X	X	X	X	X		X	X	X		X	X		X	X			
Lomandraceae	*Lomandra fluviatilis*	River Mat-rush																								X
Lomandraceae	*Lomandra glauca*		X																	X						X
Lomandraceae	*Lomandra gracilis*																									X
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat Rush																							X	X
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat Rush	X	X	X	X	X	X	X	X	X	X				X		X		X	X					
Lomandraceae	*Lomandra obliqua*																									X
Lomandraceae	*Lomandra* spp.									X																
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry					X											X	X				X		X	X
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow											X	X	X							X				
Malvaceae	*Sida corrugata*	Corrugated sida			X																					
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	X	X	X		X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Menispermaceae	*Stephania japonica var. discolor*	Snake Vine																	X							
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine																					X			
Myrtaceae	*Angophora costata*	Smooth Bark Apple																							X	
Myrtaceae	*Corymbia gummifera*	Bloodwood	X																							
Myrtaceae	*Corymbia maculata*	spotted gum	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany						X	X										X			X	X			
Myrtaceae	*Eucalyptus fibrosa*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Myrtaceae	*Eucalyptus globoidea*	White Stringybark																							X	
Myrtaceae	*Eucalyptus moluccana*	Grey Box																					X	X		
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark		X							X								X			X	X			
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint							X																	
Myrtaceae	*Eucalyptus punctata*																						X		X	
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark		X																						
Myrtaceae	*Eucalyptus sparsifolia*	Narrow-leaved Stringybark	X								X									X						
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum																	X							
Myrtaceae	*Leptospermum polygalifolium*	Tantoon																							X	
Myrtaceae	*Melaleuca nodosa*	Ball Honey myrtle			X												X									
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Paperbark																	X							
Myrtaceae	*Syncarpia glomulifera*	Turpentine	X																							
Oleaceae	*Notelaea longifolia f. longifolia*	Large Mock-olive															X		X		X	X			X	
Oleaceae	*Notelaea ovata*								X																	
Orchidaceae	*Acianthus caudatus*																									X
Orchidaceae	*Pterostylis* sp.	Greenhood									X															
Oxalidaceae	*Oxalis perrenans*		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Family	Scientific Name	Common Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B101
Passifloraceae	*Passiflora herbertiana*	Native Passionfruit																		X						
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax-lily					X												X						X	
Phormiaceae	*Dianella revoluta*		X					X		X	X											X				X
Phyllanthaceae	*Breynia oblongifolia*	Coffee bush																	X						X	X
Phyllanthaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree	X																						X	X
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme spurge																					X			
Pittosporaceae	*Billardiera scandens var.scadens*	Apple Berry dumpling																							X	X
Pittosporaceae	*Bursaria spinosa*	Blackthorn	X		X	X	X	X	X	X	X	X		X					X		X		X			X
Pittosporaceae	*Pittosporum revolutum*	Rough Pittosporum																		X						
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongue	X	X	X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell										X	X	X		X	X		X	X						
Poaceae	*Andropogon virginicus*	Whisky Grass																							X	
Poaceae	*Arrhenatherum elatius**	False Oatgrass																								X
Poaceae	*Aristida vagans*	Threeawn Speargrass	X					X	X	X	X	X						X		X		X			X	X
Poaceae	*Axonopus fissifolius**	Carpet Grass	X	X			X	X				X		X	X			X	X	X	X	X	X			
Poaceae	*Bothriochloa macra*	Red Grass																X				X				
Poaceae	*Cenchrus clandestinus**	Kikuyu			X	X				X		X	X		X		X	X		X	X			X		
Poaceae	*Chloris gayana**																								X	
Poaceae	*Cortaderia selloana*	Pampas Grass																							X	
Poaceae	*Cynodon dactylon*	Couch Grass			X	X				X			X	X	X		X	X			X	X		X		
Poaceae	*Dichanthium* spp.						X																			
Poaceae	*Dichelachne* spp.		X															X				X				
Poaceae	*Digitaria parviflora*	Small flower Fingergrass	X				X					X											X		X	
Poaceae	*Echinopogon caespitosus*	Hedgehog- grass	X					X	X			X							X	X						
Poaceae	*Ehrharta erecta*	Panic Veldtgrass		X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X			
Poaceae	*Entolasia marginata*	Wiry Panic																	X						X	
Poaceae	*Entolasia stricta*	Wiry Panic	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X		X		X	X
Poaceae	*Eragrostis brownii*	Brown's Lovegrass						X			X							X								
Poaceae	*Eragrostis elongata*	Clustered Lovegrass																X								
Poaceae	*Eriochloa* spp.					X																				
Poaceae	*Imperata cylindrica*	Bladey Grass							X													X			X	
Poaceae	*Microlaena stipoides*	Weeping Grass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Poaceae	*Oplismenus aemulus*	Australian Basket Grass					X							X	X				X			X	X			
Poaceae	*Oplismenus imbecillis*	Basket Grass			X										X											
Poaceae	*Panicum effusum*	Hairy Panic			X																					
Poaceae	*Panicum maximum**	Guinea grass				X																				
Poaceae	*Panicum simile*	Two-colour Panic	X		X					X		X								X		X			X	X
Poaceae	*Paspalidium* distans			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Poaceae	*Paspalum dilatatum**	Paspalum		X			X			X	X		X				X	X	X	X		X			X	
Poaceae	*Poa affinis*									X	X	X						X								
Poaceae	*Poa labillardierei var. labillardierei*	Tussock grass																								X

Family	Scientific Name	Common Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B101
Poaceae	*Poa sieberiana*																					X				
Poaceae	*Rytidosperma pallidum*	Red anther Wallaby Grass						X		X	X	X													X	
Poaceae	*Rytidosperma tenuius*																									
Poaceae	*Setaria parviflora**	Pigeon grass												X	X	X		X				X				
Poaceae	*Setaria pumila**	Pale Pigeon Grass																								X
Poaceae	*Sporobolus africanus*	Parramatta Grass	X	X	X	X				X			X	X			X	X		X		X	X	X		
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass																	X							
Poaceae	*Themeda triandra*	Kangaroo Grass	X	X				X	X	X	X	X						X		X		X			X	X
Polygonaceae	*Rumex* spp.																					X				
Portulacaceae	*Portulaca* spp.*					X															X					
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel																						X		
Proteaceae	*Banksia spinosa*	Hairpin Banksia																							X	
Proteaceae	*Hakea sericea*	Needle Bush	X																							
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung																							X	
Pteridaceae	*Adiantum aethiopicum*	Common Maiden hair																	X						X	
Pteridaceae	*Cheilanthes sieberi*	Rock fern	X	X				X	X	X	X							X		X		X			X	X
Pteridaceae	*Pellaea falcata*	Sickle fern					X																			
Ranunculaceae	*Clematis aristata*	Old Man'Beard					X																X			
Ranunculaceae	*Clematis glycinoides*																									X
Rhamnaceae	*Alphitonia excelsa*	Red Ash					X															X	X			X
Rubiaceae	*Opercularia diphylla*						X	X	X	X	X							X				X	X			X
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo																					X			
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush																							X	
Solanaceae	*Cestrum parqui**	Green Cestrum			X	X															X					
Solanaceae	*Solanum nigrum**	Blackberry Nightshade				X							X	X							X	X	X			
Solanaceae	*Solanum prinophyllum*	Forest Nightshade			X	X	X	X	X			X	X		X	X	X		X	X	X	X	X			
Solanaceae	*Solanum pseudocapsicum**	Madeira Winter													X								X			
Solanaceae	*Solanum stelligerum*			X			X																X			
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower	X																							
Verbenaceae	*Lantana camara**	Lantana	X	X	X	X	X	X	X			X	X			X			X	X		X	X		X	X
Verbenaceae	*Verbena bonariensis**	Purple Top												X								X				X
Violaceae	*Viola bentonicifolia*	Native Violet							X																	
Violaceae	*Viola hederacea*	Ivy-leaved Violet																				X	X			
Vitaceae	*Cayratia clematidea*	Native Grape					X		X						X								X			

*Exotic species

Appendix D BAM Plot Sheets

Appendix C is inclusive of B101 conducted in 2021. No paper data sheets were used in the field.

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form — Site Sheet no: 2

		Survey Name	Zone ID	Recorders			
Date	20 6 18.	Black Hill ind	V21.	A Cavallaro & P. Smith			
Zone 56	Datum GDA94	Plot ID	BO1	Plot dimensions	20×20	Photo #	✓100 – 0039
Easting 0370865	Northing 6366063	IBRA region	Sydney Basin	Midline bearing from 0 m	5°		
Vegetation Class		Hunter - Macleay Dry Sclerophyll forest				Confidence: (H) M L	
Plant Community Type		1592 - Spotted Gum - Red Ironbark - Grey gum shrub - grass open		EEC: Yes		Confidence: (H) M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	8
	Shrubs	5
	Grasses etc.	15
	Forbs	7
	Ferns	1
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	71.1
	Shrubs	3.7
	Grasses etc.	49.3
	Forbs	2.4
	Ferns	1
	Other	0.2
High Threat Weed cover		3

BAM Attribute (1000 m² plot) DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	III (3)	I (1)
30 – 49 cm	ⅡⅡ ⅡⅡ III (13)	
20 – 29 cm	ⅡⅡ ⅡⅡ ⅡⅡ (15)	
10 – 19 cm	ⅡⅡ ⅡⅡ ⅡⅡ I (16)	
5 – 9 cm	ⅡⅡ ⅡⅡII (12)	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	ⅡⅡ ⅡⅡ ⅡⅡ ⅡⅡ ⅡⅡ ⅡⅡ ⅡⅡ ⅡⅡ (40)	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	50	70	40	40	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	59					0					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			underscrubbing, few midstorey, young canopy
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			light grazing (cattle) compare to others: i- comparison to natives
Fire damage			
Storm damage			
Weediness			low weeds compared to others. (3+4)
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 20 06 18	Blackhill Ind	Bol (267)	AC & PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata	N	15.	2	T	
TG	Eucalyptus tereticornis	N	10.	2	T	
TG	Corymbia gummifera.	N	10.	1	T	
TG	Syncarpia glomulifera.	N	5	3	T	
TG	Allocasuarina torulosa	N	1	2	Tree	
TG	Microlaena stipoides.	N	30	500	Grass	
GG	Entolasia stricta.	N	40.	500	Grass	
EG	Cheilanthes sieberi	N	1	100.	Fern	
FG	Oxalis perennans	N	0.1	3	Forb	
	~~Exo~~ Axonopus fissifolius	HTE	2.	50.	G	
GG	Pilothrix desta.	N	0.5	10.	Sedge	
GG	Fimbristylis dichotoma	N	0.5	10.	Sedge	
GG	Digitaria parviflora	N	2	50.	Grass	
SG	Pimelea linearifolia.	N	0.1	2.	Shrub	
SG	~~Exo~~ Euphorbia peplus	N	0.1	2		
GG	Lomandra ~~sp~~. filiformis sub filiformis	N	0.5	2		
GG	Themeda triandra	N	0.5	10.		
FG	Platia purpurascens	N	0.1	100.		
	Hypochaeris radicata	E	0.1	10.		
FG	~~Exo~~ Verbena cinerea	N	0.5	20.		
FG	Brunoniella australis	N	0.5	50.		
GG	Aristida vagans	N	2	100.		
SG	Acacia ebenegla	N	3	0.5		
SG	Hakea sericea.	N	0.1	1.		
GG	Lomandra ~~glauca~~ multiflora	N	0.1	3		
	Lantana camara	HTE	1	2		
SG	Bursaria spinosa	N	0.5	1		
OG	Hardenbergia violacea	N	0.1	3		
GG	Lomandra glauca.	N	0.1	2		
GG	Panicum simile.	N	0.5	10		
FG	Lomandra tuberoides	N	0.1	2		
FG	Dianella revoluta	N	0.1	1		
OG	Kennedia ~~pros~~.	N	0.1	1		
FG	Solenogyne bellioides.	N	0.1	20.		
GG	Cyperus ~~sp~~ gracilis	N	0.1	10.		
TG	Glochidion ferdinandi	N	0.1	1		
	Sida rhombifolia	E	1	4		
GG	Echinopogon caespitosus	N	1	10.		
	Plantago bracteata.	E	0.2	2		
GG	Lomandra filiformis sub coriacea	N	0.5	10.		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3	Survey Name	Plot Identifier	Recorders
Date 20 6 18.	Blacknill Ind	BO1 (267)	AC & PS.

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
GG	Sporobolus africanus	E	0.5	10.		
TG	Eucalyptus sparsifolia.	N	5	1.		
GG	Dichelachne sp.	N	0.5	3		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	20 6 18.	Black Hill ND	VZ1.	A Caballero B P. Smith.			
Zone 56	Datum GDA 94.	Plot ID	802 (268)	Plot dimensions	20x20.	Photo #	0036
Easting 370885	Northing 6367617.	IBRA region	Sydney Basin	Midline bearing from 0 m	170°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence: H M L (H circled)	
Plant Community Type	1592 - Spotted gum - red ironbark.			EEC: ✓		Confidence: H M L (H circled)	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	2
	Grasses etc.	7
	Forbs	8
	Ferns	1
	Other	5
Sum of Cover of native vascular plants by growth form group	Trees	52
	Shrubs	2
	Grasses etc.	8.8
	Forbs	5.7
	Ferns	0.5
	Other	0.6
High Threat Weed cover		12.1

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BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	| (1)	
30 – 49 cm	HHT HHT |||| (14)	
20 – 29 cm	HHT HHT HHT HHT HHT (25)	
10 – 19 cm	HHT HHT HHT HHT | (21)	
5 – 9 cm	HHT |||| (9)	
< 5 cm	|||| (4)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	HHT | (6)	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	95 95 90 85 70	0 0 0 0 0	0 0 0 0 0	
Average of the 5 subplots	87	0	0	

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			young canopy
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			light grazing (cattle) due to presence of natives.
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 20 6 18	Blacktill Ind	B02	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata.	N	20.	18		
TG	Eucalyptus ~~fibrosa~~ M. paniculata	N	2	1		
TG	Eucalyptus ~~M~~ Sideraphloia	N	20.	17.		
FG	Plata purpurescars.	N	5	200.		
	sida rhombifolia.	E	5	150.		
	Axonops. fissifolius	HTE	2	100.		
	~~Ehrharta~~, erecta	HTE	2	100		
GG	eriochloa stricta.	N	5	300.		
GG	microlaena stipoides	N	1	30.		
GG	Cyperus gracilis.	N	1	100.		
OG	Desmodium. Varians.	N	0.1	20.		
OG	glycine tabacina.	N	0.1	50		
FG	commelina cyanea.	N	0.1	10.		
	Paspalum dilatatum.	HTE	0.1	10		
	senecio. spp.	E	0.1	3.		
	~~Solanum.~~		~~0.1~~	~~1~~		
GG	paspalodium distans.	N	0.5	50		
GG	lomandra ~~confertifolia~~ multiflora	N	0.1	20.		
GG	lomandra filiformis subsp. filiformis	N	1	100.		
	plantago lanceolata.	E	0.1	20.		
	hydrocotyle.	HTE	8.	5.		
	~~Dianella revoluta~~	N	10	2		
FG	Einadia hastata	N	0.1	20.		
FG	murdannia graminea	N	0.1	2		
SG	Bursaria spinosa	N	1	2.		
GG	Themeda triandra	N	0.2	20		
FG	~~plectranthus~~ parviflorus	N	0.1	1		
OG	Haloragis viridis	N	0.1	10.		
OG	pandorea pandorana.	N	0.1	3		
SG	Solanum. stelligerum.	N	1	30.		
FG	Vernonia ~~cinerea~~ cinerea	N	0.1	20.		
OG	parsonsia straminea	N	0.1	1		
	sporobolus africanus	E	0.1	1		
EG	Cheilanthes sieberi	N	0.5	8		
FG	Dichondra repens.	N	0.1	1		
FG	~~Ca~~ Caesia parviflora	N	0.1	30.		
TG	Eucalyptus fibrosa.	N	10.	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date	20 6 18.	Survey Name	Zone ID	Recorders
Zone 56	Datum GDA 94	Hacienda ND	V2 4	A Cavallaro P. Smith
Easting 370488	Northing 6367748.	Plot ID	BOS(270)	Plot dimensions 20x20 / Photo # 0040
		IBRA region	Sydney Basin	Midline bearing from 0 m 190°
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest		Confidence: H M L
Plant Community Type	1592	Spotted gum - red ironbark	EEC: ✓	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	2
	Grasses etc.	8
	Forbs	5
	Ferns	-
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	20
	Shrubs	5.5
	Grasses etc.	33.9
	Forbs	3.3
	Ferns	-
	Other	0.1
High Threat Weed cover		43.2

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BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (1)	
50 – 79 cm	1 (1)	
30 – 49 cm	10 (10)	
20 – 29 cm	18 (18)	
10 – 19 cm	16 (16)	
5 – 9 cm	16 (16)	
< 5 cm	4 (4)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	19 (19)	

Counts apply when the **number of tree stems** within a **size class is ≤ 10. Estimates can be used** when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 40 20 25 20	10 20 5 5 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	27	8	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			young canopy
Cultivation (inc. pasture)			
Soil erosion			erosion present from cattle.
Firewood / CWD removal			
Grazing (identify native/stock)			heavy grazing (cattle)
Fire damage			
Storm damage			
Weediness			high density weed groundcover
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 20 6 18	Blackhill rnd	BO3	AC + PS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata.	N	15	26		
TG	Eucalyptus fibrosa.	N	5	4		
SG	Melaleuca nodosa	N	5	6		
SG	Bursaria spinosa	N	0.5	3		
FG	Einadia. hastata	N	0.5	20		
GG	Microlaena stipoides	N	30	200		
	Ehrharta. erecta	HTE	40	500		
	Sporobolus africans	E	1	20		
	Sida rhombifolia.	E	0.5	50		
FG	Solanum prinophyllum.	N	0.5	20		
FG	Commelina cyanea	N	0.2	15		
FG	Pratia purpurascens	N	[illegible]	50		
GG	Paspalidium distans.	N	0.5	20		
	Chenchrus clandestinum.	HTE	1	20		
GG	Lomandra multiflora.	N	0.1	3		
GG	Oplismenus imbecillis	N	0.1	20		
FG	Sida corrugata.	N	0.1	1		
GG	Cyperus gracilis	N	2	200		
	Plantago lanceolata.	E	0.2	50		
(	Cynodon dactylon	E	2	200		
	Lantana camara	HTE	2	2		
	Sonchus spp.	E	0.1	2		
	Senecio spp.	E	0.1	10		
OG	Glycine tabacina	N	0.1	10		
GG	Entolasia stricta	N	1	35		
GG	Panicum effusum	N	0.1	1		
GG	Panicum simile.	N	0.1	1		
	Cestrum parqui..	HTE	0.2	2		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	21 06 18	Blackhill IND	V2	Acavallaro & P. Smith			
Zone	Datum	Plot ID	B04 (271)	Plot dimensions	20x20	Photo #	100-004
56	GDA 94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	295°		
370493	6367184						
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence:	H M L
Plant Community Type	1592	Spotted gum - red ironbark		EEC: ✓		Confidence:	H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	1
	Grasses etc.	5
	Forbs	7
	Ferns	-
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	35
	Shrubs	0.1
	Grasses etc.	15.5
	Forbs	1.6
	Ferns	-
	Other	0.2
High Threat Weed cover		41.8

