AEP

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

FOR

PROPOSED RESIDENTIAL SUBDIVISION

AT

VARIOUS LOTS, STATION LANE LOCHINVAR, NSW

Prepared for: **The Bathla Group**

4 May 2020

AEP Ref: 1909

BOAMS Ref: 18983

P 0418 681 581 E CRAIG@ANDERSONEP.COM.AU PO BOX 210 ADAMSTOWN NSW 2289 ABN 27 170 660 510

EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) was commissioned by The Bathla Group to undertake a Biodiversity Development Assessment Report (BDAR) over land identified as Lot 3 DP 564631, Lot 4 and the eastern section of Lot 2 DP 634523. The land to be subdivided is known as 51, 134 and 146 Station Lane, Lochinvar NSW, in the Maitland Local Government Area (LGA). The Subject Site covers approx. 72.77ha of highly degraded native vegetation or disturbed, non-native pasture vegetation, of which the entirety is proposed to be cleared as part of a residential subdivision in accordance with the existing zoning.

This report has been prepared to meet the requirements of the Biodiversity Assessment Method 2017 (BAM) established under Section 6.7 of the NSW BC Act 2016. This assessment utilises methods detailed within the BAM Order 2017 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values.

The Subject Site contains two (2) Plant Community Type (PCT) 1603 – *Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter* (0.70ha) and PCT 1731 – *Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley* (0.46ha). These PCTs are commensurate with two State listed Endangered Ecological Communities (EEC), respectively *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* and *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*. The remainder of the Subject Site (71.61ha) consists of land dominated by exotic flora and cleared areas including gravel tracks, dwellings, farm buildings and highly managed pastureland, which do not require assessment for ecosystem values and were determined not to provide habitat for threatened species.

Fauna species recorded were typical of those expected in this locality and in this type of remnant habitat with marginal connection to vegetation offsite. Threatened species recorded within the Study Area included Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Falsistrelle (*Falsistrellus tasmaniensis*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus orianae oceanensis*), East Coast Freetail-bat (*Micronomus norfolkensis*), Southern Myotis (*Myotis macropus*), Grey-headed Flying-Fox (*Pteropus poliocephalus*), Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*).

To offset residual impacts of the proposal upon identified biodiversity values, the proposal would require a total of 13 x PCT 1603 and 5 x PCT 1731 Ecosystem Credits (or equivalent). As PCT 1604 is listed as an EEC under the *Biodiversity Conservation Act*, suitable offsets must also satisfy the Final Determination for *Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions*. Additionally, 13 x Southern Myotis and 28 x Large-eared Pied Bat Species Credits are required to satisfy offset requirements for residual impacts caused to species not addressed within ecosystem credits.

While impact to Large-eared Pied Bat breeding habitat is a potential Serious and Irreversible Impact (SAII), no suitable breeding habitat has been identified within 2km of the Subject Site, as such development of the Subject Site is not a candidate SAII for Large-eared Pied Bat. No other SAIIs are likely to occur as a result of the proposal.

Consideration of Avoid and Minimise requirements included the establishment of two riparian corridors within the Study Area, that will effectively result in a net gain to biodiversity. The riparian corridor in the north-east will cover an area of approx. 2.5ha and the riparian corridor within the north west will be reconditioned and is likely to increase by approx. 1.3ha. The 3.8ha of newly created riparian vegetation will generate a net gain for biodiversity of approx. 2.3ha. Additionally, two (2) Onsite Detention Basin, proposed as part of the development, will create aquatic habitat covering approx. 3ha and result in improved water quality within the local catchment.

Assessment of the proposal under other relevant environmental policy instruments including *SEPP (Koala Habitat Protection) 2019* and the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were undertaken. The remnant vegetation present aligns with a highly modified form of Central Hunter Valley eucalypt forest and woodland ecological community which is listed as Critically Endangered under the Act. However, due to its highly degraded nature, it does not fulfill the condition threshold and is not commensurate with the Critically Endangered Ecological Community. The Study Area only provides potential seasonal foraging habitat for relevant fauna species, it is not mapped as important habitat for Swift Parrot or Regent Honeyeater, and no Grey-headed Flying-fox roost camp is present within the site. In addition, the absence of records of Koala in the last 18 years on site or in the locality mean that the Subject Site is not considered as Core Koala Habitat under the relevant SEPP and as such, no further provisions of the policy apply. Furthermore, whilst Commonwealth-listed Grey-headed Flying-fox and Large-eared Pied Bat were detected on site, only small amounts of degraded vegetation will be removed which may constitute habitat and better habitat occurs in the locality. As such no impact is expected to occur to fauna species listed under the EPBC Act and referral under the Act is likely to be unnecessary for this development.