V1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	11 (2)	
30 – 49 cm	16	
20 – 29 cm	11	1 (1)
10 – 19 cm	15	
5 – 9 cm	6	
< 5 cm	3	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	7	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 70 45 20 60	5 20 40 60 25	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	56	30	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			understorey, ~~other regular grazing~~, no midstorey
Cultivation (inc. pasture)			Generally young canopy w/ single occurrence of logging
Soil erosion			track from cattle. out here.
Firewood / CWD removal			
Grazing (identify native/stock)			obvious regular grazing (cattle)
Fire damage			
Storm damage			
Weediness			high weed density
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 21 06 18	Blackhill IND	B04	D. Cavallaro P Smith

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata	N	15	20		
TG	Eucalyptus fibrosa	N	20	7		
	Sida rhombifolia	E	5	200		
	Eragrostis erecta	HTE	40	500		
FG	Commelina cyanea	N	0.5	50		
FG	Solanum prinophyllum	N	0.1	5		
	Cenchrus clandestinum	HTE	1	100		
GG	Cyperus gracilis	N	0.2	50		
FG	Einadia hastata	N	0.5	150		
GG	Paspalidium distans	N	10	300		
	Senecio spp	E	0.1	10		
GG	Microlaena stipoides	N	5	400		
SG	Bursaria spinosa	N	0.1	1		
FG	Plantago purpurescens	N	0.1	20		
GG	Lomandra multiflora	N	0.1	2		
	Cynodon dactylon	E	0.5	20		
	Eriochloa	E	0.1	2		
FG	Oxalis perennans	N	0.1	20		
FG	Einadia nutans	N	0.2	60		
GG	Entolasia stricta	N	0.2	30		
	Sporobolus africanus	E	0.1	3		
	Lantana camara	HTE	0.5	1		
FG	Portulaca spp.	N	0.1	1		
	Panicum maxima	E	0.1	1		
	Senecio madagascariensis	HTE	0.1	10		
OG	Parsonsia straminea	N	0.1	1		
OG	Glycine tabacina	N	0.1	10		
	Cestrum parqui	HTE	0.2	1		
	Solanum nigrum	E	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 3

VZ

Date	21/06/18	Survey Name	Zone ID	Recorders			
Zone 56	Datum GDA94	BHill Ind	VZ 1	ACAVALLARO & P. Smith.			
Easting 361438	Northing 6366388	Plot ID	B05(27)	Plot dimensions	20x20	Photo #	100-0044
		IBRA region	Syd Basin	Midline bearing from 0 m	330°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence:	H M L
Plant Community Type		1592 - Spotted Gum - Red Ironbark		EEC: ✓		Confidence:	H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	12
	Forbs	15
	Ferns	1
	Other	10
Sum of Cover of native vascular plants by growth form group	Trees	30.1
	Shrubs	0.5
	Grasses etc.	11.3
	Forbs	6.2
	Ferns	0.1
	Other	1.5
High Threat Weed cover		15.3

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	II (2)	
30 – 49 cm	HHT HN III (13)	
20 – 29 cm	HHT HHT IIII (14)	
10 – 19 cm	HHT HHT HN IIII (19)	
5 – 9 cm	HN III (8)	
< 5 cm	II (2)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	12+4+12 = 28m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	70 80 65 80 50	1 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	69	0.2	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Relatively young Forest lacking native mid
Cultivation (inc. pasture)			Good mix of native & exotic understory
Soil erosion			–
Firewood / CWD removal			
Grazing (identify native/stock)			Grazing evident (cattle) not as negative (resistant native)
Fire damage			less influence from paddocks (exclosure
Storm damage			blocks) large old trees
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 21 6 18	Blackill Ind	BO5	AC + PS.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata	N	10	22		
TG	Eucalyptus fibrosa	N	20	6		
	lantana camara	HTE	10	6		
	Ehrharta erecta	HTE	5	200		
FG	Solanum prinophyllum	N	1	50		
FG	Oxalis perennans	N	0.1	10		
OG	geitonoplesium cymosum	N	0.1	4		
FG	Pratia ~~[illegible]~~ purpurascens	N	1	250		
OG	glycine tabacina	N	0.2	50		
FG	plectranthus parviflorus	N	0.1	[illegible] 2		
GG	oplismenus [illegible] aemulus	N	5	500		
FG	Brunoniella australis.	N	2	300		
GG	cyperus gracilis	N	1	500		
OG	glycine microphylla	N	0.1	1		
GG	microlaena stipoides	N	2	400		
	sida rhombifolia	E	1	200		
	plantago lanceolata	E	0.2	5		
FG	Brachyscome multifida	N	0.1	15		
GG	entolasia stricta	N	[illegible] 2	40		
FG	Vernonia cinerea	N	0.1	25		
OG	Pandorea pandorana	N	0.1	20		
TG	alphitonia excelsa	N	0.1	2		
SG	Bursaria spinosa	N	0.1	3		
GG	lomandra multiflora	N	0.1	[illegible]5		
FG	Einadia hastata	N	0.1	20		
GG	paspalidium distans	N	0.5	30		
SG	Solanum stelligerum	N	0.2	15		
OG	Clematis aristata	N	0.1	1		
OG	parsonsia straminea	N	0.5	3		
	senecio madagascariensis.	HTE	0.1	5		
FG	goodenia hederacea	N	[illegible]1	50		
OG	eustrephus latifolius	N	0.1	10		
EG	pellaea falcata	N	0.1	1		
FG	Desmodium varians.	N	0.1	1		
FG	solenogyne bellioides	N	0.1	5		
OG	hardenbergia violacea	N	0.1	1		
GG	fimbristylis dichotoma.	N	0.1	10		
FG	caesia parviflora.	N	0.2	12		
OG	cassytha pubescens	N	0.1	1		
GG	lepidosperma laterale.	N	0.1	10		

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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400 m² plot: Sheet 3 of 3

Date	Survey Name	Plot Identifier	Recorders
21 6 18	Blackhill Ind	BO5	AC + PS

GF Code	Top 3 native species in each growth form group: Full species name mandatory *All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
SG	Acacia fimbriata	N	0.1	1		
FG	Dianella caerulea var producta	N	0.1	5		
FG	Dichondra repens	N	0.1	10		
FG	Opercularia diphylla	N	0.1	3		
SG	Denhamia silvestris	N	0.1	2		
	~~Morgania [illegible]~~	~~N~~	~~0.1~~	~~2~~		
OG	Cayratia clematidea	N	0.1	1		
GG	Lomandra filiformis var. coriacea	N	0.2	10		
GG	Digitaria parviflora	N	0.1	2		
GG	Dichanthium sp	N	0.1	1		
	Axonopus fissifolius	HTE	0.1	3		
GG	Juncus usitatus	N	0.1	1		
	Paspalum dilatatum	HTE	0.1	1		

Growth Form Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, **200**, …, 1000, …

Mapped VZ2

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BAM Site – Field Survey Form

Site Sheet no: 1 of 3

Date	21 6 18	Survey Name	Zone ID	Recorders		
Zone 56	Datum GDA 94	Plot ID	BG6 (273)	Plot dimensions	20x20	Photo # 0049
Easting 369380	Northing 6366855	IBRA region	Sydney Basin	Midline bearing from 0 m	30°	
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence: H M L
Plant Community Type		592 - spotted gum - red ironbark		EEC: ✓		Confidence: H M L

A Cavallaro P Smith

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	14
	Forbs	10
	Ferns	1
	Other	4
Sum of Cover of native vascular plants by growth form group	Trees	45
	Shrubs	3.8
	Grasses etc.	13.5
	Forbs	3.4
	Ferns	0.1
	Other	0.4
High Threat Weed cover		0.9

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (1)	
50 – 79 cm	IIII (4)	
30 – 49 cm	10 (10)	
20 – 29 cm	13 (13)	
10 – 19 cm	32 (32)	
5 – 9 cm	11 (11)	
< 5 cm	1 (1)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	36 (36)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 45 60 70 70	5 20 5 0 5	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	66	9	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			minimal midstorey - generally large canopy.
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			grazing apparent
Fire damage			
Storm damage			
Weediness			some weed cover
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 21 6 18	Blackhill Rd	B06	AC & PS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata.	N	20	11		
TG	Eucalyptus fibrosa	N	20	7		
TG	Eucalyptus acmenioides	N	5	1		
GG	Entolasia stricta.	N	10	300		
FG	Goodenia hederacea	N	[illegible]	100		
GG	Lomandra confertifolia	N	0.1	20		
GG	Themeda triandra	N	0.1	5		
GG	Aristida vagans.	N	0.2	20		
OG	Pandorea pandorana	N	0.2	3		
	Senecio madagascariensis	HTE	0.1	4		
OG	Glycine tabacina	N	0.1	10		
OG	Glycine clandestina	N	0.1	5		
FG	Brunoniella australis	N	0.1	20		
OG	Hardenbergia violacea	N	0.1	2		
FG	Pratia purpurascens	N	1.5	100		
GG	Lepidosperma laterale	N	0.1	5		
	~~Microlaena glomerata~~ Axonopus fissifolius	HTE	0.1	2		
FG	Opercularia diphylla.	N	0.1	10		
GG	Lomandra multiflora	N	0.2	30		
GG	Fimbristylis dichotoma	N	0.2	30		
GG	Eragrostis brownii	N	0.1	2		
GG	Echinopogon caespitosus.	N	0.1	10		
GG	Paspalidium distans	N	0.1	20		
GG	Microlaena stipoides	N	2	100		
GG	Lomandra gracilis	N	0.1	10.		
EG	Cheilanthes sieberi	N	0.1	2		
	Lantana camara	HTE	0.5	2		
SG	Bursaria spinosa	N	1.5	5		
FG	Vernonia cinerea	N	0.1	10		
GG	Juncus usitatus	N	0.1	2		
FG	Caesia parviflora	N	0.2	50		
SG	Leucopogon juniperinus	N	0.2	1		
FG	Oxalis perennans	N	0.1	10.		
FG	Dianella revoluta.	N	0.1	1		
	Plantago lanceolata	E	0.2	12		
FG	Solanum prinophyllum	N	0.1	10		
GG	Rytidosperma fulvum	N	0.1	3		
SG	Ritera spinosa.	N	0.1	1		
FG	Einadia hastata	N	0.1	1		
	Ehrharta ~~longiflora~~ erecta	HTE	0.2	20		

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders
21 6 18	BCG	Blackhill nd	A C + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
SG.	Acacia elongata.	N	2	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 3

Date	21 06 18	Survey Name	BHill Ind	Zone ID	V1	Recorders	A. CAVALLARO / P. Smith
Zone 56	Datum GDA94	Plot ID	RO7(274)	Plot dimensions	20x20	Photo #	0053
Easting 369426	Northing 6366768	IBRA region	Syd Basin	Midline bearing from 0 m	120°		
Vegetation Class	Hunter-Macleay Dry Sclerophyll forest					Confidence: (H) M L	
Plant Community Type	1592 - Spotted gum - red ironbark			EEC: ✓		Confidence: (H) M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	4
	Grasses etc.	12
	Forbs	11
	Ferns	1
	Other	7
Sum of Cover of native vascular plants by growth form group	Trees	45
	Shrubs	5.4
	Grasses etc.	12.1
	Forbs	3.2
	Ferns	0.1
	Other	0.7
High Threat Weed cover		6.1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	9	4
20 – 29 cm	14	8
10 – 19 cm	21	
5 – 9 cm	3	
< 5 cm	1	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	43	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 70 60 50 70	5 5 10 2 2	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	67	4.8	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Long best minimal native midstorey
Cultivation (inc. pasture)			cattle track.
Soil erosion			
Firewood / CWD removal			evidence of some grazing.
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			(High Grass Kentang behind)
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 21 06 18	Brickhill Ind	807 (274)	PS AC

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
TG	Corymbia maculata	N	20	5		
TG	Eucalyptus fibrosis	N	15	11		
TG	Eucalyptus acmenioides	N	5	1		
SG	Bursaria spinosa.	N	5	12		
	lantana camara.	HTE	5	10		
	ehrharta erecta	HTE	1	300		
GG	microlaena stipoides	N	1	300		
OG	glycine clandestina.	N	0.1	10		
FG	dianella purpurescens	N	2	400		
FG	caesia parviflora.	N	0.1	30		
OG	persoonia staminea.	N	0.1	10		
GG	entolasia stricta	N	5	250		
OG	glycine tabacina.	N	0	20		
	senecio madagascariensis	HTE	0.1	10		
GG	fimbristylis dichotoma	N	0.2	100		
FG	vernonia cinerea	N	0.1	10		
GG	themeda triandra.	N	0.1	10		
OG	hardenbergia violacea.	N	0.1	2		
SG	indigofera australis	N	0.1	1		
OG	desmodium varians	N	0.1	1		
FG	oxalis perennans	N	0.1	5		
FG	opercularia diphylla.	N	0.1	5		
FG	echiton invaucals.	N	0.1	2		
FG	brunoniella australis	N	1	50		
EG	cheilanthes sieberi	N	0.1	2		
GG	paspalidium distans	N	5	200		
SG	Acacia fimbriata	N	0.1	2		
GG	lomandra multiflora	N	0.1	20		
GG	lomandra confertifolia	N	0.1	10		
GG	aristida vagans	N	0.2	40.		
	Sida rhombifolia	E	0.1	15		
OG	pandorea pandorana	N	0.1	1		
GG	lomandra filiformis subsp filiformis	N	0.1	20		
SG	Denhamia silvestris	N	0.2	15		
FG	Brachyscome multifida	N	0.2	30.		
SG	notelaea ovata	N	0.2	1		
FG	Viola. betonicifolia	N	0.1	4		
GG	lomandra filiformis subsp coriacea	N	0.1	4.		
OG	cayratia clematidea	N	0.1	10.		
GG	imperata cylindrica	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3

Date	Survey Name	Plot Identifier	Recorders
21 06 18	Beckhill Ind	BO7 (274)	PS + AC.

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
	hypochoeris radicata	E	0.1	10		
GG	echinopogon caespitosus	N	0.1	10		
	desmodium varians	N	0.1	10		
~~FG~~	~~Acacia~~					
FG	plectranthus parviflorus.	N	0.1	2		
FG	solanum pinnatum.	N	0.2	10		
TG.	Eucalyptus piperita.	N	5	3		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	21 6 18	Blackhill IND	VZ3	A. Cavaliero + P. Smith			
Zone	Datum	Plot ID	BOS (275)	Plot dimensions	20x20	Photo #	0063
56	GDA 94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	220°		
369810	6346895						
Vegetation Class		Hunter-Macdonald Dry Sclerophyll Forest					Confidence: H M L
Plant Community Type		1592 (grassland)		EEC: ✓			Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	Trees	1
	Shrubs	3
	Grasses etc.	13
	Forbs	11
	Ferns	1
	Other	2
Sum of **Cover** of native vascular plants by growth form group	Trees	0.1
	Shrubs	0.3
	Grasses etc.	13
	Forbs	1.4
	Ferns	0.1
	Other	0.2
High Threat Weed cover		0.4

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the **number of tree stems** within a **size class is ≤ 10**. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	20	35	5	20	70	40	20	50	50	20	25	25	10	20	0	0	0	0	0
Average of the 5 subplots	17					46					20					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Cleared area next to track. - ground cover only.
Cultivation (inc. pasture)			
Soil erosion			some bare ground.
Firewood / CWD removal			
Grazing (identify native/stock)			Evidence of grazing, cow paths
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 21 6 18	Blacktill Ind	BOS	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
GG	Sida rhombifolia	N	5	500		
GG	Entolasia stricta	N	0.5	200		
GL	Pespeticlium distans	N	5	500		
FG	Goodenia hederacea	N	0.1	30		
GG	Themeda triandra	N	0.2	50		
GG	Lomandra multiflora	N	0.1	20		
GG	Lomandra filiformis sub. filiformis	N	0.1	10		
EG	Cheilanthes sieberi	N	0.1	20		
FG	Hydrocotyle diphylla	N	0.2	30		
GG	Elagrostis brownii	N	0.2	50		
TG	Eragrostis tibiosa	N	0.1	1		
GG	Rytidosperma fulva	N	0.1	40		
	Senecio madagascariensis	HTE	0.1	30		
GG	Juncus usitatus	N	0.5	50		
	Paspalum dilatatum	HTE	0.1	30		
	Sporobolus africanus	E	0.1	20		
	Hypochaeris radicata	E	0.1	30		
FG	Oxalis perrenans	N	0.1	30		
	Cynodon dactylon	E	20	600		
GG	Poa affinis	N	0.1	1		
FG	Sonchus tenuifolius	N	0.1	2		
GG	Lomandra spp.	N	0.1	10		
SG	Cassinia uncata	N	0.1	2		
FG	Chrysocephalum apiculatum	N	0.2	100		
GG	Panicum Simile	N	0.1	50		
SG	Dillwynia retorta	N	0.1	1		
FG	Blumenella asteliis	N	0.2	100		
FG	Hypericum gramineum	N	0.1	50		
FG	Plantago purpurascens	N	0.1	100		
OG	Glycine tabacina	N	0.1	50		
GG	Microlaena stipoides	N	1	300		
SG	Bursaria spinosa	N	0.1	2		
	Ehrharta erecta	HTE	0.1	30		
FG	Caesia parviflora	N	0.1	50		
	Plantago lanceolata	E	0.1	50		
	Sida rhombifolia	E	0.1	30		
FG	Wahlenbergia gracilis	N	0.1	10		
FG	Dianella revoluta	N	0.1	5		
	Cenchrus clandestinus	HTE	0.1	10		
OG	Glycine clandestina	N	0.1	30		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Survey Name	Zone ID	Recorders
BLACKHILL BCM IND	VZ 7	A. Cavalieri + P. Smith