Contents

Tables

Figures

Plates

Appendices

Study Certification and Licensing

This report was written by, Yann Buissiere BEnvMgt & Dip Cons & Land Mgmt, and reviewed and certified by Ian Benson BEng (Civil) & GradDipSc (Ecology) (BAAS: 18147) of Anderson Environment & Planning.

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW DPI; and
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 14/600(2)) issued by NSW DPI; and
- Animal Research Establishment Accreditation Number 53724.

Certification:

As the principal author, I, Ian Benson, make the following certification:

- This report has been written to comply with the requirements of the BAM 2017 and obligations outlined within the BAM Assessor Code of Conduct and includes, in the opinion of the writer, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area, and inferences of such for biodiversity credit calculations;
- BAM Assessment methodology, as well as Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:

IAN BENSON
Principal Ecologist
Anderson Environment & Planning
BAAS 18147
Calculator Ref: 00018980/BAAS18147/20/00018983

4 May 2020

Glossary of Terms

APZ	Asset Protection Zone
BAM	*Biodiversity Assessment Method Order* (2017) that determines: • Methodology applicable to quantifying biodiversity values inherent within a development site; • Avoid and minimise efforts required to be employed as part of any development proposal; and • Number and class of credits required to offset residual impacts of the proposal upon the biodiversity values therein.
BC Act	*Biodiversity Conservation Act 2016*
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset the impacts of a development.
BAM Calculator (BAM-C)	The online tool used to interpret site survey data and regional location information to quantify ecosystem and species credits required / generated at a development / stewardship site.
Biodiversity credits	Ecosystem or Species Credits required to offset the loss of biodiversity values on a development site.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats.
Council	Maitland City Council
Development Lands	Land upon which the development is proposed, and within which impacts upon biodiversity are required to be offset. Majority of the Development lands are zoned R1 – General Residential.
DoEE	The Commonwealth Department of the Environment and Energy
DPI	The NSW Department of Primary Industries
DPIE	The NSW Department of Planning, Industry and Environment

Ecosystem credit	The class of biodiversity credits created or required for the impact on EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a vegetation type.
EEC	Endangered Ecological Community (under BC Act).
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
OEH	The former NSW Office of Environment and Heritage
PFC	Percentage Foliage Cover
Study Area	Subject Site and adjacent areas as shown in **Figure 1.**
Subject Site	Lot 3 DP 564631, Lot 4 and the eastern section of Lot 2 DP 634523 as shown in **Figure 1.**
Species credit	Class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area based on habitat surrogates.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community

1.0 Stage 1 – Biodiversity Assessment

1.1 Introduction

A residential subdivision is proposed within land known as Station Lane, Lochinvar, NSW. At the request of The Bathla Group (the client), Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Development Assessment Report (BDAR) addressing the proposed development within Lot 3 DP 564631, Lot 4 and the eastern section of Lot 2 DP 634523 located respectively at 51, 134 and 146 Station Lane, Lochinvar NSW (the Subject Site).

The BDAR undertaken adheres to the approach outlined in the Biodiversity Assessment Methodology (OEH 2017a) (the BAM) and the Biodiversity Assessment Method (BAM) Calculator User Guide (OEH 2017b).

1.1.1 The Proposal

The proposed development involves a residential subdivision covering an area of approx. 72.77ha. Development will include the construction of internal roads, two (2) Onsite Stormwater Detention (OSD) basins and the establishment of two riparian corridors (within the north-east and north-west of the Subject Site).

The entirety of vegetation within the Subject Site is proposed to be cleared.

The plan of the residential subdivision is outlined in **Appendix C**.

1.1.2 Assessment Scope

The BDAR presented herewith aims to quantify impacts of the proposal upon biodiversity values based upon the methods described within the *Biodiversity Assessment Method Order 2017* (BAM), including threatened entities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act).

This report includes:

- **Stage 1 – Biodiversity Assessment** – including the mapping of remnant vegetation communities including Endangered Ecological Communities (EECs) within the site, the location of previously identified threatened species and their habitats, and potential contemporary occurrence of threatened species identified within the BAM Calculator; and
- **Stage 2 – Impact Assessment** – identification of impact avoidance and mitigation measures, and the quantifying of offset requirements in the form of biodiversity credits based upon residual impacts of the proposal.

1.1.3 Site Particulars

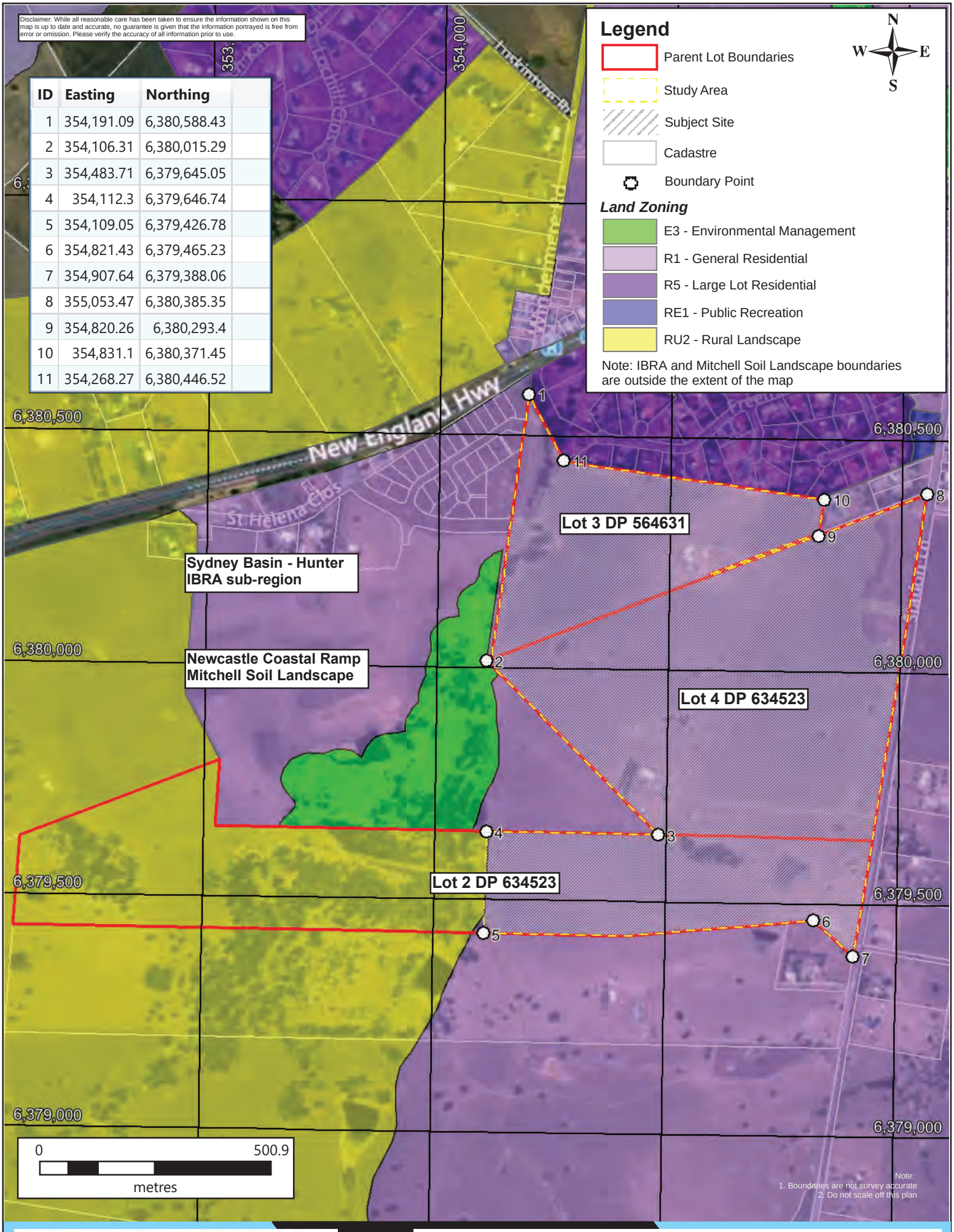
- **Address** – 51, 134 and 146 Station Lane, Lochinvar NSW.
- **Title** – Lot 3 DP 564631, Lot 4 and the eastern section of Lot 2 DP 634523.
- **LGA** – Maitland.
- **Study Area** – 76.68ha covering various Lots (as described above)
- **Subject Site** – The Subject Site comprises only those lands that will be cleared or affected by the development, totalling approx. 72.77ha.
- **Zoning** – Development is proposed within land zoned R1 – General Residential.
- **Current Land Use** – The Subject Site is predominantly composed of cleared pasture grassland but also possesses three separate clumps of trees, scattered paddock trees and a riparian corridor located in the north west corner of the site. One residential dwelling and associated farm buildings are located within each allotment. Four dams (two large and two small dams) occur within the Subject Site, however, due to the ongoing drought, only one had water at the time of the survey. Cattle and horses are present within the Subject Site.
- **Surrounding Land Use** – Land directly south and east of the Subject Site is also zoned R1 and comprises similar pastureland. Note that the western section of Lot 2 DP 634523 is currently zoned RU2 – Rural Landscape and is not subject to this assessment. Residential development to the north is zoned R5 – Large Lot Residential and part of Lochinvar Creek west of the Subject Site is zoned E3 – Environmental Management.