Date	21 6 18	Plot ID	BCM (276)	Plot dimensions	20x20	Photo #	0069
Zone 56	Datum GDA 94	IBRA region	Syd Basin	Midline bearing from 0 m	130°		
Easting 369834	Northing 6366814						

Vegetation Class	Hunter - Mackay Dry Sclerophyll Forest		Confidence: (H) M L
Plant Community Type	1592 - spotted gum - red ironbark	EEC: ✓	Confidence: (H) M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	3
	Grasses etc.	11
	Forbs	11
	Ferns	1
	Other	4
Sum of Cover of native vascular plants by growth form group	Trees	45
	Shrubs	5.2
	Grasses etc.	4.2
	Forbs	1.1
	Ferns	0.1
	Other	0.5
High Threat Weed cover		0.2

34

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	5	
20 – 29 cm	17	
10 – 19 cm	31	
5 – 9 cm	12	
< 5 cm	3	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	29	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 95 95 75 98	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	88.6	0	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			young canopy, minimal midstorey, understorey.
Cultivation (inc. pasture)			
Soil erosion			cattle track.
Firewood / CWD removal			
Grazing (identify native/stock)			some grazing.
Fire damage			
Storm damage			
Weediness			minimal weed cover.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 2 6 18	Rochill Ind	B09	AC + P.Smith

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
TG	corymbia maculata.	N	25.	15		
TG	Eucalyptus fibrosa	N	10.	5.		
TG	Eucalyptus paniculata	N	5.	1		
TG	Eucalyptus sparsifolia.	N	5	2		
SG	Banksia spinosa.	N	5.	9.		
CG	entolasia stricta	N	0.5	50.		
GG	paspalidium distans.	N	12	100.		
GG	themeda triandra.	N	0.1	20.		
FG	pratia purpurascens	N	0.1	50.		
GG	microlaena stipoides	N	0.5	100.		
GG	aristida vagans.	N	0.1	10.		
CG	parsonsia straminea.	N	0.1	1		
GG	lomandra ~~longifolia~~ confertifolia.	N	0.1	10.		
GG	lomandra filiformis	N	0.1	10.		
GG	poa affinis	N	0.5	230.		
GG	lomandra multiflora.	N	0.1	10		
FG	Dianella revoluta.	N	0.1	20.		
FG	Brunoniella ~~aus~~ australis	N	0.1	30.		
FG	Caesia parviflora.	N	0.1	30.		
FG	einadia hastata.	N	0.1	4.		
	paspalum ~~distans~~ dilatatum	HTE	0.1	3.		
CG	hardenbergia violacea	N	0.2	10.		
GG	Rytidosperma fulva.	N	0.1	5.		
FG	goodenia ~~hetrophylla~~.	N	0.1	5.		
	senecio madagascariensis	HTE	0.1	5.		
SG	Dillwynia retorta	N	0.1	1		
CG	Desmodium varians	N	0.1	10.		
SG	Acacia fimbriata.	N	0.1	2.		
CG	kennedia prostrata.	N	0.1	1		
FG	pterostylis sp.	N	0.1	15.		
EG	Dianthes sieberi	N	0.1	20		
FG	opercularia diphylla	N	0.1	10.		
FG	oxalis perennans	N	0.1	5		
FG	goodenia hederacea	N	0.1	10.		
GG	eragrostis brownii	N	0.1	5.		
FG	solenogyne bellioides.	N.	0.1	12		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	22 6 18	Blacktown LND	VZ1	A. Cavicchio + P. Smith			
Zone	Datum	Plot ID	B010 (277)	Plot dimensions	20x20	Photo #	0015
56	GDA94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	310°		
369477	6367031						
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence:	(H) M L
Plant Community Type		1592 - Spotted gum - red ironbark		EEC:	✓	Confidence:	(H) M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	4
	Grasses etc.	15
	Forbs	11
	Ferns	0
	Other	4
Sum of Cover of native vascular plants by growth form group	Trees	50
	Shrubs	2.4
	Grasses etc.	13.9
	Forbs	3.1
	Ferns	0
	Other	0.8
High Threat Weed cover		1.4

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (1)	
50 – 79 cm	4 (3)	1 (1)
30 – 49 cm	4 (4)	
20 – 29 cm	10 (10)	
10 – 19 cm	26 (26)	
5 – 9 cm	8 (8)	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	53 (53)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	70 80 80 80 70	5 5 2 5 10	/ / / / /	/ / / / /
Average of the 5 subplots	76	5.4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			understorey, limited midstorey
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			obvious cattle grazing
Fire damage			
Storm damage			
Weediness			low
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 22 6 18	Blackhill Ind	Bold (27)	A. Caballero + P. Smith

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata	N	20	11		
T	Eucalyptus fibrosa	N	30	7		
S	Bursaria spinosa	N	2	10		
	Lantana camara	HTE	0.5	1		
G	Entolasia stricta	N	05	200		
G	Microlaena stipoides	N	10	1000		
F	Goodenia hederacea	N	1	300		
O	~~Lobelia~~ Hardenbergia violacea	N	0.5	5		
F	Oxalis perennes	N	0.1	30		
	Sida rhombifolia	E	0.1	25		
F	Vernonia cinerea	N	0.1	50		
G	Lomandra multiflora	N	0.1	20		
G	Paspalidium distans	N	0.2	300		
O	Persoonia stevenii	N	0.1	5		
F	Platic purpurascens	N	0.2	200		
F	Einadia nutans	N	0.1	20		
F	Solanum prinophyllum	N	02	30		
	Cereus clandestinus	HTE	0.1	3		
G	Lomandra filiformis subsp.	N	1	50		
G	Cyperus gracilis	N	1	100		
F	Brunoniella australis	N	1	100		
	Plantago lanceolata	E	0.1	20		
F	Caesia parviflora	N	0.1	30		
O	Glycine clandestina	N	0.1	20		
	Senecio madagascariensis	HTE	0.1	10		
G	Aristida vagans	N	02	50		
S	Cassinia uncata	N	0.2	5		
G	Juncus usitatus	N	0.1	3		
G	Rytidosperma fulvum	N	0.1	3		
F	Echinopogon inaequalis	N	0.1	3		
F	Veronica plebeia	N	0.1	10		
	Cyperus eragrostis	HTE	0.1	5		
F	Commelina cyanea	N	0.1	3		
	Axonopus fissifolius	HTE	0.1	10		
	Ehrharta erecta	HTE	0.5	50		
S	Acacia fimbriata	N	0.1	3		
G	Themeda triandra	N	0.1	80		
	Conyza sp	E	0.1	1		
G	Digitaria parviflora	N	0.1	1		
G	Echinopogon caespitosus	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3

Date	Survey Name	Plot Identifier	Recorders
22 6 18	BRADHILL IND	B010(277)	A. Cavallaro + P. Smith

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
G	panicum simile	N	0.1	1		
G	poaeffinis	N	0.2	20		
O	Pandorea pandorana	N	0.1	1		
G	lomandra confertifolia	N	0.1	10		
S	Acacia elongata	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 2

Date	22 06 18	Survey Name	B/Hill Ind	Zone ID	V2[illegible]4	Recorders	A. Cawood + P. Smith
Zone 56	Datum GDA94	Plot ID	BOII(278)	Plot dimensions	20x20	Photo #	0051
Easting 369533	Northing 6367192	IBRA region	Sydney Basin	Midline bearing from 0 m	250°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest					Confidence: H M L
Plant Community Type		1592 - Spotted gum - red ironbark				EEC: ✓	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	0
	Grasses etc.	5
	Forbs	7
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	55
	Shrubs	0
	Grasses etc.	9.1
	Forbs	0.7
	Ferns	0
	Other	0.1
High Threat Weed cover		61.8

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	IIII (4)	
30 – 49 cm	III (3)	
20 – 29 cm	IIII II (7)	
10 – 19 cm	IIII IIII IIII IIII (20)	
5 – 9 cm	II (2)	
< 5 cm	I (1)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	IIII IIII IIII IIII IIII (24)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	40	60	60	35	35	30	2	25	30	5	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	50					18.4					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Veg canopy, no mid, understorey, bare patches
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			high impact grazing (cattle)
Fire damage			
Storm damage			
Weediness			high weed density (grandora)
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 22 6 18	Blackhill Rd	BH (278)	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata	N	25	19		
T	Eucalyptus fibrosa	N	30	6		
F	Oxalis perennes	N	0.1	50		
	Cynodon dactylon	E	10	500		
	Sida rhombifolia	E	1	100		
	Plantago lanceolata	E	0.5	200		
	Conyza sp	E	0.1	10		
	Hypochaeris radicata	E	0.1	30		
	Solanum nigrum	E	0.1	10		
	Melaleuca Carolinana	E	0.1	5		
	Ehrharta erecta	HTE	50	1000		
	Heliotropium amplexicaule	HTE	1	50		
F	Einadia nutans	N	0.2	20		
F	Solanum prinophyllum	N	0.2	30		
	Cenchrus clandestinum	HTE	10	200		
F	Einadia hastata	N	0.1	10		
G	Lomandra filiformis	N	0.1	2		
F	Commelina cyanea	N	0.1	20		
G	Cyperus gracilis	N	1	50		
	Paspalum dilatatum	HTE	0.5	100 m²		
G	Paspalidium distans	N	5	100		
G	Microlaena stipoides	N	1	300		
	Sporobolus africanus	E	0.2	20		
	Cirsium vulgare	E	0.1	1		
F	Veronica persica	N	0.1	3		
	Senecio madagascariensis	HTE	0.2	20		
G	Eriochloa gracilis	N	2	100		
	Lantana camara	HTE	0.5	1		
F	Plectranthus parviflorus	N	0.1	100		
	Sonchus spp.	E	0.1	1		
	Cardamine spp.	E	0.1	1		
O	Ipomoea cairica	N	0.1	1		
	Pereskia bleo	E	0.1	1		
	Lepidium bonariense	E	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date	22 6 18	Survey Name	Zone ID	Recorders	
		Blackhill IND	V ~~Z4~~ 52	A. Cavallaro + P Smith	
Zone: 56	Datum: GDA 94	Plot ID	B12 (279)	Plot dimensions: 20x20	Photo #: 0585
Easting: 369699	Northing: 6367259	IBRA region	Sydney Basin	Midline bearing from 0 m	340
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest			Confidence: H M L
Plant Community Type		1592 - Spotted gum - red ironbark.		EEC: ✓	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	1
	Grasses etc.	7
	Forbs	11
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	35
	Shrubs	0.1
	Grasses etc.	20.5
	Forbs	1.3
	Ferns	0
	Other	0.1
High Threat Weed cover		~~25~~ 2

22

DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	I (1)	
30 – 49 cm	IIII III (8)	
20 – 29 cm	IIII IIII I (11)	
10 – 19 cm	IIII IIII I (11)	I (1)
5 – 9 cm	II (2)	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	18m.	

BAM Attribute (1000 m² plot)

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	65, 30, 20, 55, 25	5, 0, 2, 0, 0		
Average of the 5 subplots	39	1.4.		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			underscrubbed no midstorey
Cultivation (inc. pasture)			
Soil erosion			cattle tracks
Firewood / CWD removal			
Grazing (identify native/stock)			cattle grazing high impact.
Fire damage			
Storm damage			
Weediness			grandrale weeds high
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 22 6 18	Bochill Ind	B12 (279)	AC + PS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
		N	15	8		
T	Corymbia maculata	N	20.	67		
T	eucalyptus fibrosa	HTE	20	~~100~~ 500		
	Axonopus fissifolius	E	~~13~~ 2	100		
	sida rhombifolia	N	15	200		
G	microlaena stipoides	E	0.1	10.		
	sporobolus africanus	N	0.1	40.		
F	commelina cyanea.	N	0.1	50.		
F	platia purpurascens	HTE	10	300		
	Ehrharta ~~longiflora~~ erecta.	E	2	100		
	hypochaeris radicata.	E	5.	400		
	plantago lanceolata	N	2	200		
G	entolasia stricta	N	2	300.		
G	paspalidium distans.	N	0.1	50.		
F	caesia parviflora	N	2	200		
G	cyperus gracilis	E	15	500		
	cynodon dactylon.	N	0.1	100		
F	dichondra repens	N	0.1	100		
F	oxalis perennans	N.	0.1	4		
F	geranium homeanum	N	0.2	80		
G	oplismenus aemulus.	E	0.1	10.		
	~~[illegible]~~ modiola caroliniana	E	0.1	40.		
	~~[illegible]~~ sp. Paronychia brasiliana	HTE	0.2	20		
	senecio madagascariensis	N	0.2	50.		
G	fimbristylis dichotoma	E	0.1	20.		
	setaria parviflora.	E	0.1	5.		
	Conyza sp.	N	0.2	20.		
F	veronica plebeia	N	0.1	20		
F	cotula australis.	N	0.1	2		
S	bursaria spinosa	N	0.1	10		
O	glycine tabacina.	N	0.2	20.		
F	solanum prinophyllum	E	0.1	1		
	Solanum nigrum	E	0.1	1		
	trifolium repens	N	0.1	1		
F	erodium hastata	N	0.1	2		
G	juncus usitatus	E	0.1	2.		
	verbena bonariensis	N	0.1	2		
F	Gnodia trigonyres					

GF – circle code if 'top 3'.

GF Code: see Growth Form definitions in Appendix 1   **N:** native, **E:** exotic, **HTE:** high threat exotic

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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BAM Site – Field Survey Form

Site Sheet no: 1 of 3

		Survey Name	Zone ID	Recorders			
Date	22 6 18	Blacknill Ind	VZ2	A. Cavallaro + P. Smith			
Zone	Datum	Plot ID	BB (200	Plot dimensions	20x20	Photo #	0092
56	EDA 94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	170°		
369739	6367017						
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence:	H M L
Plant Community Type		1592 - Spotted gum - red ironbark		EEC: ✓		Confidence:	H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	1
	Grasses etc.	10
	Forbs	11
	Ferns	0
	Other	3
Sum of Cover of native vascular plants by growth form group	Trees	36
	Shrubs	0.1
	Grasses etc.	14.2
	Forbs	3.2
	Ferns	0
	Other	0.4
High Threat Weed cover		10.4

15 Weed 28

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	IIII (5)	
30 – 49 cm	IIII IIII III (13)	
20 – 29 cm	IIII IIII IIII III (18)	
10 – 19 cm	IIII I (6)	
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	31	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	75 85 35 65 85	5 2 40 10 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	69	11.4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			* under scrub, no mid story, generally [illegible]
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			obvious grazing (cattle) / adjacent to paddock.
Fire damage			
Storm damage			
Weediness			mod weed dense.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

* Babblers Recorded x5

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22 6 18	Blackhill Rd	B13 (280)	AC + PS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	corymbia maculata	N	25	11		
T	eucalyptus fibrosa	N	10	5		
T	Allocasuarina torulosa	N	1	1		
O	cayratia clematidea	N	.2	20		
	sida rhombiblia	E	0.1	40		
G	oplismenus aemulus	N	1	100		
F	solanum prinophyllum	N	0.1	10		
	ehrharta erecta	HTE	5	200		
F	geranium homeanum	N	0.1	2		
	solanum pseudocapsicum	E	0.1	1		
F	dichondra repens	N	2	500		
	Axonopus fissifolius	HTE	5	500		
F	commelina cyanea	N	0.1	40		
	cynodon dactylon	E	10	500		
	cenchrus clandestinus	HTE	0.1	30		
	Bidens pilosa	HTE	0.1	1		
O	glycine clandestina	N	0.1	30		
G	oplismenus imbecillis	N	0.1	4		
G	fimbristylis dichotoma	N	2	50		
F	Brunoniella australis	N	0.2	30		
G	cyperus gracilis	N	5	100		
F	caesia parviflora	N	0.2	50		
G	lomandra filiformis sb filiformis	N	0.2	20		
	plantago lanceolata	E	2	300		
G	juncus usitatus	N	0.2	10		
F	platia purpurescens	N	0.1	100		
G	microlaena stipoides	N	10	500		
F	alternanthera denticulata	N	0.1	1		
	cyperus eragrostis	HTE	0.1	10		
F	Plectranthus parviflorus	N	0.1	4		
	hypochaeris radicata	E	1	50		
O	Desmodium varians	N	0.1	50		
	paronychia brasiliana	E	0.1	20		
F	whalenbergia gracilis	N	0.1	1		
	senecio madagascariensis	HTE	0.1	20		
	hypochaeris glabra	E	0.1	10		
F	oxalis perennans	N	0.1	200		
G	lomandra filiformis sub. coriacea	N	0.2	20		
S	indigofera australis	N	0.1	1		
G	~~sedge 1~~ Juncus homalocaulis	N	0.1	20		

GF Code: see Growth Form definitions in Appendix 1   **N:** native, **E:** exotic, **HTE:** high threat exotic   **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders
22 6 18	Blackhill Ind	B13	AC + RS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
G	Pospalodium distens	N	0.2	50.		
	Setaria parviflora	E	0.1	20		
	Cardamine spp.	E	0.1	10.		
	Melodia carolinana	E	0.1	10		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Survey Name	Zone ID	Recorders
Blackhill IND	V22	P. Smith + A. Gaviglio.