Figure 1 depicts the extent of the Study Area and **Figure 2** shows the Study Area in the context of the broader locality. For clarity within figures, an indicative lot layout has been provided within the Masterplan for the site in **Appendix C**.

1.1.4 Information Sources

Information and spatial data provided within this BDAR has been compiled from various sources including:

- Aerial Photograph Interpretation (API) of the site and surrounding locality;
- State survey guidelines (DEC 2004; DECC 2009; OEH 2016a, OEH 2018);
- Review of regional mapping for the site prepared as part of the Lower Hunter – Central Coast Regional Environmental Management Strategy (LHCCREMS) (NPWS 2000);
- Previous surveys conducted within the site and surrounding areas by Hill (2003);
- OEH Threatened Species, Populations and Ecological Communities website https://www.environment.nsw.gov.au/threatenedspeciesapp/);
- Search and review of flora and fauna sighting records in the OEH Atlas of NSW Wildlife within 10km of the site;
- Protected Matters Search within a 5km radius of the site held by the Commonwealth Department of the Environment and Energy, summarising Matters of National Environmental Significance that may occur in, or may relate to the Study Area;
- Contact with the LMBC to determine the site is mapped as *Important Swift Parrot Habitat* or *Important Regent Honeyeater Habitat* (**Appendix H**).
- Collective knowledge gained from previous ecological survey and assessment in the Maitland area over the past 20 years; and
- Anecdotal records.



AEP

Title: Figure 1 - Site Location

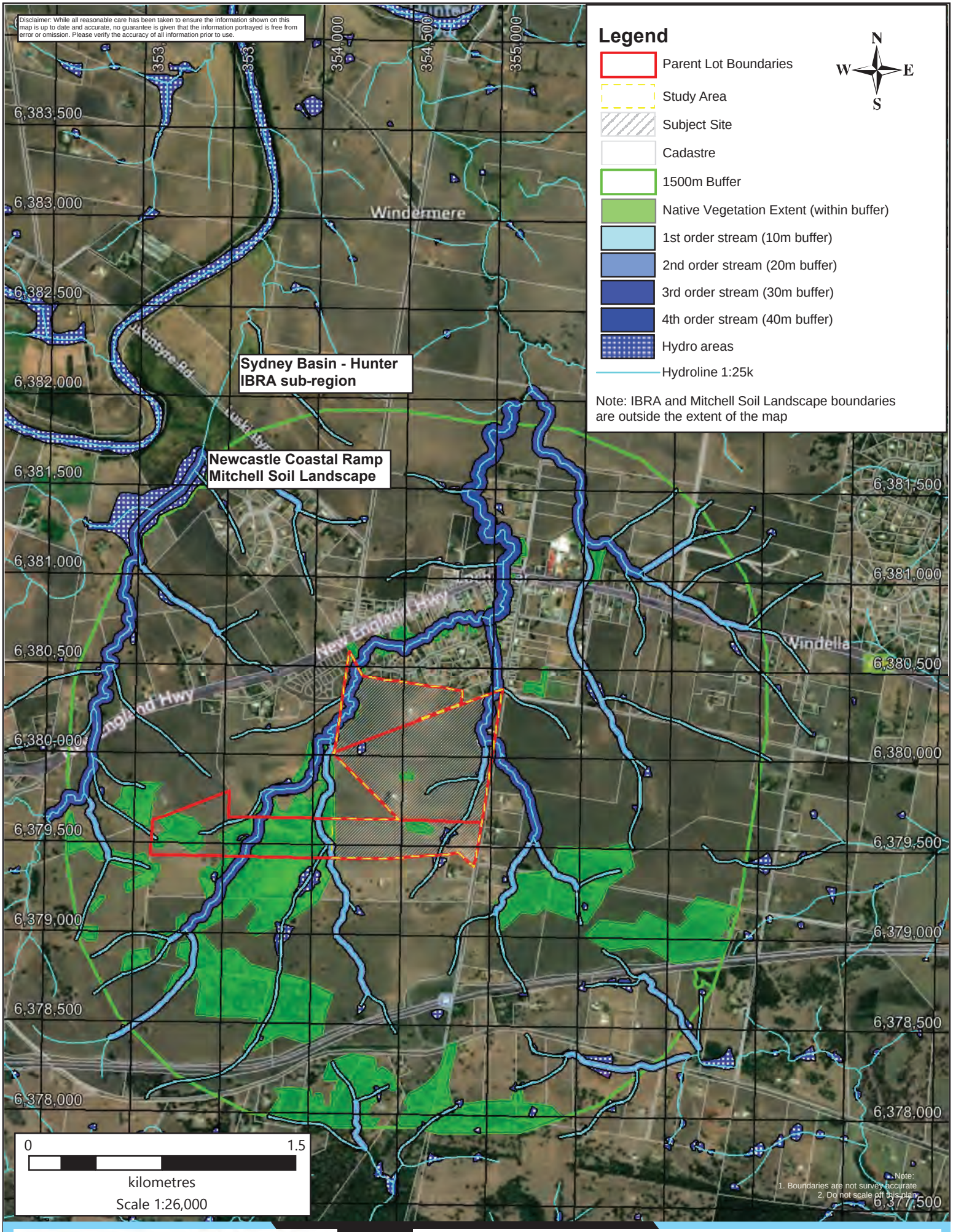
Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909



AEP

Title: Figure 2 - Location Map

Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909

1.2 Landscape Features

1.2.1 Regional Landscapes

The development site was identified as occurring within the following landscape areas:

- *IBRA Bioregion* – Sydney Basin.
- *IBRA Subregion* – Hunter.
- *Mitchell Landscape* –Newcastle Coastal Ramp.

Delineation of *Mitchell Landscape* areas are shown in both **Figure 1 – Site Location** and **Figure 2 – Landscape Maps.**

1.2.2 Identified Landscape Features

The Calculator identifies seven (7) landscape features that require assessment for their relevance to the site. These features are:

- *Rivers and Streams*: A small section of Lochinvar Creek is present within Lot 3 in the north west corner of the Subject Site. Additionally, one unnamed first order drainage line starts within Lot 2 and runs along the eastern boundary of the site. The drainage line possesses three dams along its length, turns into a 2nd order stream and drains into Greedy Creek within Lot 4. Greedy Creek joins Lochinvar Creek approximately 400m downstream which ultimately flows into the Hunter River.
- *Wetlands*: No mapped wetlands or CM SEPP wetlands occur within the Subject Site.
- *Native Vegetation Extent*: Approximately 1.16ha of modified remnant native vegetation occur within the Subject Site, identified as two separate PCTs. The riparian vegetation within the north west corner of the site covers 0.46ha and has been identified as PCT 1731 - *Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley*. The two clumps of trees and scattered paddock trees have been identified as PCT 1603 - *Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter* and covers approx. 0.7ha. Additionally, a windrow is present behind the dwelling within Lot 4 and is made of *Casuarina glauca*, *Corymbia maculata* and *Melaleuca armillaris*. This windrow is man-made and covers approximately 0.17ha. Due to the artificial nature of this vegetation, no PCT was allocated to this vegetation. The remainder of the Subject Site comprises 2.53ha of mostly cleared areas including dwellings, farm buildings and internal roads as well as 68.91ha of mostly exotic pasture and other disturbed areas.
- Connectivity Features: The Subject Site is connected to pasturelands to the east and south though this is separated by minor road, Station Lane to the east. Low density residential housing is located immediately north of the site. There is very limited connectivity over open, managed land that is unlikely to be used by any terrestrial mammals. However, some connectivity is present immediately to the west of the site through vegetation along Lochinvar

Creek. The proposed development will not affect this connectivity as the riparian vegetation located in the north-west corner of the Subject Site will not be impacted. Avifauna and flying mammals will not have current connectivity impacted by the development. The rest of the remnant vegetation present onsite consist of scattered paddock trees and two small clumps of trees that are already isolated from the larger tract of vegetation west of the site by exotic pasture.

- Areas of geological significance and soil hazard features: The Subject Site does not possess any area of geological significance. The site is mapped as Acid Sulphate Soil Class 5, under the Maitland LEP 2011 and the following condition applies:

"*Development consent is required for the carrying out of works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land*."

- Features identified in SEARs for major projects: N/A.

- Areas of Outstanding Biodiversity Value (AOBV) under the BC Act: None.

1.2.3 Site Context Components

1.2.3.1 Method

Site layout allowed for the landscape values to be determined based upon a site-based method, rather than that of a linear method.

1.2.3.2 Landscape Native Vegetation Cover

The 1500m buffer placed around the site is approx. 1372ha in size. Of this, approx. 178ha comprise native vegetation as per Section 4.3.2 of the BAM. This equates to approx. **12.9%** native vegetation cover and was entered as such within the Calculator.