Date	22 6 18	Plot ID	B14 (281)	Plot dimensions	20x20	Photo #	0104
Zone 56	Datum GDA 94	IBRA region	Sydney Basin	Midline bearing from 0 m	355°		
Easting 369796	Northing 6366947						

Vegetation Class	Hunter-Macleay Dry Sclerophyll Forest		Confidence: (H) M L
Plant Community Type	1592 - Spotted gum - red ironbark	EEC: ✓	Confidence: (H) M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	2
	Grasses etc.	8
	Forbs	12
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	50
	Shrubs	0.3
	Grasses etc.	37.4
	Forbs	1.4
	Ferns	0
	Other	0.1
High Threat Weed cover		10.6

7 Weed

25

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1 (1)	
30 – 49 cm	13 (13)	
20 – 29 cm	11 (11)	
10 – 19 cm	3 (3)	
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	17m.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 90 70 40 50	2 5 2 2 30	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	67	8.2	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			understorey, no midstorey, sparse canopy evidence of logging
Cultivation (inc. pasture)			
Soil erosion			cattle tracks
Firewood / CWD removal			
Grazing (identify native/stock)			evidence cattle grazing
Fire damage			
Storm damage			
Weediness			mod weeds (lantana)
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 22 6 18	Blacktill ind	BL4 (281)	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	~~Eradia pastata~~ Corymbia maculata	N	20	8		
T	eucalyptus fibrosa	N	30	7		
F	eiradia pastata	N	0.2	40		
G	microlaena stipoides	N	20	600		
F	platia purpurescens	N	0.1	200		
G	pasepalidium distans	N	0.5	500		
	sida rhombifolia	E	0.1	50		
F	setaria parviflora	N	0.2	10		
	Enydra erecta	HTE	10	250		
G	Cyperus gracilis	N	2	50		
	Plantago lanceolata	E	0.5	100		
	hypochaeris radicata	E	0.1	20		
F	paesia parviflora	N	0.1	30		
G	rush 1	N	0.1	2		
F	Veronica perbella	N	0.1	2		
F	alternanthera denticulata	N	0.1	2		
O	glycine tabacina	N	0.1	5		
	setaria parviflora	E	0.1	20		
F	eiradia tetragena	N	0.5	50		
F	wahlenbergia gracilis	N	0.1	1		
F	plectranthus parviflora	N	0.1	1		
	lantana camara	HTE	0.5	1		
F	dichondra repens	N	0.1	200		
S	atriplex semibaccata	N	0.2	10		
G	lomandra filiformis sub coriacea	N	0.1	5		
F	Oxalis perennans	N	0.1	100		
	Cyperus eragrostis	HTE	0.1	50		
G	Entolasia stricta	N	10	400		
G	lomandra multiflora	N	0.1	1		
F	commelina cyanea	N	0.1	10		
G	lomandra filiformis sub filiformis	N	0.1	1		
S	Acacia fimbriata	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Survey Name	Zone ID	Recorders
Bochhill Ind	VZ4	Adam Cavalieri + Phoebe Smith

Date	26 6 18	Plot ID	BSM5 (282)	Plot dimensions	20x20	Photo #	0113
Zone 56	Datum GDA 94						
Easting 370107	Northing 6367235	IBRA region	Sydney Basin	Midline bearing from 0 m	110°		

Vegetation Class	Hunter-Macleay Dry Sclerophyll Forest		Confidence: (H) M L
Plant Community Type	1592 - Spotted gum - red ironbark	EEC: ✓	Confidence: (H) M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	1
	Grasses etc.	4
	Forbs	8
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	27.1
	Shrubs	1
	Grasses etc.	35.2
	Forbs	1.4
	Ferns	0
	Other	0.1
High Threat Weed cover		50.5

17.

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	11	
20 – 29 cm	9	
10 – 19 cm	4	
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	16	

Counts apply when the **number of tree stems** within a **size class is ≤ 10**. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 80 70 60 80	5 0 20 5 5	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	68	7	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 26 6 18	Blackhill Rd	B15.	PC + PS.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata	N	25	10		
T	Eucalyptus fibrosa.	N	2	1		
S	Melaleuca nodosa.	N	1	1		
T	Notelaea longifolia.	N	0.1	1		
G	Paspalidium distans	N	20	500		
G	Microlaena stipoides	N	15	500		
	Sida rhombifolia.	E	0.5	200		
	Cenchrus clandestinum	HTE	40	1000		
	Plantago lanceolata.	E	0.5	200		
F	Plantia purpurascens	N	0.5	300		
F	Einadia trigona.	N	0.2	50		
F	Commelina cyanea	N	0.2	100		
	Hypochaeris radicata.	E	0.2	50.		
	Ehrharta erecta	HTE	10	300		
	Cynodon dactylon	E	0.5	200		
	Sonchus spp.	E	0.1	10.		
	Senecio madagascariensis	HTE	0.2	50.		
G	Cyperus gracilis	N	0.1	30		
F	Oxalis perennans	N	0.1	40		
F	Solanum prinophyllum	N	0.1	4		
F	Veronica plebeia	N	0.1	3		
	Paspalum dilatatum	HTE	0.2	20		
G	Lomandra filiformis subsp filiformis	N	0.1	2		
F	Einadia hastata	N	0.1	10.		
F	Cotula spp.	N	0.1	5		
	Sporobolus africanus	E	0.1	10		
O	Hardenbergia violacea	N	0.1	1		
	Paronychia brasiliana.	E	0.1	120		
	Opuntia spp.	HTE	0.1	2		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	26 6 18	Stockmill Ind	VZ3	A. Gavalalo + P. Smith			
Zone: 56	Datum: GDA 94	Plot ID	B16 (285)	Plot dimensions	20x20	Photo #	0118
Easting: 369264	Northing: 6366496	IBRA region	Sydney Basin	Midline bearing from 0 m	355°		
Vegetation Class	Hunter - Macleay Dry Sclerophyll Forest					Confidence: (H) M L	
Plant Community Type	1592 - spotted gum - red ironbark			EEC: ✓		Confidence: (H) M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	0
	Grasses etc.	11
	Forbs	5
	Ferns	1
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0.1
	Shrubs	0
	Grasses etc.	14.5
	Forbs	0.9
	Ferns	0.1
	Other	0.1
High Threat Weed cover		15.9

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	20	5	15	25	10	35	20	15	5	15	0	0	0	0	1	0	0	0	0	0
Average of the 5 subplots	15					18					0.2					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			no canopy, grassed next track
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			obvious cattle grazing
Fire damage			
Storm damage			
Weediness			high weed density.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 26 6 18	Blackhill Incl	B16.	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
G	Paspalidium distans.	N	10	300		
	Axonopus fissifolius	HTE	15	500		
G	Bothriochloa macra	N	2	100.		
G	Lomandra ~~confertifolia~~ multiflora	N	0.5	40.		
	Cynodon dactylon.	E	70	1500		
	Sporobolus africanus	E	0.5	50.		
G	Eragrostis brownii	N	0.1	20.		
G	Themeda triandra	N	0.2	20.		
	Senecio madagascariensis	HTE	0.2	50.		
	Paspalum dilatatum.	HTE	0.5	50.		
	Hypochaeris radicata.	E	1	100.		
F	Chrysocephalum apiculata	N	0.5	200.		
	Sida rhombifolia	E	0.1	5.		
G	Aristida vagans	N	0.1	30.		
G	Microlaena stipoides	N	1	100.		
F	Cotula spp.	N	0.1	20.		
G	Poa affinis	N	0.2	20.		
	herb sp. 1 (asteraceae)		0.1	20.		
G	Dichelachne spp.	N	0.1	20.		
	Plantago bellardii.	E	0.2	50.		
G	Juncus homalocaulis.	N	0.1	10		
G	Cyperus gracilis	N	0.1	40.		
	Carex. dandestinum	HTE	0.1	5.		
	Setaria parviflora.	E	0.1	2		
	Heliotropium amplexicaule	HTE	0.1	5.		
F	Echium plantagineum	N	0.1	5.		
T	Eucalyptus fibrosa (juvenile)	N	0.1	1		
F	Opercularia diphylla	N	0.1	1		
O	Desmodium varians.	N	0.1	1		
F	Oxalis perennans	N	0.1	5		
E	Chenopodium sieberi	N	0.1	10.		
G	Eragrostis elongata.	N	0.1	20		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 3

Date	27 06 18	Survey Name	Zone ID	Recorders
		B/Hill Ind	VZ 6	A. CAVALLARO / P. Smith
Zone: 56	Datum: GDA94	Plot ID	BO17 (284)	Plot dimensions: 20x20 / Photo #: 0124
Easting: 369703	Northing: 6367575	IBRA region	Syd basin	Midline bearing from 0 m: 305°
Vegetation Class		Hunter-macleay Dry Sclerophyll forest		Confidence: H M L
Plant Community Type		1589- Spotted gum - broad leaved Mahogany - grey gum dry	EEC: ?	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	6
	Shrubs	4
	Grasses etc.	9
	Forbs	15
	Ferns	1
	Other	9
Sum of Cover of native vascular plants by growth form group	Trees	66.5
	Shrubs	11.3
	Grasses etc.	82.6
	Forbs	7.9
	Ferns	0.5
	Other	2.7
High Threat Weed cover		36

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (1)	1 (1)
50 – 79 cm	III (3)	
30 – 49 cm	IIII (5)	
20 – 29 cm	IIII (4)	
10 – 19 cm	II (2)	
5 – 9 cm	II (2)	
< 5 cm	IIII I (6)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	IIII IIII I (11)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	25	25	30	45	20	5	1	2	2	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	29					4					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Obvious historic clearing, w/ a few large old trees lacks midstorey (native),
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			Signs of grazing native & cattle + Grazed disturbance (Bracken).
Fire damage			
Storm damage			
Weediness			High density lantana, Particularly adjacent to Cnr living.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 17 06 18	R/Hill Ind	B017	A. CAVALLARO / P. Smith

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus fibrosa	N	1	1		
T	Corymbia maculata.	N	30.	1		
T	Eucalyptus acmenoides.	N	10	2		
T	Eucalyptus. paniculata.	N	20.	2		
S	Melaleuca styphelioides	N	10.	11		
T	Eucalyptus. tereticornis	N	5.	1		
	lantana camara	HTE	35.	13		
O	glycine clandestina.	N	0.5	2200		
G	Microlaena stipoides.	N	70.	2000		
F	dichondra repens.	N	0.5	200.		
F	Oxalis perennans	N	0.2	400.		
	plantago lanceolata.	E	0.2	60		
F	pratia purpurascens	N	0.2	200		
G	oplismenus aemulus	N	10.	1000		
	sida rhombifolia.	E	0.5	300		
	~~sporobolus africanus~~					
O	pandorea pandorana.	N	0.5	100		
G	paspalidium distans	N	1	500.		
F	Pseudanthemum variabile,	N	0.5	100.		
F	cassia. parviflora.	N	0.1	20		
	hypochaeris radicata.	E	0.2	50.		
F	Brunoniella australis	N	2	200.		
O	Desmodium varians	N	0.2	50		
	Senecio madagascariensis	HTE	0.5	100		
F	plectranthus parviflora.	N	0.1	5		
G	juncus usitatus.	N	0.1	20.		
	paspalum dilatatum.	HTE	0.1	5		
G	entolasia stricta.	N	1	300		
O	~~[illegible]~~ tylophora barbata	N	0.1	20.		
F	commelina cyanea	N	0.5	100.		
O	eustrephus latifolius	N	0.5	50.		
	Stenotaphrum secundatum	HTE	0.1	10.		
O	parsonsia straminea	N	0.1	10		
F	Vernonia cinerea	N	0.1	20.		
F	siegesbeckia orientalis	N	0.1	20		
O	stephania japonica	N	0.1	1		
F	solanum prinophyllum	N	0.1	1		
T	notelaea longifolia.	N	0.5	2.		
O	hardenbergia violacea	N	0.1	1		
	axonopus fissifolius.	HTE	0.2	20		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3	Survey Name	Plot Identifier	Recorders
Date 27 6 18	Blackhill incl	B17	PS & AC.

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
G	Cyperus gracilis	N	0.2	30.		
G	Entolasia marginata	N	0.1	30.		
	Ehrharta erecta	HTE	0.1	50.		
O	~~Dioscorea~~ dioscorea transversa	N	0.1	5		
F	~~Desmodium~~ desmodium rhytidophyllum	N	0.1	1		
S	Breynia oblongifolia	N	0.1	3		
S	Lantana camara	N	1	5		
E	Sida rhombifolia	N	0.5	100		
G	Lomandra filiformis ssp. filiformis	N	0.1	2		
S	Dennenia silvestris	N	0.2	5.		
F	Veronica persica	N	0.1	3		
F	Geranium homeanum	N	0.1	4.		
O	Hibbertia scandens	N	0.1	1		
F	Dianella caerulea var. producta	N	0.1	5.		
O	Gethyllis cymosum	N	0.1	1		
G	Echinopogon caespitatus	N	0.1	3		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 3

		Survey Name	Zone ID	Recorders			
Date	27 6 18	Blackwood	VZ 1	A. Cabalero + P. Smith			
Zone 56	Datum GDA 94	Plot ID	B18 (255)	Plot dimensions	20x20	Photo #	0131
Easting 370660	Northing 6365123	IBRA region	Sydney Basin	Midline bearing from 0 m	80°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll forest				Confidence: H M L	
Plant Community Type		1592 - Spotted gum - red ironbark		EEC: ✓		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	16
	Forbs	11
	Ferns	1
	Other	4
Sum of Cover of native vascular plants by growth form group	Trees	40
	Shrubs	0.9
	Grasses etc.	70.3
	Forbs	1.5
	Ferns	0.1
	Other	0.4
High Threat Weed cover		1.9

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	9	
20 – 29 cm	18	
10 – 19 cm	2	
5 – 9 cm	1	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	42	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	75 85 35 55 55	5 2 40 10 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	67	11.4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Past clearing, limited mid story.
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			some grazing - less compared to adjac plots
Fire damage			
Storm damage			
Weediness			some lantana - low weed species.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

* Plot did not have additional species observed adjacent No difference in veg apart from species A. maidenii C. gummi

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 27 6 18	Blackhill Ind	B18	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata.	N	10	32		
T	eucalyptus fibrosa.	N	25	9		
T	eucalyptus sparsifolia	N	5	1		
G	Microlaena stipoides.	N	40	1500		
	Aristida bisetalis.	HTE	0.1	30		
G	entolasia stricta.	N	10	300		
	sporobolus africanus.	E	0.2	250		
	Sida rhombifolia.	E	0.2	100		
F	oxalis perennans	N	0.1	200		
O	glycine microphylla	N	0.1	30		
F	platia repressans.	N	0.5	400		
	plantago lanceolata.	E	0.1	50		
G	paspalidium distans	N	1	300		
G	lomandra filiformis sub filiformis	N	0.3	50		
G	lomandra multiflora.	N	0.2	20		
G	themeda triandra.	N	0.2	20		
G	lomandra glauca	N	0.2	20		
G	panicum simile	N	0.1	20		
F	Verronia cinerea.	N	0.1	50		
G	juncus usitatus	N	0.2	50		
O	glycine clandestina	N	0.1	10		
G	ptilotrix deusta.	N	0.5	50		
E	Cheilanthes sieberi	N	0.1	20		
F	Wahlenbergia communis	N	0.1	10		
S	Cassinia uncata.	N	0.2	5		
F	Veronica perbella	N	0.1	4		
F	einadia hastata.	N	0.1	20		
S	Bursaria spinosa.	N	0.3	4		
	lantana Camara.	HTE	1	24		
G	Cyperus spp.	N	0.1	1		
G	fimbristylis dichotoma	N	0.1	20		
O	hardenbergia violacea.	N	0.1	10		
F	goodenia hederacea sub	N	0.1	30		
G	lepidosperma laterale.	N	0.2	20		
S	acacia falcata.	N	0.1	5		
G	cristida vagans	N	10	700		
S	Daviesia ulicifolia.	N	0.2	1		
G	echinopogon caespitosus	N	0.1	10		
	Cenchrus clandestinum	HTE	0.1	20		
O	passiflora herbertiana	N	0.1	2		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3	Survey Name	Plot Identifier	Recorders
Date 27 6 18	Blackhill Rd	B18	AC + PS

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
	Senecio madagascariensis	HTE	0.1	10.		
F	Solanum prinophyllum	N	0.1	5.		
	Ehrharta erecta.	HTE	0.5	100		
	Hypochaeris radicata	E	0.2	30.		
F	Commelina cyanea	N	0.1	40.		
S	Pultenaea euchilla.	N	0.2	2		
	Paspalum dilatatum.	HTE	0.1	2		
F	Brunoniella australis	N	0.1	1		
G	Cyperus gracilis.	N	0.1	10.		
F	Cotula spp.	N	0.1	10		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code if 'top 3'.**

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date	27 6 18	Survey Name	Zone ID	Recorders			
Zone 56	Datum GDA 94	Backhill Ind	VZA	Adam Conaran + P. Smith			
Easting 370671	Northing 6367606	Plot ID	B19 (286)	Plot dimensions	20x20	Photo #	0138
		IBRA region	Sydney Basin	Midline bearing from 0 m	290°		
Vegetation Class	Hunter-Macleay Dry Sclerophyll Forest					Confidence: H M L	
Plant Community Type	1592			EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	2
	Grasses etc.	5
	Forbs	8
	Ferns	0
	Other	3
Sum of Cover of native vascular plants by growth form group	Trees	45.1
	Shrubs	0.2
	Grasses etc.	20.7
	Forbs	1.1
	Ferns	0
	Other	0.5
High Threat Weed cover		30.9

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BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	IIII IIII I (11)	
20 – 29 cm	IIII IIII II (12)	
10 – 19 cm	II (2)	
5 – 9 cm	/	
< 5 cm	/	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	IIII IIII IIII II (19m)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	70	25	40	90	80	15	10	10	0	5										
Average of the 5 subplots	61					8														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	R	Veg fairly young lacks recruitment & LOS
Cultivation (inc. pasture)			
Soil erosion			VO
Firewood / CWD removal			
Grazing (identify native/stock)	3	R	Cattle grazing extensive. lacks midstorey
Fire damage		/	
Storm damage		/	
Weediness			Many exotic grasses.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 27 06 18	Blackhill ind	B19	A. CAVALLARO / P. Smith

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus fibrosa	N	25	6		
T	Corymbia maculata	N	20	5		
	Sida rhombifolia	E	0.2	100		
G	Paspalidium distans	N	15	500		
F	Pratia purpurascens	N	0.2	50		
F	Enadia hastata.	N	0.1	50		
	Axonopus fissifolius	HTE	0.2	20		
G	Microlaena stipoides	N	[illegible]	100		
	Cynodon dactylon	E	2	100		
	Solanum nigrum	E	0.1	10		
	Hypochaeris radicata.	E	0.2	50		
	Senecio sp	E	0.1	10		
	cenchrus clandestinum.	HTE	10	200		
F	Commelina cyanea	N	0.1	20		
G	Cyperus gracilis	N	0.1	20		
G	Entolasia stricta	N	0.5	50		
F	Enadia trigynus	N	0.1	10		
D	Glycine clandestina	N	0.1	5		
F	Oxalis perennans	N	0.1	10		
F	Solanum prinophyllum.	N	0.1	10		
	Senecio madagascarensis	HTE	0.1	20		
F	Cotula sp	N	0.1	5		
T	Notelaea longifolia	N	0.1	1		
G	Lomandra multiflora	N	0.1	1		
O	Pandorea pandorana	N	0.2	20		
O	Desmodium varians	N	0.2	30		
	~~Ehrharta~~ ~~erecta~~ Ehrharta erecta	HTE	~~25~~ 5	200		
S	Bursaria spinosa	N	0.1	1		
	Cortularia . spp.	E	0.1	1		
F	Plectranthus parviflorus.	N	0.1	1		
	Plantago lanceolata	E	0.1	10		
S	Pahmania sylvestris	N	0.1	1		
	Castrum praecox	HTE	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 3

Date	27 6 18	Survey Name	Zone ID	Recorders			
Zone 56	Datum GDA94	Bochill Ind	VZ 2	Adam Cavallo + P. Smith			
Easting 370150	Northing 6366993	Plot ID	B20 (287)	Plot dimensions	20x20	Photo #	0143
		IBRA region	Sydney Basin	Midline bearing from 0 m	110°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence: H M L	
Plant Community Type		1592		EEC: Y		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	6
	Shrubs	1
	Grasses etc.	15
	Forbs	16
	Ferns	1
	Other	5
Sum of Cover of native vascular plants by growth form group	Trees	36.2
	Shrubs	0.1
	Grasses etc.	17.8
	Forbs	13.6
	Ferns	0.1
	Other	1.3
High Threat Weed cover		25.5

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BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	
50 – 79 cm		
30 – 49 cm	11 (2)	
20 – 29 cm	IIII IIII II (12)	
10 – 19 cm	IIII IIII I (11)	
5 – 9 cm	IIII (5)	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	IIII IIII III (14)	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	35 85 30 75 65	10 10 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	57	4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			past clearing, limited mid storey
Cultivation (inc. pasture)			
Soil erosion			bare ground in places
Firewood / CWD removal			
Grazing (identify native/stock)			cattle grazing
Fire damage			
Storm damage			
Weediness			
Other			large thickets of lantana - some good weeds near creekline.