1.3 Native Vegetation

1.3.1 Regional Mapping

Previous datasets included those conducted by Hill (2009) and National Parks and Wildlife Service (NPWS) as part of the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) in 2000. Communities mapped within the site for each dataset are provided in **Table 1.**

Table 1 - Regional Vegetation Mapping Results

Vegetation Community	LHHCREMS* (2008)	Hill (2009)
Hunter Lowland Red Gum Forest Variant	0.49ha	0.49ha
Other: Non-native vegetation	72.28ha	72.28ha
Total	**72.77ha**	**72.77ha**

1.3.2 Field Survey Results

1.3.2.1 Plant Community Types (PCTs)

Flora surveys were undertaken to produce a flora species list for the Study Area, to search specifically for threatened flora species known from the wider area, and to gather data necessary to both derive vegetation community type(s) and meet relevant survey guidelines. Such works included:

- Identification of all vascular plant species encountered during fieldwork. Study area coverage was both systematic to ensure all key points of the Study Area were checked, and therein the Random Meander Technique (Cropper, 1993) was utilised to maximise species encountered.
- Eight (8) BAM plots. A copy of the plot data is provided in **Appendix D**.
- A full list of all flora species recorded during fieldwork is included as **Appendix B.**

- Targeted searches in areas of potentially suitable habitat were undertaken for any threatened flora species previously recorded in the locality. Such species were identified via the BAM Calculator as well as database searches.

The location of all flora and fauna survey efforts is provided within **Figure 4**. The field survey determined that the remnant vegetation present within the Subject Site was likely to be a highly degraded and modified form of two separate types of vegetation: Central Hunter Grey Box - Ironbark Woodland and Central Hunter Riparian Forest.

The majority of the vegetation present within the Study Area, based on current survey and broad site assessment of adjoining areas, is composed of highly disturbed grazing land.

1.3.2.2 PCT determination

Field survey identified two separate native vegetation communities on the Subject Site:

- Central Hunter Grey Box - Ironbark Woodland
- Central Hunter Riparian Forest

These two (2) vegetation communities occur as small remnant pockets scattered across the Subject Site. The vast majority of the vegetation present consist of exotic grasses and groundcovers, likely introduced for the purpose of pasture improvement. The site is currently being grazed by cattle.

Due to the highly modified and managed nature of the site, including the lack of a shrub layer and sparse ground layer within the remnant vegetation, PCT determination used mainly canopy trees and groundcovers as diagnostic species.

Analysis of the floristic composition and landscape position of the community against the Vegetation Information System (VIS) classification system determined that the vegetation on site is commensurate with two PCTs, respectively:

- 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter.
- 1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.

Due to the highly modified and managed nature of the site, including the lack of a shrub layer and sparse ground layer within the remnant vegetation, PCT determination used mainly canopy trees and groundcovers as diagnostic species. The methodology used to allocate PCTs to each vegetation community is described in **Table 2**

Vegetation communities for the site are shown in **Figure 3**. Additional site photographs are included in **Appendix G**.

Table 2 - PCT Determination Table

Vegetation	Central Hunter Ironbark – Spotted Gum – Grey Box Forest	Central Hunter Riparian Forest
Search Item	**Plot 1, 3, 5, 6**	**Plot 7**
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter
NSW Landscape	Sydney – Newcastle Barriers and Beaches	Sydney – Newcastle Barriers and Beaches
Vegetation Class	Hunter-Macleay Dry Sclerophyll Forests; Coastal Valley Grassy Woodlands	Coastal Swamp Forests
Potential PCTs	**1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1603, 1604, 1626, 1748**	**1649, 1716, 1717, 1718, 1722, 1724, 1726, 1729, 1730, 1731**
Diagnostic species	- 1588, 1589, 1590, 1591, 1592, 1593, were discarded due to the absence within the upper stratum of most key diagnostic species for these PCTs (*Eucalyptus paniculata, Eucalyptus umbra, Eucalyptus fibrosa, Eucalyptus punctata* etc…). Additionally, the two dominant canopy species present onsite, *Eucalyptus crebra* and *Eucalyptus moluccana* are not listed as diagnostic species for these PCTs. - 1626 was discarded due its geographic location being restricted to Nelson Bay. - 1748 was discarded due to the absence of *Eucalyptus crebra*, co-dominant canopy species present onsite as a diagnostic species for the upper stratum of that PCT. Additionally, most ground stratum diagnostic species for that PCT are absent from the Subject Site. - 1601 was discarded due to the absence onsite of *Eucalyptus fibrosa*, diagnostic species for that PCT. Additionally, the co-dominant canopy species *Eucalyptus moluccana* is not listed as an upper stratum diagnostic species for that PCT.	- 1649, 1716, 1718, 1724 and 1726 were discarded due to the absence of *Casuarina glauca*, the dominant upper stratum species within that vegetation community, as a diagnostic species for these PCTs. - 1617, 1722, 1729 and 1730 were discarded due to being geographically restricted to the Central Coast and Lower North Coast. Additionally, all diagnostic species for the mid and lower stratum for these PCTs are absent from the site such as the myrtaceous shrubs of the *Melaleuca* genus as well as sedges and rushes typical of these plant communities. - 1731 was chosen due to the presence within this community onsite of *Casuarina glauca* and *Cynodon dactylon*, two diagnostic species for this PCT. Additionally, *Microlaena stipoides and dichondra repens*, while not present within the BAM plot, were witnessed to occur within the riparian corridor.

	Except for *Aristida vagans*, no ground stratum species diagnostic of this PCT is present within this community onsite. - 1602 was discarded due to the absence of the co-dominant canopy species *Eucalyptus moluccana* from the diagnostic species for that PCT. - 1603 and 1604 are closely related and share most diagnostic species. However, 1604 was discarded due to the absence as a diagnostic species in the lower stratum of *Themeda triandra*, one of the dominant grass present onsite. Additionally, *Corymbia maculata* is listed as a dominant species for that PCT and is absent from the remnant vegetation present onsite. - PCT 1603 is associated with the Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions is largely equivalent to the Listed TSC Act: Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions. This vegetation has been mapped onsite as part of the regional mapping project and species typical of this community are present onsite including *Maireana microphylla* (Small-leaf Bluebush), *Desmodium varians* (Slender Tick-trefoil) and *Glycine tabacina*.	
Result	**1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter**	**1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley**
Diagnostic species present on site	- Upper stratum: *Eucalyptus crebra, Eucalyptus moluccana* - Mid stratum: None - Ground stratum: *Themeda australis, Aristida ramosa, Eremophila debilis*	- Upper stratum: *Casuarina glauca* - Ground stratum: *Cynodon dactylon, Microlaena stipoides, Dichondra repens.*
Vegetation Formation (Type)	Grassy Woodland	Forested Wetlands
Vegetation Class	Coastal Valley Grassy Woodlands	Coastal Swamp Forests
Estimate cleared value of PCT (%)	74	62
EEC	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

1.3.2.3 Habitat Trees

A total of 39 hollow-bearing trees (HBT) were identified within the Subject Site. Hollows present onsite range from small to large and may be suitable for a range of species of birds and microbats. Due to their isolation from larger tracts of bushland to the west of the Subject Site, it is unlikely that they would be suitable for gliders. No hollow present were deemed suitable for forest owls (not large nor high enough). At the time of the field surveys, one hollow was observed to be occupied by a resident *Psephotus haematonotus* (Red-rumped Parrot). Details of the HBT survey is provided in **Table 3** below. Hollow-bearing trees are presented in **Figure 5**.

Table 3 - Hollow-bearing Tree Survey

HBT	Species	Small	Medium	Large	Hollow type	Height (meters)
HBT1	Dead Stag	5	0	0	Spout and trunk	2-5m
HBT2	Dead Stag	3	2	3	Spout	3-7m
HBT3	*Eucalyptus moluccana*	3	0	0	Spout	4-6m
HBT4	*Eucalyptus moluccana*	1	0	0	Spout	6m
HBT5	*Eucalyptus moluccana*	5	1	0	Spout and trunk	3-6m
HBT6	*Eucalyptus moluccana*	1	0	0	Fissure in dead trunk	3m
HBT7	*Eucalyptus moluccana*	1	1	0	Spout and fissure in dead trunk	7-8m
HBT8	*Eucalyptus moluccana*	6	2	0	Spout, limb and fissure	7-9m
HBT9	*Eucalyptus moluccana*	3	0	0	Limb and trunk	2.5-5m
HBT10	*Eucalyptus moluccana*	1	0	0	Limb	4.5m
HBT11	*Eucalyptus tereticornis*	4	0	0	Limb and trunk	3-6m
HBT12	*Eucalyptus moluccana*	3	0	0	Limb and spout	8-12m
HBT13	*Eucalyptus moluccana*	0	1	0	Dead trunk	6m
HBT14	*Eucalyptus moluccana*	0	1	0	Dead trunk	5m
HBT15	*Eucalyptus moluccana*	1	1	0	Dead trunk (50cm crack)	4-5m
HBT16	*Eucalyptus moluccana*	0	2	0	Dead trunk	2-4m
HBT17	*Eucalyptus tereticornis*	2	0	0	Spout	4-8m
HBT18	*Eucalyptus moluccana*	3	3	0	Spout, limb and trunk	3-9m
HBT19	*Eucalyptus moluccana*	4	0	0	Spout	3-6m
HBT20	*Eucalyptus moluccana*	3	0	0	Spout	5-8m
HBT21	*Eucalyptus moluccana*	2	0	0	Spout and limb	8-10m
HBT22	*Eucalyptus moluccana*	2	2	0	Spout and limb	5-10m
HBT23	*Eucalyptus moluccana*	1	3	0	Spout and limb crack	4-6m
HBT24	*Eucalyptus tereticornis*	4	1	1	Spout, limb, dead trunk	3.5-6m
HBT25	*Eucalyptus moluccana*	5	0	0	Spout and limb	2.5-7m
HBT26	*Eucalyptus moluccana*	3	0	0	Spout	4-6m
HBT27	Dead Stag	8	3	0	Spout, limb, trunk	4-10m
HBT28	*Eucalyptus moluccana*	2	0	0	Limb	10m
HBT29	*Eucalyptus moluccana*	4	1	0	Spout and limb	5-8m
HBT30	*Eucalyptus moluccana*	3	1	0	Spout and limb	5-7m