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 27 6 18	Blackhill Ind	B020	AC/BS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata	N	5	1		
T	Eucalyptus fibrosa	N	20	1		
T	Eucalyptus. paniculata	N	5	1		
T	Notelea longifolia	N	1	2		
	Lantana camara	HTE	25	15		
	Sida rhombifolia	E	0.5	30		
G	Microlaena stipoides	N	15	200		
G	Paspalidium distans	N	5	100		
	Ehrharta erecta	E	1	50		
G	Glycine clandestina.	N	0.5	100		
F	Pratia purpurascens	N	1	200		
F	Brunonella australis	N	0.2	50		
G	Themeda triandra	N	0.4	100		
G	Cyperus gracilis.	N	0.1	2		
F	Persicaria decipiens	N	0.1	5		
	Plantago lanceolata.	E	0.2	20		
	Cynodon dactylon.	E	5	150		
G	Oplismenus aemulus?	N	0.5	30		
F	Solanum prinophyllum	N	0.1	10		
F	Cassia parvifolia	N	0.1	30		
F	Enadia hastata	N	0.2	15		
G	Lomandra [illegible] confertifolia.	N	0.1	2		
F	Commelina cyanea	N	0.5	30		
F	Dianella revoluta.	N	0.1	3		
G	Panicum simile	N	0.1	2		
G	Juncus usitatus	N	0.1	10		
	Setaria parviflora	HTE	0.2	50		
E	Chloris gayana	E	0.1	10		
	Sporobolus africanus.	E	0.2	20		
F	Opercularia diphylla.	N	0.1	2		
G	Dichelachne sp	N	0.1	5		
F	Vicia hederacea	N	0.1	2		
	~~Goodenia~~		0.			
G	Imperata cylindrica.	N	0.1	3		
O	Desmodium varians	N	0.1	5		
F	Wahlenbergia communis	N	0.1	4		
G	Lomandra filiformis.	N	0.2	5		
F	Oxalis perennans	N	0.1	20		
F	Rumex sp.	N	0.1	6		
	Aeonium [illegible]	HTE	02	50		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 2 of 3

Date	Survey Name	Plot Identifier	Recorders
27 6 18	Blackhill Incl.	B20	AC + BS.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Alphitonia excelsa	N	0.2	2.	M	
	Paspalum ~~dilatatum~~ dilatatum	HTE	0.1	10		
	Verbena bonariensis	E	0.5	30		
	Solanum nigrum.	E	0.1	1		
	Senecio madagascariensis	HTE	0.2	30		
F	Rhodiola carolinana	E	0.2	10		
G	Dicondra repens.	N	0.1	10		
F	Anthela jagan?	N	0.5	20		
O	Plectanthus parviflorus.	N	0.1	2		
F	Kennedia prostrata.	N	0.1	1		
G	Eragrostis sp	N	0.5	30		
	Bothriochloa macra.	E	0.2	100		
G	Cotula sp	N	0.2	30		
O	Poa sieb?	E	0.1	20		
O	Glycine tabacina	N	0.1	5		
	Hardenbergia violacea.	N	0.5	10		
S	Cirsium vulgare	N	0.1	2		
T	Lophostemon suaveolens	E	0.1	2		
	Eucalyptus acmenoides	N	0.1	1		
		N	5	2		

See Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 3

		Survey Name	Zone ID	Recorders			
Date	3 7 18	Blackhill Rd	VZ1	Adam Cavaleo + P. Smith			
Zone 56	Datum GDA 94	Plot ID	B21 (255)	Plot dimensions	20x20	Photo #	132/134
Easting 370458	Northing 6366717	IBRA region	Sydney Basin.	Midline bearing from 0 m	15°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence: H M L	
Plant Community Type		1592 - Spotted gum - red ironbark		EEC: ✓		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	7
	Shrubs	6
	Grasses etc.	8
	Forbs	16
	Ferns	-
	Other	9
Sum of Cover of native vascular plants by growth form group	Trees	67.2
	Shrubs	1.9
	Grasses etc.	2.1
	Forbs	7.8
	Ferns	-
	Other	3.5
High Threat Weed cover		55.1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		1 (1)
50 – 79 cm	II (2)	1 (1)
30 – 49 cm	𝍸 𝍸 (10)	
20 – 29 cm	𝍸 𝍸 𝍸 II (17)	
10 – 19 cm	𝍸 𝍸 IIII (14)	
5 – 9 cm	𝍸 𝍸 IIII (14)	
< 5 cm	IIII (4)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	45m.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	65 40 85 60 70	0 0 0 0 10	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	64	2	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			~~no~~ midstorey minimal, understorey.
Cultivation (inc. pasture)			
Soil erosion			cattle track.
Firewood / CWD removal			
Grazing (identify native/stock)			less grazing by cattle comparatively.
Fire damage			
Storm damage			
Weediness			weedy understorey (erharta) & lantana
Other			SE slope.

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 3 7 18	Blacktown Ind	B21 (288)	A. Cavallaro + P. Smith

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Corymbia maculata.	N	15.	6		
T	Eucalyptus moluccana	N	25	2		
T	Eucalyptus acmenioides	N	15.	6		
T	Eucalyptus paniculatum	N	10	13		
S	Bursaria spinosa	N	1	10.		
	lantana camara	HTE	5.	4		
S	Solanum stelligerum	N	0.5	50		
	Ehrharta erecta.	HTE	50.	1000		
F	Brunoniella australis	N	5	100		
F	Plectranthus parviflorus	N	1	500.		
O	glycine clandestina	N	0.2	100.		
O	Commelina cyanotica	N	0.5	100.		
F	Pectranthus parviflorus	N	0.1	30.		
F	Vernonia cinerea	N	0.1	30.		
O	Pandorea pandorana	N	2	50		
F	dichondra repens	N	0.5	100.		
F	Einadia hastata	N	0.1	20.		
G	Microlaena stipoides	N	0.5	300.		
	sida rhombifolia.	E	0.1	200.		
	hypochaeris radicata	E	0.1	50		
G	entolasia stricta	N	0.1	100.		
F	Solanum pimpinellifolium	N	0.1	30.		
G	opismenus aemulus	N	0.2	200.		
G	Paspalidium distans	N	0.5	200.		
F	Viola hederacea.	N	0.1	10.		
O	Desmodium varians.	N	0.1	100		
G	Lomandra filiformis sub filiformis	N	0.1	10.		
G	Cyperus gracilis	N	0.5	50.		
	Plantago lanceolata	E	0.1	20.		
F	Geranium parviflorum	N	0.1	50		
F	Oxalis perennans	N	0.1	50.		
O	Eustrephus latifolius	N	0.1	30.		
S	Maytenus silvestris	N	0.1	5		
F	Solanum bellioides	N	0.1	5.		
	Sporobolus africanus	E	0.1	1		
O	Clematis aristata	N	0.2	220.		
T	Eucalyptus punctata	N	12	13		
O	Geitonoplesium cymosum	N	0.2	10.		
O	Hardenbergia violacea	N	0.1	5.		
T	Ceratopetalum apetalum	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3

Date	Survey Name	Plot Identifier	Recorders
3 7 18	Blacktill Ind	B21 (288)	A. Cavallaro + P. Smith

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
F	Brachyscome multifida	N	0.1	20		
F	Commelina cyanea	N	0.1	20		
S	phyllanthus hirtellus	N	0.1	1		
S	Indigofera australis	N	0.1	1		
	Senecio madagascariensis	HTE	0.1	10		
G	Lomandra ~~multiflora~~ confertifolia	N	0.1	1		
G	Digitaria parviflora	N	0.1	1		
F	Cirsium triganos	N	0.1	2		
	Solanum nigrum	E	0.1	1		
T	Elphitemia excelsa	N	0.1	1		
O	Sarcopetalum harveyanum	N	0.1	1		
F	Opercularia diphylla	N	0.1	2		
	Solanum pseudocapsicum	E	0.1	1		
F	Sigesbeckia orientalis.	N	0.1	1		
S	Acacia elongata	N	0.1	5		

h Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or*

ss, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

10, 20, 30, ... 100, 200, ..., 1000, ...

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	2 8 18	Bhillwdst	V2-5	Phoebe Smith			
Zone 56	Datum GDA 94.	Plot ID	B22 (331)	Plot dimensions	20×50	Photo #	
Easting 0370259	Northing 6566741	IBRA region	Sydney Basin.	Midline bearing from 0 m	20°		
Vegetation Class		Hunter-Macleay Dry Sclerophyll Forest				Confidence: H M L (H circled)	
Plant Community Type		1592			EEC:	Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	–
	Grasses etc.	1
	Forbs	2
	Ferns	–
	Other	–
Sum of Cover of native vascular plants by growth form group	Trees	35
	Shrubs	–
	Grasses etc.	10.
	Forbs	0.3
	Ferns	–
	Other	–
High Threat Weed cover		90

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		1 (1)
50 – 79 cm	1 (1)	
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	10m.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	1, 2, 1, 1, 1	10, 20, 0, 1, 0	0, 0, 0, 0, 0	0, 0, 0, 0, 0
Average of the 5 subplots	1.2	2.6.	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			extensive clearing, no mid storey, minimal canopy
Cultivation (inc. pasture)			pasture paddock
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			cattle grazing
Fire damage			
Storm damage			
Weediness			dense weedy groundcover.
Other			extreme disturbance.

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 2 8 18	B/hill indust	22 (331)	phoebe smith.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus moluccana	N	15	1		
T	Corymbia maculata.	N	20	1		
	Araujia fissilis.	HTE	60.			
	Sporobolus africanus.	E	1	40.		
	Senecio madagascariensis	HTE	5			
	Plantago lanceolata.	E	15			
	Hypochaeris radicata.	E	1	100.		
F	~~[illegible]~~ cotula australis	E	5			
	~~[illegible]~~ Lysimachia arvensis	E	2	50.		
	Sida rhombifolia.	E	0.5	30.		
F	Plectranthus parviflorus	N	0.2	200		
F	Oxalis perennans.	N	0.1	200.		
	~~[illegible]~~ Cirsium vulgare	E	0.1	10.		
	Cenchrus clandestinus.	HTE	25			
	Glycine clandestina.	E	25			
G	Juncus usitatus.	N	0.2	10.		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 3

		Survey Name	Zone ID	Recorders			
Date	20 07 18	B/Hill Index	VZ6	AC / PS			
Zone	Datum	Plot ID	B0 (304)	Plot dimensions	5x20	Photo #	100-13
56	GDA94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	240°		
369584	6367724						
Vegetation Class						Confidence: H M L	
Plant Community Type		1592		EEC: ?		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	8
	Shrubs	12
	Grasses etc.	10
	Forbs	4
	Ferns	2
	Other	5
Sum of Cover of native vascular plants by growth form group	Trees	42.6
	Shrubs	63.5
	Grasses etc.	80.5
	Forbs	5.7
	Ferns	6
	Other	1.0
High Threat Weed cover		16.6

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (1)	1 (1)
50 – 79 cm	1 (1)	
30 – 49 cm	III (3)	
20 – 29 cm	IIII I (6)	
10 – 19 cm	(53)	
5 – 9 cm	(47)	
< 5 cm	(59)	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	4 m.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 40 30 70 70	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	48	0	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 3	Survey Name	Plot Identifier	Recorders
Date 20 07 18		BO	

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Angophora costata	N	10	20+		
T	Eucalyptus fibrosa	N	5			
T	Corymbia maculata	N	1	2		
T	Eucalyptus globoidea.	N	15			
S	Acacia elongata	N	10			
S	Dodonea triquetra	N	20			
S	Acacia falcata.	N	0.5	50.		
T	Eucalyptus punctata.	N	10.			
S	acacia ulicifolia.	N	1	2		
S	Daviesia ulicifolia.	N	1	4		
	Chloris gayana	HTE	10.			
G	Themeda triandra	N	40			
G	Entolasia stricta.	N	5			
	Conyza sp	E	0.5	20		
E	cheilanthes sieberi	N	5			
O	Billardiera scandens.	N	0.5	30		
G	Aristida vagans.	N	1	100		
T	Glochidion ferdinandi	N	0.5	10.		
	plantago lanceolata.	E	1	100.		
	andropogon virginicus	HTE	5.			
S	leptospermum polygalifolium	N	30.			
F	Dianella caerulea var. producta	N	5.			
G	lomandra longifolia	N	1	300		
F	pratia purpurascens.	N	0.5	300		
	hibbertia pilosa.	HTE	0.5	50		
E	adiantum aethiopicum.	N	1	200.		
F	goodenia ovata	N	0.1	10.		
S	Bursaria obovata	N	0.2	15.		
O	glycine clandestina	N	0.2	20.		
G	imperata cylindrica	N	30			
S	Persoonia linearis	N	0.2	10.		
	lonicera canadensis	HTE	0.5	20.		
G	entolasia marginata.	N	0.5	100		
G	rhytidosperma pallidum.	N	0.2	200		
G	panicum simile.	N	0.1	20.		
S	Banksia spinosa.	N	0.2	1		
S	Cassinia aculeata.	N	0.1	10.		
	hypochaeris radicata.	E	0.5	50		
O	Hardenbergia violacea.	N	0.1	2		
	Centaurea solstitialis	HTE	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet 3 of 3	Survey Name	Plot Identifier	Recorders
Date 20 07 18	B/hill Indest	BO (354)	ACIPS.

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
O	Inbtertic species	N	0.1	1		
	Paspalum dilatatum.	HTE	0.5	30		
S	Polycias sambucifolia.	N	0.2	2		
T	rotelaea longifolia.	N	0.1	1		
T	Allocasuarina littoralis.	N	1	2		
G	lepidosperma laterale	N	0.1	1		
S	acacia longifolia.	N	30.1	1		
G	digitaria parviflora	N	0.1	1		
O	eustrephus latifolius.	N	0.1	10		
F	Oxalis perennes	N	01	10.		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Appendix E BAM Calculator Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011491/BAAS17044/18/00011492	17032_ Black Hill Industrial Estate_revision	10/06/2021
Assessor Name	Report Created	BAM Data version *
Matt Doherty	09/07/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS17044	Finalised	09/07/2021
Assessment Revision	Assessment Type	BOS entry trigger
1	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* 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	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter											
1	1592_High	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	67.3	67.3	22.1	Endangered Ecological Community		High Sensitivity to Potential Gain	2.00		745
2	1592_Moderate	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	49.7	49.7	29.1	Endangered Ecological Community		High Sensitivity to Potential Gain	2.00		722
3	1592_Low-Grassland	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	14.9	14.9	2.6	Endangered Ecological Community		High Sensitivity to Potential Gain	2.00		0
4	1592_Low	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	45.4	45.4	17.5	Endangered Ecological Community		High Sensitivity to Potential Gain	2.00		398

5	1592_Low_ST	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	12.7	12.7	1.5	Endangered Ecological Community		High Sensitivity to Potential Gain	2.00		0
										Subtotal	**1865**
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley											
6	1584_High	Not a TEC	82.4	82.4	0.78			High Sensitivity to Potential Gain	1.50		24
										Subtotal	**24**
										Total	**1889**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

Appendix F EPBC Likelihood of Occurrence Table

EPBC Likelihood of Occurrence

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Birds				
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-Oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark *Eucalyptus eugenioides* and other Stringybark species, and Broad-leaved Ironbark *E. fibrosa* can also contribute important nectar flows at times. Although the study area comprises suitable foraging habitat, surveys undertaken by RPS (2017) on site, in accordance with EPBC Act guidelines, found no Regent Honeyeaters on site. Additionally, the site is located outside important habitat areas (Breeding) that have been developed by OEH.	Unlikely
Botaurus poiciloptilus	Australasian Bittern	Endangered	Inhabits dense tall sedge vegetation and permanent wetlands. The site comprises dry sclerophyll forest with no permanent wetlands. No suitable habitat occurs within the study area.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Calidris canutus	Red Knot	Endangered Migratory	Inhabits intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. No suitable habitat occurs within the study area.	Unlikely
Calidris ferruginea	Curlew Sandpiper	Critically Endangered & Migratory	Inhabits intertidal mud flats in estuaries, bays, lakes and lagoons or areas of bare mud or sand on which to forage. No suitable habitat occurs within the study area.	Unlikely
Calidris tenuirostris	Great Knot	Critically Endangered Migratory	Inhabits sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. No suitable habitat occurs within the study area	Unlikely
Charadrius leschenaultii	Greater Sand Plover	Vulnerable Migratory	Inhabits coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. No suitable habitat occurs within the study area	Unlikely
Charadrius mongolus	Lesser Sand Plover	Endangered Migratory	Inhabits coastal areas in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. No suitable habitat occurs within the study area	Unlikely
Dasyornis brachypterus	Eastern Bristlebird	Endangered	Inhabits dense, low vegetation including heath and open woodland with a heathy understorey. Potential habitat is in a modified or degraded state due to cattle grazing and a managed understorey. The site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintaining a	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			managed understorey of the native vegetation. This land management practice has reduced the likelihood of this species occurring in the study area.	
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	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. No suitable habitat occurs within the study area.	Unlikely
Grantiella picta	Painted Honeyeater	Vulnerable	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. No suitable habitat occurs within the study area.	Unlikely
Lathamus discolor	Swift Parrot	Critically Endangered	This species migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. The study area comprises suitable foraging habitat, and this species may seasonally use resources within the study area opportunistically or during migration. However, surveys undertaken by RPS (2017) on site, in accordance with EPBC Act guidelines, found no Swift Parrots on site. Additionally, the species is unlikely to be dependent on habitat within the study area (i.e. for breeding or important life cycle periods), or habitat is in a modified or degraded state.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Limosa lapponica baueri	Bar-tailed Godwit	Vulnerable	Inhabits coastal environments such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. No suitable habitat occurs within the study area.	Unlikely
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	Inhabits coastal environments such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. No suitable habitat occurs within the study area.	Unlikely
Numenius madagascariensis	Eastern Curlew	Critically Endangered & Migratory	Inhabits intertidal mud flats in estuaries, bays, lakes and lagoons. No suitable habitat occurs within the study area.	Unlikely
Rostratula australis	Australian Painted Snipe	Endangered	Inhabits floodplain wetlands of major coastal rivers, minor flood plain, coastal sandplain wetlands and estuaries. No suitable habitat occurs within the study area.	Unlikely
Frogs				
Heleioporus australiacus	Giant burrowing Frog	Vulnerable	Inhabits open dry sclerophyll forest, woodlands, and heaths, breeding in soaks or pools within first or second order streams. Open dry sclerophyll forests on site have high levels of disturbance from pastoral land management practices and as such do not constitute suitable habitat or this species.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The permanent water bodies present are infested with water hyacinth containing no suitable vegetation in the form of bullrushes and spikerushes.	Unlikely
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	Inhabits wet and dry sclerophyll forests and heathlands, breeding in a wide range of water bodies including semi-permanent dams, permanent ponds, ephemeral pools, and permanent streams. The drainage lines present do not contain permanent water. Open dry sclerophyll forests on site have high levels of disturbance from pastoral land management practices and as such do not constitute suitable habitat or this species.	Unlikely
Mixophyes balbus	Stuttering Frog	Vulnerable	Inhabits sclerophyll forests and rainforests of upland areas, breeding in forest streams with permanent water. The drainage lines present do not contain permanent water. No suitable habitat occurs within the study area.	Unlikely
Mixophyes iteratus	Giant Barred Frog	Endangered	Inhabits moist riparian habitats in rainforests or wet sclerophyll forest, generally lower elevation permanent or semi-permanent streams where they breed. The study area comprises vegetation in the form of dry sclerophyll forest which does not align with this species associated habitat.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			No suitable habitat occurs within the study area.	
Reptiles				
Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable	Inhabits sandstone land forms, typically among exposed sandstone outcrops in a variety of vegetation types. The study area is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned No suitable habitat occurs within the study area.	Unlikely
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Found mainly in areas with extensive cliffs and caves. 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. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. No caves are present on site thus no suitable habitat occurs within the study area.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Dasyurus maculatus maculatus (SE mainland population)	Spotted-tail Quoll	Endangered	Inhabits a wide range of habitat types, including woodlands, rainforest, coastal heath and inland riparian forest. This species uses fallen logs and hollow bearing trees. Predates primarily on terrestrial fauna, however is an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Potential habitat is present within the study area, however this is in a degraded state due to cattle grazing and a managed understorey. The site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintaining a managed understorey of the native vegetation. This land management practice has reduced the likelihood of this species occurring in the study area due to a reduction in prey and denning sites.	Unlikely
Petauroides volans	Greater Glider	Vulnerable	Inhabits and is restricted to eucalypt forests and woodlands. This species favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. No continuous stretch of vegetated forest and woodlands are present within the study area. Additionally, the study area is located outside of this species geographic distribution.	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Generally, browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. The site comprises no suitable habitat in the form of rocky landscape characteristics and no records exist as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely
Phascolarctos cinereus	Koala	Vulnerable	Inhabit eucalypt woodlands and forests in a fragmented distribution throughout eastern Australia. In NSW this species mainly occurs on the central and north coasts	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			with some populations in the west of the Great Dividing Range but have been recorded in the southern tablelands. This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. This species may be an occasional visitor to the study area, but habitat similar to the study area is widely distributed in the local area, indicating the species is not dependent on the available habitat within the impacted area for breeding or important life cycle periods. Past field surveys did record the presence of low numbers of *Eucalyptus tereticornis* (Koala Feed Tree). At no point was this species observed at >15% cover triggering the need for a SEPP 44 assessment. RPS (2017) recorded no Koalas in their targeted surveys.	
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	Vulnerable	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The study area is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. Potential habitat is in a modified or degraded state due to cattle grazing and a managed understorey. The site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintaining a managed understorey of the native vegetation. This land management practice has reduced the likelihood of this species occurring in the study area	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	Inhabits heathlands, woodlands with dense undergrowth, vegetated sand dunes, generally in areas with soils suitable for digging. The study area is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. Potential habitat is in a modified or degraded state due to cattle grazing and a managed understorey. The site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintaining a managed understorey of the native vegetation. This land management practice has reduced the likelihood of this species occurring in the study area	Unlikely
Pteropus poliocephalus	Grey-headed Flying Fox	Vulnerable	Occurs 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. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The site comprises dry sclerophyll forest which does not align with the associated vegetation for this species. Furthermore, no known roosting colonies are present on site.	Unlikely
Plants				

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Acacia bynoeana	Bynoe's Wattle	Vulnerable	This species occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include *Corymbia gummifera, Eucalyptus haemastoma, Eucalyptus parramattensis*, *Banksia serrata* and *Angophora bakeri.* The vegetation within the subject site is a dry sclerophyll forest formation, in which only one of the listed over-storey species associated with the threatened species occurs (*Corymbia gummifera*) The site is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. This species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintain a managed understorey of the native vegetation. This land management practice has limited the likelihood of this species being detected within the subject site.	Unlikely
Angophora inopina	Charmhaven Apple	Vulnerable	This species occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest. The site comprises only one of the associated canopy species, indicating a reduction in the likelihood of this species occurrence in the study area. Additionally, this species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely
Asterolasia elegans		Endangered	This species is known from only seven populations. Occurs on Hawkesbury sandstone in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The study area is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. The site is also located outside of its known geographic distribution.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Caladenia tessellata	Thick-lipped Spider-orchid	Vulnerable	This species is generally found in grassy sclerophyll woodland on clay loam or sandy soils. Potential habitat is present in the study area. However, this species is unlikely to be dependent on habitat within the study area. Potential habitat is in a modified or degraded state due to cattle grazing and a managed understorey. RPS (2017) undertook targeted surveys for this species during its optimal flowering time (Sept-Oct) and was not recorded.	Unlikely
Commersonia prostrata	Dwarf Kerrawang	Endangered	This species inhabits sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark (*E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*E. haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago. The vegetation within the study area is in the form of dry sclerophyll forest dominated by *C. maculata* and Ironbarks which does not align with this species known associated vegetation. In addition, the site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintain a managed understorey of the native vegetation. This land management practice has limited the likelihood of this species being detected within the subject site.	Unlikely
Cryptostylis hunteriana	Leafless Tongue-orchid	Vulnerable	This species is known to be extremely cryptic as it does not flower each year. Known to occur within a wide range of habitats including woodlands to swamp heaths. Within the Hunter region larger populations have been typically found in woodland dominated by *Eucalyptus racemosa* (Scribbly Gum) and it prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedge land, or moist to dry clay loams in coastal forests. This species is known to occur in association with *C. subulata* and *C. erecta.* The vegetation within the subject site is a dry sclerophyll forest formation, which is one of the many variable vegetation this species is associated. The site is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. This species has not been recorded within the locality as defined on the OEH	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			Bionet using a 10km search radius of the locality. In addition, the site has been used as a commercial poultry farm and since the decommissioning the site has been routinely grazed, maintaining a managed understorey of the native vegetation. This land management practice has limited the likelihood of this species being detected within the subject site.	
Cynanchum elegans	White-flowered Wax Plant	Endangered	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation and other associated vegetation types such as littoral rainforest; coastal scrub and open forest and woodland. Species associated include; 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 Honey myrtle *Melaleuca armillaris* scrub to open scrub. The study area vegetation does provide marginal habitat in the form of Spotted Gum aligned open forest and woodland. The current grazing pressures and historic disturbance associated with the subject site indicate that it is likely to reduce the occurrence of this species within the study area, though cannot be ruled out on this attribute alone. On this basis further survey is required.	Likely
Eucalyptus glaucina	Slaty Red Gum	Vulnerable	This species grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils. This species is found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, and west of Maitland (DoEE 2008). The site is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is consistent with the moderately fertile and well-watered soils this species is generally aligned. As such similar vegetation occurs on site in the formation of a dry sclerophyll forest. On this basis further survey is required.	Likely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Eucalyptus parramattensis subsp. decadens	Earp's Gum	Vulnerable	This species generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. Only two separate meta-populations are recorded, one of which is in the Kurri Kurri area. The site is located within the Beresfield soil landscape in which topsoils are mapped to be predominantly a black loam, which is inconsistent with the sandy soils this species is generally aligned. Furthermore, this species has not been recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality	Unlikely
Euphrasia arguta		Critically Endangered	This species has been recorded in eucalypt forests with a mixed grass and shrub understorey. Dense populations are known to occur in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. The study area is located outside of its known geographic distribution.	Unlikely
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	This species is sporadically distributed throughout the Sydney Basin with sizeable populations in the Hunter in the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast. This species grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Occurs in a range of vegetation types from heath and shrubby woodland to open forest, the Hunter in Kurri Sand Swamp Woodland and is also known to occur in *C. maculata- A. costata* open forest. Associated species in the Kurri Sand Swamp Woodland include *Eucalyptus parramattensis* subsp. *decadens*, *Angophora bakeri* and *E. fibrosa* with *Acacia elongata*, *Dillwynia parvifolia*, *Melaleuca thymifolia*, *Grevillea montana*, *Eragrostis brownii* and *Aristida vagans*. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Hunter occurrences are usually 30-70m ASL, while	Likely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			the southern Sydney occurrences are typically at 100-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks. Similar vegetation occurs on site in the formation of dry sclerophyll forest and in particular in the northern edge of the study area where it transitions into *C. maculata – A. costata* open forest. One record exists as defined on the OEH Bionet using a 10km search radius of the locality. On this basis further survey is required.	
Melaleuca biconvexa	Biconvex Paperbark	Vulnerable	This species generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. This species is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. The vegetation within the subject site is predominantly a dry sclerophyll forest formation of which is not associated with this species. The watercourse is severely disturbed with large thickets of *Lantana camara* due to erosion from cattle grazing and past land disturbance. No records exist as defined on the OEH Bionet using a 10km search radius of the locality.	Unlikely
Pelargonium sp. Stristellum	Omeo Stork's-bill	Endangered	This species has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. No suitable habitat occurs within the study area.	Unlikely
Phaius australis	Lesser Swamp-orchid	Endangered	Inhabits swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. The study area is located outside of its known geographic distribution. No suitable habitat occurs within the study area.	Unlikely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Prasophyllum sp. Wybong	A leek orchid	Critically Endangered	Known to occur in open eucalypt woodland and grassland. The study area is located outside of its known geographic distribution.	Unlikely
Pterostylis gibbosa	Illawarra Greenhood	Endangered	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. 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*. No suitable habitat occurs within the study area.	Unlikely
Rhizanthella slateri	Eastern Underground Orchid	Endangered	Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Limited potential habitat occurs within the study area and habitat is mainly in a modified or degraded state due to cattle grazing and a managed understorey.	Unlikely
Rutidosis heterogama	Heath Wrinklewort	Vulnerable	This species grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides. This species has been recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. Potential habitat is present in the study area; however, the site is in a highly disturbed state due to current cattle grazing and historic understorey management. Although the current grazing pressures and historic disturbance associated with the subject site indicates that it is likely to reduce the occurrence of this species within the study area due to a major loss in shrubby understorey, similar vegetation occurs on site and it is located within its known geographic distribution. This species has been	Likely

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
			recorded within the locality as defined on the OEH Bionet using a 10km search radius of the locality. On this basis further survey is required.	
Syzygium paniculatum	Magenta Lilly Pilly	Vulnerable	Occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. No suitable habitat occurs within the study area	Unlikely
Tetratheca juncea	Black-eyed Susan	Vulnerable	Locally this species is usually found in low open forest/woodland with an undisturbed mixed shrubby understorey and grassy groundcover often in association with the Awaba Soil Landscape. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. Current grazing pressures and historic disturbance on site has resulted in a highly modified landscape causing a major loss in shrubby understorey which has reduced the likelihood of occurrence of this species on site. RPS (2017) undertook targeted surveys for this species during its optimal flowering time (Sept-Oct) and was not recorded. However, due to this species inconsistent flowering events, potential habitat present in the north west corner of the study area, and records existing as defined on the OEH Bionet using a 10km search radius of the locality. The need for further survey cannot be ruled out.	Likely
Thesium australe	Austral Toadflax	Vulnerable	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). Marginal potential habitat is present in the study area. However, this species is unlikely to be dependent on habitat within the study area, and habitat is in a modified or degraded state due to cattle grazing and a managed understorey.	Unlikely

Appendix G Personnel Qualifications

Name	Title	Qualifications	Roles
Matt Doherty	Director	▪ BAM Assessor (#BAAS17044) ▪ B. Landscape Management and Conservation (Soil and Water Management) ▪ Bush Regeneration Cert IV	Approval of BDAR. Review and approval of BDAR. Contributor to BDAR and fieldwork including fauna surveys. Overarching guidance of BAM assessment and BDAR development.
Adam Cavallaro	Senior Ecologist	▪ BAM Assessor (#BAAS18056) ▪ B. Environmental Science (Conservation Ecology) ▪ Bush Regeneration Cert IV	Undertake BAM assessment and BDAR. Field work including PCT identification, vegetation mapping, and threatened flora surveys. Contributor to BDAR and preparation of mapping.
Phoebe Smith	Field Ecologist	▪ B. Environmental Science and Management (Honours) ▪ Master Environmental Management & Sustainability	Field work including threatened flora and fauna surveys, assisting with vegetation assessment. Contributor to BDAR
Bret Stewart	Ecologist	▪ Bachelor of Science in Evolution and Ecology	Field work including threatened flora and fauna surveys, assisting with vegetation assessment.
Coral Pearce	Ecologist	▪ Ms. Of Science – Ecology	Field work including BAM plot and threatened species habitat assessment Contributor to BDAR

Chris Spraggon	Ecologist	▪ B. Science (Honours) ▪ Conservation & Land Management Cert III	Field work including BAM plot and threatened species habitat assessment

Appendix H Detailed Project Description

3 Description of the Development

The proposed development seeks consent for the subdivision of Part Lot 1131 in Deposited Plan 1057179 to create 39 large industrial lots, as shown on the subdivision plan[19], which is included within Appendix C. Additionally, the proposal includes the remediation of the site to ensure that site is suitable for future occupation for industrial use.

This proposal constitutes stage 2 of a concept development application submitted to Cessnock City Council, pursuant to s.22 of the *Environmental Planning and Assessment Act 1979* (refer to section 6.8.3). This stage of the concept development application includes:

- Creation of two signalised intersections to provide suitable access to the subdivision.
- The realignment of the existing watercourse that traverse the western portion of the site.
- Civil earthworks to provide a suitable foundation for future industrial development,
- Extension, augmentation and/ or adaptation of essential services (*i.e.* water, sewer & telecommunications) to cater for the future tenants of the industrial development,
- Construction of a 132/11kV substation and the relocation of the existing aboveground 132kV high voltage transmission line,
- Remediation of the site to ensure suitable occupation for industrial use,
- Subdivision of Part of Lot 1131 in Deposited Plan 1057179 to create 39- industrial lots and 1 environmental conservation lot; to be delivered in six stages,
- Construction of the ring-road network to provide suitable access to all proposed industrial lots, and
- Infrastructure to capture, detain and treat all stormwater collected on site.

More detail in relation to the components of the proposed development are provided below.

3.1 Access

Access to the site will be obtained off John Renshaw Drive via two signalised intersections; as depicted on the concept plan prepared by ADW Johnson and included within Appendix C. The eastern intersection will provide shared access for the proposed development and the adjoining development to the east of the subject site. Vehicles will be able to enter and leave the site via both intersections east or west bound.

3.2 Channel Realignment

It is proposed that a vegetated channel will be constructed to convey road and lot runoff northwards into an upper tributary of Weakley's Flat Creek. The channel is a realignment of a 1st order stream. The channel shall be trapezoidal in shape, vegetated and generally

[19] ADW Johnson. (2018). *Plan of Subdivision*. Drawing Reference 239590-PSK-001. Revision D

parallel with the western access road as illustrated within the concept engineering plans contained in Appendix C.

3.3 Earthworks

Substantial earthworks are proposed to provide to achieve overall finished site levels as shown in the civil drawings at Appendix C. To achieve the required finished site levels across the site, the proposal requires a significant amount of cut & fill. It is important to note that no cut/ fill will be imported or exported as a result of the development.

3.4 Infrastructure and Services

The proposed development has access to all essential services, as previously discussed in section 2.4. ADW Johnson have prepared a Water and Wastewater Servicing Strategy to ensure that the proposed development is adequately serviced. These strategies, included within Appendix E, are currently with Hunter Water Corporation for review and endorsement.

In addition, an application has been prepared by Power Design & Energy Projects Pty Ltd to Ausgrid to support the construction of a 132/11kV substation in the south eastern corner of the development site.

It is proposed that gas and telecommunication services will be provided to each of the allotments within the proposed subdivision. Consultation with the relevant service authority for the supply of each serviced will be conducted before the issue of the subdivision certificate.

3.5 Site Remediation

The site will be remediated in accordance with the Remedial Action Plan prepared by JBS&G, which is included in Appendix H. The preferred remedial approach for the impacts comprise:

- Excavation and on-site encapsulation of identified Asbestos Containing Material (ACM) impacted Area of Environmental Concern (AEC),
- Excavation and on-site encapsulation of identified ACM, nutrient and bacterial impacted AEC (i.e. areas where all three of these contaminant groups are present),
- On-site treatment (i.e. excavation, drying and aeration) and reuse of nutrient and bacteria only impacted AEC, and
- Excavation and off-site disposal of any waste material in fill and on ground (aesthetic), with recycling of this material to the extent practicable and onsite reuse after recycling subject to geotechnical considerations.

Unexpected finds that may arise following demolition and during remediation or bulk earthworks will also require to be addressed along similar lines.

3.6 Subdivision and Staging

The proposed subdivision will be delivered in accordance with the staging plan prepared by ADW Johnson and included within Appendix C. The industrial subdivision and site remediation works will be conducted in six stages. Details of the proposed subdivision are provided in Table 4 below.

Table 4: Proposed Subdivision

Stage	No of Lots	Area (ha)
1	Six	19.7
2	Eight	30.71
3	Seven	33.15
4	Six	35.25
5	Six	28.83
6	Five	30.48

The concept proposal allows for flexibility in the staging and timing of development of the catalyst precinct to enable development to respond to changing site conditions, opportunities efficiencies, infrastructure delivery and market demands.

3.7 Stormwater Strategy

The development will be supported by typical civil infrastructure including roads, water and sewer reticulation and other services. Stormwater management infrastructure associated with the development will incorporate a conventional pit-and-pipe drainage network discharging to water courses described in section 2.3.3.

3.8 Waste Management

A Waste Management Plan has been prepared to accompany the development application and has been discussed in section 7.12. The Waste Management Plan has identified the nature and volumes of waste generated as a result of the proposed development, as well as the mitigation measure to be implemented to ensure no adverse harm to human health or environment.

3.9 Analysis of the Alternatives

Due to the extent of contamination present through the site, as part of the preparation of the Remedial Action Plan, a number of remediation options were considered. Each remediation option has considered the treatment of:

- ACM in stockpiles/ surface spoils/ fill,
- Biological & Associated Malodourous Soils, and
- Waste material in fill on ground.

Each options is discussed in further detail below.

3.9.1 Option 1

Onsite treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level.

3.9.1.1 *ACM in stockpiles/ surface spoils/ fill*

Handpicking of ACM within a soil matrix (such as stockpiles/ surface soils/ fill) is labour intensive and can be costly and time consuming. It involves laying the material in remedial 'pads' and repeated raking and hand picking until all ACM is removed. The success of the remediation method is highly dependent upon the soil and the amount of other building rubble present within the fill. The more 'clayey' the soil, or the more building rubble present, the harder it is to achieve validation. Given the relatively minor amount of ACM material identified that requires remediation and the potential difficulties in achieving validation of handpicked soils, this is not the preferred option.

3.9.1.2 *Biological & Associated Malodourous Soils*

Biological impacted soils associated with disposal of poultry carcasses and general poultry operations may not have had sufficient oxygen and time to degrade. Treatment of these aspects may be achievable through excavation, drying and aeration to promote destruction of biological residues. Amendment may be required to assist, and subject to validation the material could then be reused within topsoil. Onsite treatment of biological impacted soils is a possible option.

3.9.1.3 *Waste Material in fill on ground (aesthetic)*

The waste materials, including building rubble and poultry carcasses, in and on soils poses an aesthetic issue that cannot be treated onsite. Screening may assist to segregate waste materials for preferred management (option 3, section 3.9.3).

3.9.2 Option 2

Offsite treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level, after which the soil is returned to the site.

3.9.2.1 *ACM in stockpiles/ surface spoils/ fill*

There are no known licensed offsite treatment facilities to treat asbestos impacted soils. This option is not appropriate.

3.9.2.2 *Biological & Associated Malodourous Soils*

This option is technically feasible, however, it involves duplication of transport and material handling costs; involved in removing the material to an appropriately licensed offsite treatment facility, assuming a facility licenses to treat this type of material can be identified. This option is considered not to be cost effective or sustainable, and offsite treatment facilities may not be licensed to treat these specific impacts.

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3.9.2.3 *Waste Material in fill on ground (aesthetic)*

The waste material poses an aesthetic issue that cannot be treated and returned to the site. This is not a suitable option for remediation.

3.9.3 Option 3

Excavation and offsite removal of the impacted material.

3.9.3.1 *ACM in stockpiles/ surface spoils/ fill*

As the material is bonded and intact (based upon the information obtained to date), removal of ACM sheet is relatively inexpensive, easy to conduct, and the ACM can then be removed from the site. However, considering that considerable excavation and filling of the site is required for development, as well as encapsulation of the ACM impacted soils is possible, and a more financially viable option than disposing it offsite; this is not the preferred option. This would only be considered further is ACM impacted soil was at volumes in excess of that which could be capped onsite, which is considered unlikely.

3.9.3.2 *Biological & Associated Malodourous Soils*

Given the ability to treat this material onsite and subsequent possible reuse of treated material, to minimise offsite disposal volumes and associated cost, this option is not preferred. However, should the preferred option (onsite treatment, section 3.9.1.2) for this material be unsuccessful, or the material be considered unsuitable for reuse for reasons other than the identified impacts (e.g. geotechnical unsuitable), offsite disposal may be a suitable alternative.

3.9.3.3 *Waste Material in fill on ground (aesthetic)*

The waste materials, including building rubble and poultry carcasses, poses an aesthetic issue that cannot be treated and returned to the site. Although, some screening of materials may assist in reducing the volume of material required for disposal. Some materials may also be able to be recycled, which is considered within this 'disposal' option. As such, this option is preferred.

3.9.4 Option 4

Consolidation and isolation of the soil by onsite containment within a properly designed barrier with ongoing management

3.9.4.1 *ACM in stockpiles/ surface spoils/ fill*

Containment of ACM impacted materials is the preferred option given the potential for considerable ACM impacted soil volumes being generated, and the development requiring considerable cut and fill to achieve the design level. It is important to note that, remediation via containment will place restrictions on the proposed redevelopment of the site (i.e. a Site Management Plan, including capping requirements), as well as a legal requirement for ongoing management placed on the ultimate custodian of the land where material is contained.

3.9.4.2 *Biological & Associated Malodourous Soils*

Given the ability to treat this material onsite and subsequent reuse of treated material, to contain this material onsite (without any treatment) is not preferred.

3.9.4.3 *Waste Material in fill on ground (aesthetic)*

As some of these materials may be able to be removed for recycling, and containment may not be feasible for materials that are not able to be compacted without any segregation/ treatment is not the preferred option.

3.10 Capital Investment Value

The estimated Capital Investment Value (CIV) for the Project is approximately $105 million (Appendix O).

Appendix I Fauna Results (MJD Environmental 2017,18 & 21)

Fauna List	
Mammals	
Acrobates pygmaeus	Feathertail Glider
Antechinus stuartii	Brown Antechinus
Astronomus australis	Western White-stripped Free-tailed Bat
*Bos tarus**	Cattle
Chalinolobus dwyeri	**Large-ear Pied Bat (V)**
Chalinolobus gouldii	Gould's Wattled Bat
Chalinolobus morio	Chocolate Wattled Bat
Macropus giganteus	Eastern Grey Kanagaroo
Macropus rufogriseus	Red-necked Wallaby
Miniopterus australis	**Little Bent-wing Bat (V)**
Miniopterus schreibersii oceanensis	**Eastern Bent-winged Bat (V)**
Mormopterus norfolkensis	**Eastern Coastal Free-tailed Bat (V)**
Mormopterus ridei	Ride's Free-tailed Bat
Nyctophilus gouldii	Gould's Long Eared Bat
*Oryctolagus cuniculus **	European Rabbit
Peremeles nasuta	Long-nosed Bandicoot
Petaurus breviceps	Sugar Glider
Pseudocheirus peregrinus	Ringtail Possum
Pteropus poliocephalus	**Grey-headed Flying-fox (V, V)**
Rattus fuscipes	Bush Rat
*Rattus rattus**	Black Rat
Rhinolophus megaphyllus	Eastern Horseshoe Bat
Saccolaimus flaviventris	**Yellow-bellied Sheath-tailed Bat (V)**
Sminthopsis murina	Common Dunnart
Trichosurus vulpecula	Common Brushtail Possum
Vespadelus vulturnus	Little Forest Bat
Vespadelus pumilus	Eastern Forest Bat
*Vulpes vulpes**	Red Fox
Birds	
Acanthiza pusilla	Brown Thornbill
Acanthorhynchus tenuirostris	Eastern Spine Bill
Aegotheles cristatus	Australian Owlet-nightjar
Anas superciliosa	Pacific Black Duck
Cacatua galerita	Sulphur Crested Cockatoo
Cacatua roseicapilla	Galah
Cacomantis flabelliformis	Fantail Cuckoo
Calyptrohynchus funereus	Yellow tailed Black Cockatoo

Chenonetta jubata	Australian Wood Duck
Colluricincla harmonica	Grey Shrike-thrush
Corcorax melanorhamphos	White Winged Cough
Cormobates leucophaeus	White-throated Treecreeper
Corocina novaehollandiae	Black-faced Cuckoo-shrike
Cracticus nigrogularis	Pied Butcher Bird
Dacelo novaeguineae	Laughing Kookaburra
Egretta novaehollandiae	White-faced Heron
Elanus axillaris	Black-shouldered Kite
Eopsaltria australis	Yellow Eastern Robin
Fulica atra	Eurasian Coot
Gymnorhina tibice	Australian Magpie
Hirundo neoxena	Welcome Swallow
Lichenostomus chrysops	Yellow Faced Honeyeater
Malurus cyaneus	Superb Fairy Wren
Manorina melanocephala	Noisy Miner
Manorina melanophrys	Bell miner
Neochmia temporalis	Red Brow Finch
Ocyphaps lophotes	Crested Pigeon
Phaps chalcoptera	Common Bronzewing
Platycerus eximius	Eastern Rosella
Podargus strigoides	Tawny Frogmouth
Pomatostomus temporalis temporalis	**Grey-crowned Babbler (V)**
Psophodes olivaceus	Eastern Whipbird
Rhipidura fuliginosa	Grey Fantail
Sericornis frontalis	White Browed Scrub Wren
Strepera graculina	Pied Currawong
Trichoglossus haematodus	Rainbow Lorikeet
Tyto novaehollandiae	**Masked Owl (V)**
Vanellus miles	Masked Lapwing
Herptofauna	
Crinia signifera	Common Eastern Toadlet
Limnodynastes peronii	Striped Marsh Frog
Intellagama lesueurii	Eastern Water Dragon
Pogona barbata	Bearded Dragon
Pseudechis porphyriacus	Red-bellied black snake
Varanus varius	Lace Monitor

Appendix J RPS Survey Effort Plan & Threatened Fauna Plan (RPS 2017)

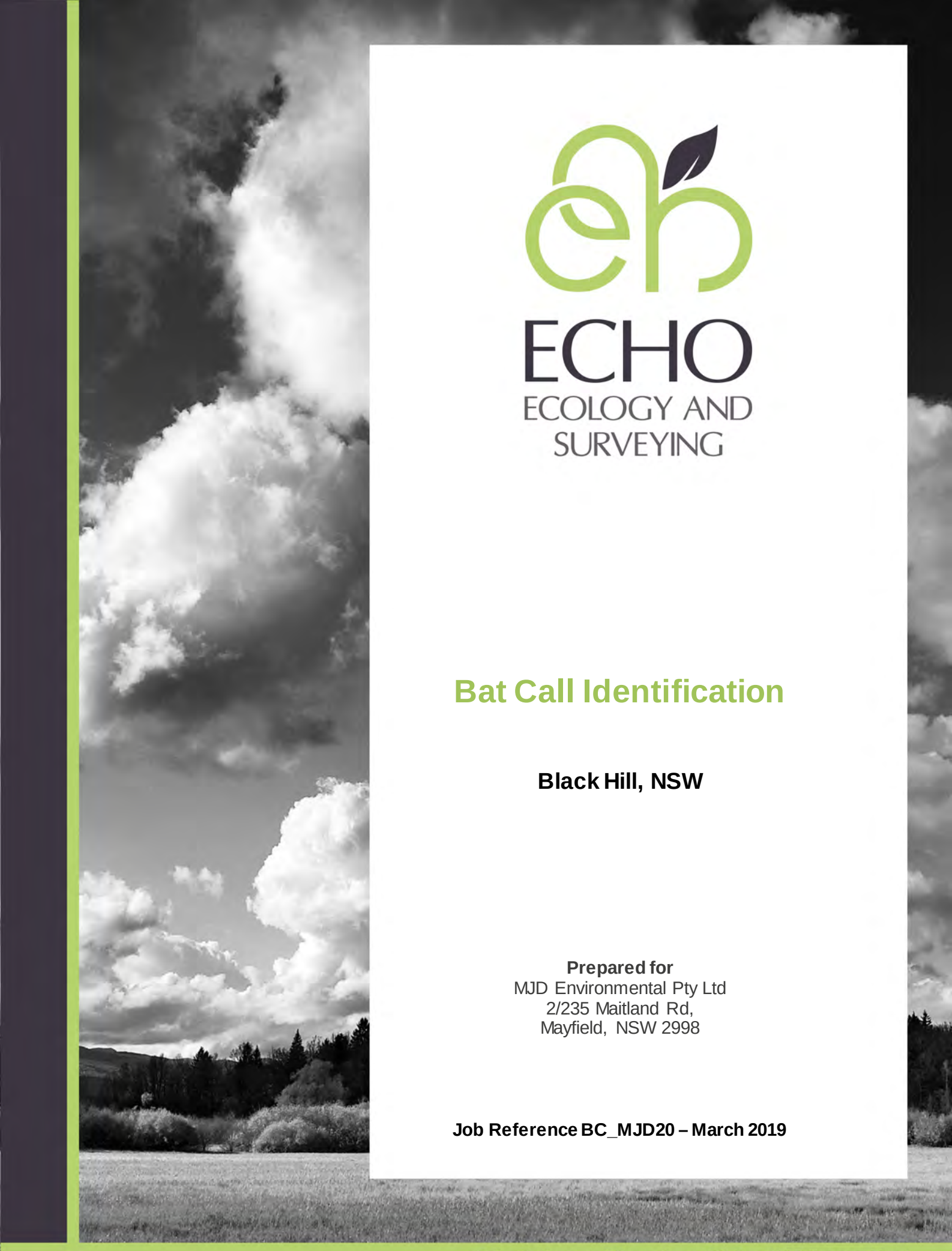
Fauna Survey Effort (RPS)

Fauna Group	Target species	Survey method	Survey effort
Herpetofauna	*Hoplocephalus bitorquatus* (Pale-headed Snake)	▪ **Herpetofauna surveys** targeting areas of appropriate habitat - Targeted habitat searches/habitat surveys - Opportunistic surveys	- Inspecting rock crevices and overhangs - Raking leaf litter and turning logs, rocks and other debris
Terrestrial	*Phascogale tapoatafa (*Common Planigale) *Planigale maculata* (Brush-tailed Phascogale)	▪ **Ground trapping using Elliot A, Elliot B and cage traps.** - Elliot traps baited with a mixture of rolled oats, peanut butter and honey. Cage traps baited with chicken necks. - Traps checked within 2 hours of sunrise each morning and captures then identified and released. - Traps were rebaited where necessary - Selected locations of traplines were based on stratification units as well as presence of understorey vegetation providing terrestrial habitat.	- Six trapping transects were undertaken within the study area containing 25 Elliot A, 25 Elliot B and six cage traps per line. - Total of 450 Elliot A trap nights, 450 Elliot B trap nights and 108 cage trap nights
		▪ **Hair Tubes using Fauna-tech Hair Tubes** - Hair tubes were baited with rolled oat, peanut butter and honey. - Hair samples sent to Barbara Triggs at 'Dead Finish' for analysis	- 10 hair tubes per trapping transects (three), resulting in 180 terrestrial trap nights.
		▪ **Spotlighting** - 75-Watt hand-held spotlight and head torch whilst driving and walking over the study area. - Areas of dense bush were targeted, as well as tracks entering and entering the study area.	- A total of 24 person hours of spotlighting was conducted over 3 nights.
		▪ **Infrared Camera Surveys** - Cameras were mounted in appropriate habitat within study area, designed to take photographs when triggered by motion - Cameras were used to detect both diurnal and nocturnal faunal movement	- Two Reconyx infrared motion cameras were utilised during field surveys - A total of six camera nights were undertaken.
Arboreal	*Petaurus norfolcensis* (Squirrel Glider)	▪ **Arboreal Trapping using mounted Elliot B size Traps** - Traps were baited with a mixture of rolled oats, peanut butter and honey. - Tree trunks were sprayed liberally with a brown sugar and water mix late in the afternoon. Traps were checked early each morning.	- Six trapping transects with six Elliot Size B arboreal traps. - 108 arboreal trap nights over three days within the study area.

Fauna Group	Target species	Survey method	Survey effort
		▪ **Hair Tubes using Fauna-tech Hair Tubes** - Hair tubes were baited with rolled oat, peanut butter and honey. ▪ Hair samples sent to Barbara Triggs at 'Dead Finish' for analysis	- 10 hair tubes per trapping transects (three), resulting in 180 terrestrial trap nights.
		▪ **Spotlighting** - 75-Watt hand-held spotlight and head torch whilst driving and walking over the study area. - Areas of dense bush were targeted, as well as tracks entering and entering the study area.	- A total of 24 person hours of spotlighting was conducted over 3 nights.
		▪ **Infrared Camera Surveys** - Cameras were mounted in appropriate habitat within study area, designed to take photographs when triggered by motion ▪ Cameras were used to detect both diurnal and nocturnal faunal movement	- Two Reconyx infrared motion cameras were utilised during field surveys - A total of six camera nights were undertaken.
		▪ **Call back** for aural recognition of threatened arboreal mammals - Pre-recorded calls of mammals with the potential to occur within the study area were broadcast to elicit vocal responses or to attract nocturnal fauna to the playback site. - Calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1 km under still night conditions	- The call of each species was broadcast for at least five minutes, followed by five minutes of listening, the area was then spotlighted on foot.
Diurnal Avifauna	*Species Credit-Avifauna*	▪ **Systematic diurnal census and opportunistic observations** - Via direct visual observation or by recognition of calls or distinctive features such as nests, feathers and owl regurgitation pellets - Targeted surveys for nectar dependant species were performed during the Spotted Gum (*Corymbia maculata*) flowering period (May to October 2017) to specifically target the Regent Honeyeater and Swift Parrot. Conditions suitable for performing targeted surveys for the Regent Honeyeater were examined on 10 separate days in this period. Conditions observed during the targeted surveys were typified by spot flowering by Spotted Gum.	- Opportunistically and during field work

Fauna Group	Target species	Survey method	Survey effort
Nocturnal Avifauna (Owls)	*Ninox connivens* (Barking Owl) *Ninox strenua* (Powerful Owl) *Tyto novaehollandiae* (Masked Owl)	▪ **Call back** for aural recognition of threatened owls - Pre-recorded calls of owls with the potential to occur within the study area were broadcast to elicit vocal responses or to attract nocturnal fauna to the playback site. - Calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1 km under still night conditions	- The call of each species was broadcast for at least five minutes, followed by five minutes of listening, the area was then spotlighted on foot. - Opportunistically and during field work
Micro-Chiropteran Bats	*Myotis macropus* (Southern Myotis)	▪ **Anabat II Detector and CF ZCAIM units** - Microbat echolocation calls were recorded for the entire night (from 6pm to 6am) - Bat call analysis was undertaken by Anna McConville who is experienced in the analysis of bat echolocation calls.	- Each survey study area had three consecutive nights of sampling, with emphasis placed on those areas deemed likely to provide potential foraging and flyway sites for microbats.
		▪ **Harp Traps** - Designed to catch microbats, allowing for visual identification. - Any microbats caught were identified early the following morning and kept in small cloth bag which was kept in a cool dark environment until they could be released at nightfall at the study area of capture.	- Utilised at 5 trap line locations

Appendix K Anabat Report (EchoEcology)



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Bat Call Identification

Black Hill, NSW

Prepared for
MJD Environmental Pty Ltd
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Job Reference BC_MJD20 – March 2019

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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

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Figure 4-5: *Miniopterus australis* definite call 14

Figure 4-6: *Miniopterus orianae oceanensis* probable call 14

Figure 4-7: *Mormopterus norfolkensis* definite call 14

Figure 4-8: *Mormopterus ridei* definite call 15

Figure 4-9: *Rhinolophus megaphyllus* definite call 15

Figure 4-10: *Saccolaimus flaviventris* definite call 15

Figure 4-11: *Vespadelus pumilus* definite call 15

1.0 INTRODUCTION

This report has been commissioned by MJD Environmental to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Black Hill, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Chris Corben, Version 4.4a) software. The calls were recorded using Data Division Ratio 8. The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

Nomenclature follows the Australian Chiroptera taxonomic list described by Reardon et al. (2015).

2.1 Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus*, by characteristic frequency or the presence of a down-sweeping tail on pulses. Call sequences which had a majority of pulses containing an up-sweeping tail were assigned to *Vespadelus pumilus*.

Chalinolobus morio calls were differentiated from those of *Vespadelus* sp. by the presence of a down-sweeping tail on the majority of pulses. We do not confidently identify *Vespadelus troughtoni* from bat calls in this region as it overlaps in frequency with both *Vespadelus pumilus* and *Vespadelus vulturnus* and we find it difficult to distinguish based on call characteristics.

Calls from *Miniopterus orianae oceanensis* were differentiated from *Vespadelus* spp. by a combination of uneven consecutive pulses and the presence of down-sweeping tails.

Calls from *Mormopterus* spp. were differentiated by the presence of mainly flat pulses. *Mormopterus norfolkensis* was differentiated from *Mormopterus ridei* in long call sequences where pulses alternated, often with a downward sloping tail.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Scotorepens orion, *Scoteanax rueppellii* and *Falsistrellus tasmaniensis* were unable to be differentiated from one another. *Falsistrellus tasmaniensis* is most frequently recorded from more elevated locations in the region and so its occurrence within the study area is unlikely. However, some records exist from coastal lowlands and so we have included it in our species groups as a precautionary measure.

Myotis macropus, *Nyctophilus geoffroyi* and *Nyctophilus gouldi* were unable to be differentiated.

Chalinolobus dwyeri, *Rhinolophus megaphyllus*, *Saccolaimus flaviventris* and *Austronomus australis* were differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 4,237 call sequences were recorded, of which 3,281 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 997 call sequences (30 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Mormopterus ridei* (Ride's Free-tailed Bat)
- *Rhinolophus megaphyllus* (Eastern Horseshoe Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Vespadelus pumilus* (Eastern Forest Bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Falsistrellus tasmaniensis* (Eastern Falsistrelle)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Scotorepens orion* (Eastern Broad-nosed Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)
- *Vespadelus troughtoni* (Eastern cave bat)
- *Vespadelus vulturnus* (Little Forest Bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors (or are difficult to identify by bat call) and habitat assessment

should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	AB1 28/02/2019	AB1 1/03/2019	AB1 2/03/2019	AB1 3/03/2019	AB1 4/03/2019	AB1 5/03/2019	AB1 6/03/2019	AB1 7/03/2019	AB1 8/03/2019
DEFINITE									
Austronomus australis	6	8	10	6	14	10	7	2	11
Chalinolobus dwyeri	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii	11	24	15	32	64	52	40	8	11
Chalinolobus morio	1	1	1	1	3	2	23	11	2
Miniopterus australis	3	7	5	9	4	11	13	11	2
Mormopterus norfolkensis	4	8	4	-	3	2	1	6	2
Mormopterus ridei	2	3	2	3	7	3	1	11	-
Rhinolophus megaphyllus	2	1	3	-	-	1	2	-	-
Saccolaimus flaviventris	-	4	2	3	-	12	-	2	2
Vespadelus pumilus	-	-	-	2	2	1	-	-	6
PROBABLE									
Austronomus australis	2	2	3	1	3	-	-	-	-

IDENTIFICATION	AB1 28/02/2019	AB1 1/03/2019	AB1 2/03/2019	AB1 3/03/2019	AB1 4/03/2019	AB1 5/03/2019	AB1 6/03/2019	AB1 7/03/2019	AB1 8/03/2019
Chalinolobus gouldii	7	20	8	14	16	38	14	8	20
Chalinolobus morio	3	-	1	-	1	2	8	-	-
Miniopterus australis	-	1	2	-	3	2	3	1	-
Miniopterus orianae oceanensis	-	-	-	-	1	-	-	-	1
Mormopterus norfolkensis	3	4	5	-	5	1	-	8	2
Mormopterus ridei	2	4	5	9	6	1	-	17	2
Saccolaimus flaviventris	-	3	-	-	-	3	-	-	-
Vespadelus pumilus	-	-	3	4	2	4	-	-	1
POSSIBLE									
Austronomus australis	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii	23	26	32	26	26	39	15	5	45
Chalinolobus morio	-	-	-	-	-	-	-	1	-
Miniopterus australis	-	-	-	-	-	-	2	1	-
Mormopterus norfolkensis	-	-	-	2	1	-	1	-	-

IDENTIFICATION	AB1 28/02/2019	AB1 1/03/2019	AB1 2/03/2019	AB1 3/03/2019	AB1 4/03/2019	AB1 5/03/2019	AB1 6/03/2019	AB1 7/03/2019	AB1 8/03/2019
Mormopterus ridei	-	-	-	1	-	1	-	1	1
Saccolaimus flaviventris	-	-	-	2	-	1	-	-	-
Vespadelus vulturnus	1	-	-	-	-	-	-	-	-
SPECIES GROUPS									
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus ridei	11	7	11	17	9	13	1	5	12
Chalinolobus gouldii / Mormopterus ridei	55	25	18	16	10	8	14	4	29
Chalinolobus gouldii / Scoteanax rueppellii	6	24	9	12	8	14	2	-	-
Chalinolobus morio / Miniopterus orianae oceanensis / Vespadelus vulturnus	9	-	-	-	-	-	-	-	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	34	52	22	20	25	43	118	101	25
Chalinolobus morio / Vespadelus vulturnus	-	1	3	-	-	5	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion	1	3	-	-	-	1	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	3	3	2	6	5	7	2	-	1
Miniopterus australis / Vespadelus pumilus	30	24	40	49	18	54	22	25	30
Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus	4	1	10	8	8	7	8	2	3

IDENTIFICATION	AB1 28/02/2019	AB1 1/03/2019	AB1 2/03/2019	AB1 3/03/2019	AB1 4/03/2019	AB1 5/03/2019	AB1 6/03/2019	AB1 7/03/2019	AB1 8/03/2019
Miniopterus orianae oceanensis / Vespadelus vulturnus	-	1	-	-	-	-	-	-	-
Mormopterus norfolkensis / Mormopterus ridei	20	19	48	32	40	6	11	35	18
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	2	-	1	-	1	1	3	1	-
Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	2	4	1	11	1	2	2	20	1
UNKNOWN									
'Noise' files	10	19	9	11	16	26	3	3	26
Social call	-	6	2	6	2	-	-	-	1
Unknown	44	73	65	71	64	51	55	29	62
TOTAL	**301**	**378**	**342**	**374**	**368**	**424**	**371**	**318**	**316**

IDENTIFICATION	AB2 28/02/2019	AB2 1/03/2019	AB2 2/03/2019	AB2 3/03/2019	AB2 4/03/2019	AB2 5/03/2019	AB2 6/03/2019	AB2 7/03/2019	AB2 8/03/2019
DEFINITE									
Austronomus australis	1	1	-	3	5	-	3	-	2
Chalinolobus dwyeri	-	1	1	-	-	-	-	-	-
Chalinolobus gouldii	-	2	-	1	2	3	1	-	2
Chalinolobus morio	-	1	-	-	-	1	-	-	-
Miniopterus australis	-	-	1	2	2	3	4	5	-
Mormopterus norfolkensis	1	-	-	-	-	-	1	-	-
Mormopterus ridei	1	3	-	3	3	-	1	2	-
Rhinolophus megaphyllus	3	8	2	5	7	6	8	5	5
Saccolaimus flaviventris	-	1	-	-	-	3	2	-	3
Vespadelus pumilus	-	-	-	-	-	-	-	-	-
PROBABLE									
Austronomus australis	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii	1	3	-	1	-	1	1	-	-

IDENTIFICATION	AB2 28/02/2019	AB2 1/03/2019	AB2 2/03/2019	AB2 3/03/2019	AB2 4/03/2019	AB2 5/03/2019	AB2 6/03/2019	AB2 7/03/2019	AB2 8/03/2019
Chalinolobus morio	-	-	-	2	-	3	-	-	1
Miniopterus australis	1	2	-	3	-	-	2	-	2
Miniopterus orianae oceanensis	-	-	-	-	-	-	-	-	-
Mormopterus norfolkensis	6	-	-	1	-	-	1	2	-
Mormopterus ridei	4	-	1	1	1	1	2	6	-
Saccolaimus flaviventris	-	1	-	-	-	-	-	-	-
Vespadelus pumilus	-	-	-	-	-	-	-	-	-
POSSIBLE									
Austronomus australis	-	-	-	-	-	-	-	-	1
Chalinolobus gouldii	1	2	3	3	3	-	-	-	1
Chalinolobus morio	-	-	-	1	-	-	-	-	-
Miniopterus australis	-	-	-	-	-	-	-	-	-
Mormopterus norfolkensis	-	-	-	-	-	-	-	-	-
Mormopterus ridei	-	-	-	-	-	-	-	-	-

IDENTIFICATION	AB2 28/02/2019	AB2 1/03/2019	AB2 2/03/2019	AB2 3/03/2019	AB2 4/03/2019	AB2 5/03/2019	AB2 6/03/2019	AB2 7/03/2019	AB2 8/03/2019
Saccolaimus flaviventris	-	-	-	-	-	-	-	-	-
Vespadelus vulturnus	-	-	-	-	-	-	-	-	-
SPECIES GROUPS									
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus ridei	8	6	4	12	17	24	13	6	7
Chalinolobus gouldii / Mormopterus ridei	8	13	7	9	11	11	7	7	9
Chalinolobus gouldii / Scoteanax rueppellii	5	3	7	3	11	7	9	1	12
Chalinolobus morio / Miniopterus orianae oceanensis / Vespadelus vulturnus	-	-	-	-	-	-	-	-	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	2	8	4	9	10	10	22	3	18
Chalinolobus morio / Vespadelus vulturnus	-	-	-	-	-	-	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion	1	-	2	1	1	-	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	4	3	2	8	14	17	6	2	6
Miniopterus australis / Vespadelus pumilus	2	1	4	-	4	4	6	4	8
Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus	2	-	5	2	2	4	40	3	8
Miniopterus orianae oceanensis / Vespadelus vulturnus	-	-	-	-	-	-	-	-	-

IDENTIFICATION	AB2 28/02/2019	AB2 1/03/2019	AB2 2/03/2019	AB2 3/03/2019	AB2 4/03/2019	AB2 5/03/2019	AB2 6/03/2019	AB2 7/03/2019	AB2 8/03/2019
Mormopterus norfolkensis / Mormopterus ridei	8	5	5	8	9	6	7	8	4
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	-	3	1	-	-	1	2	-	1
Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	-	-	-	-	-	1	-	-
UNKNOWN									
'Noise' files	1	-	1	-	-	1	-	-	1
Social call	-	-	-	-	-	-	-	-	-
Unknown	39	25	40	23	38	35	46	17	35
TOTAL	**99**	**92**	**90**	**101**	**140**	**141**	**185**	**71**	**126**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

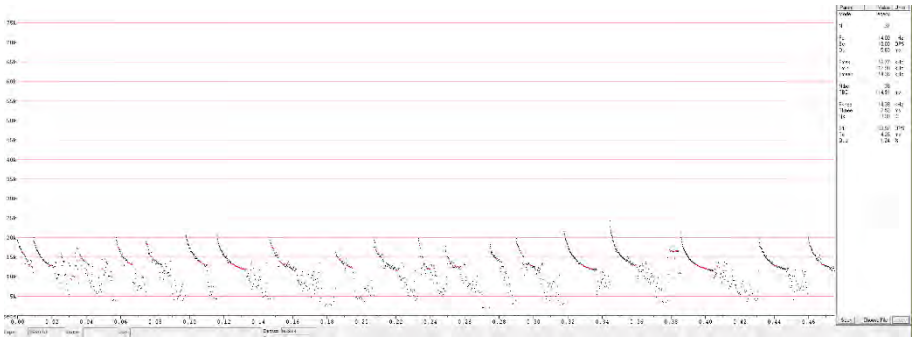

Figure 4-1: *Austronomus australis* definite call

Figure 4-2: *Chalinolobus dwyeri* definite call

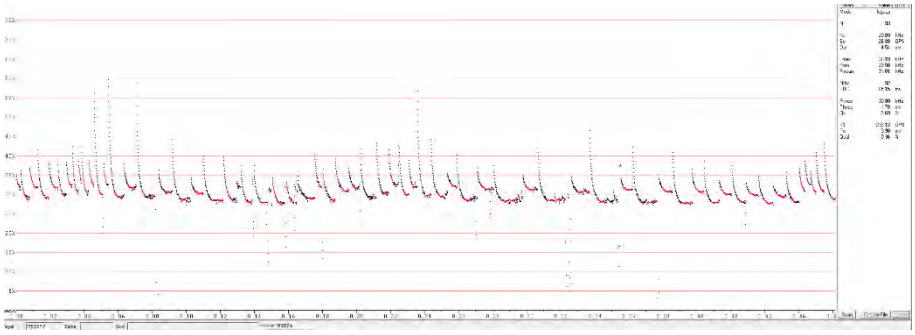

Figure 4-3: *Chalinolobus gouldii* definite call

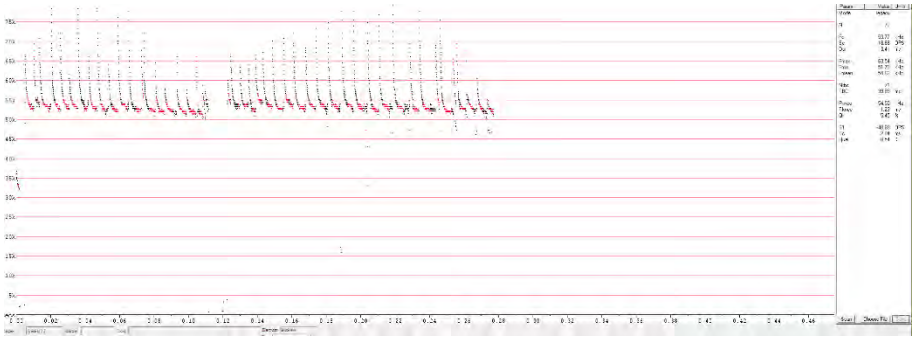

Figure 4-4: *Chalinolobus morio* definite call

Figure 4-5: *Miniopterus australis* definite call

Figure 4-6: *Miniopterus orianae oceanensis* probable call

Figure 4-7: *Mormopterus norfolkensis* definite call

Figure 4-8: *Mormopterus ridei* definite call

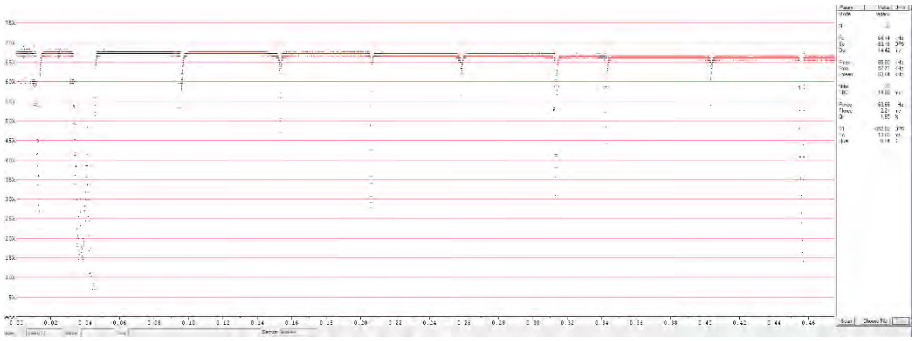

Figure 4-9: *Rhinolophus megaphyllus* definite call

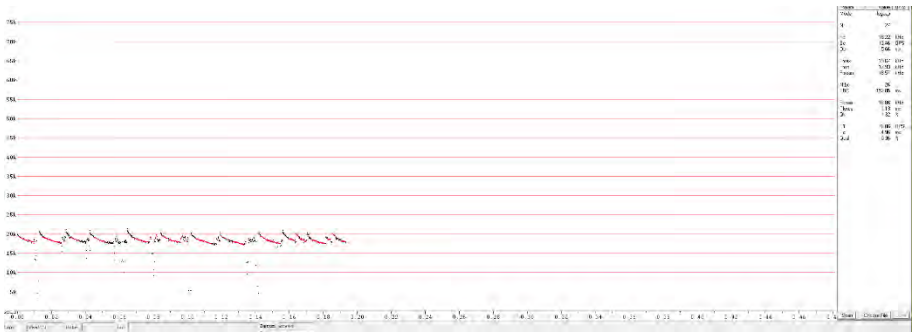

Figure 4-10: *Saccolaimus flaviventris* definite call

Figure 4-11: *Vespadelus pumilus* definite call

5.0 REFERENCES

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