HBT	Species	Small	Medium	Large	Hollow type	Height (meters)
HBT31	*Eucalyptus crebra*	1	0	0	Limb	8m
HBT32	*Eucalyptus crebra*	1	0	0	2m Fissure in dead trunk	5-7m
HBT33	*Eucalyptus crebra*	0	1	0	Limb	6m
HBT34	*Eucalyptus crebra*	1	0	0	Deep fissures in bark	2-5m
HBT35	*Eucalyptus crebra*	5	2	0	Limb and spout	5-8m
HBT36	*Angophora floribunda*	0	1	0	Trunk	5m
HBT37	Dead Stag	2	0	0	Limb	7m
HBT38	*Eucalyptus crebra*	3	0	0	Limb	4-6m
HBT39	*Eucalyptus crebra*	1	0	0	Limb	8m

1.3.3 Vegetation Information System (VIS) Characteristics

Analysis of the online VIS database has identified the following characteristics for PCT 1603 and PCT 1731.

Table 4 - VIS Classification

VIS Classification	1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
Vegetation Formation (Keith 2004)	Grassy Woodlands	Forested Wetlands
Vegetation Class (Keith 2004)	Coastal Valley Grassy Woodlands	Coastal Swamp Forest
Defining Species – Canopy	*Eucalyptus crebra* *Eucalyptus moluccana*	*Casuarina glauca* *Eucalyptus tereticornis*
Defining Species – Shrub	*Allocasuarina luehmannii* *Bursaria spinosa* *Breynia oblongifolia*	*Solanum prinophyllum*
Defining Species – Ground	*Cymbopogon refractus* *Aristida ramosa* *Themeda australis* *Cheilanthes sieberi* *Cheilanthes distans* *Pomax umbellata* *Dichondra sp. A* *Lomandra multiflora* *Eremophila debilis*	*Microlaena stipoides* *Dichondra repens* *Cynodon dactylon* *Austrostipa verticillata* *Oplismenus aemulus* *Pratia purpurascens*
Estimate cleared value of PCT (%) in CMA	77%	62%

1.3.4 Vegetation Integrity Assessment

1.3.4.1 Vegetation Zones

PCT 1603 – Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter – Grey Box Dominated

Plate 1 - PCT 1603 – Grey Box dominated in the southern part of the site

This clump of trees covers approximately 0.47ha and is dominated by *Eucalyptus moluccana* (Grey Box) but also possesses scattered *Eucalyptus tereticornis* (Forest Red Gum). The midstory is dominated by exotic species such as *Olea europaea subsp. cuspidata* (African Olive) and *Lycium ferocissimum* (African Boxthorn) and is almost devoid of native shrubs except for scattered *Maireana microphylla* (Small-leaf Bluebush) and *Eremophila debilis* (Winter Apple). The understory is dominated by *Cynodon dactylon* (Common Couch) although this is most likely a result of pasture improvement within the surrounding paddocks. Other native groundcovers present include the grasses *Panicum effusum* (Hairy Panic), *Digitaria parviflora* (Small-flowered Finger Grass) and *Aristida ramosa* (Purple Wiregrass) as well as forbs such as *Sida corrugata* (Corrugated Sida), *Brunoniella australis* (Blue Trumpet), *Desmodium varians* (Slender Tick-trefoil) and *Einadia hastata* (Berry Saltbush). The ground layer also possesses several exotic species including *Axonopus fissifolius* (Narrow-leaved Carpet Grass), *Sida rhombifolia* (Paddy's Lucerne) and *Opuntia aurantiaca* (Tiger Pear).

PCT 1603 – Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter – Narrow-leaved Ironbark dominated

Plate 2 - PCT 1603 – Narrow-leaved Ironbark dominated in the centre of the Site

This area is composed of a clump of trees and scattered paddock trees located within the centre of the site and covering approximately 0.23ha. The dominant canopy species is *Eucalyptus crebra* (Narrow-leaved Ironbark) but also possesses scattered *Angophora floribunda* (Rough-barked Apple). The midstory is absent and ground layer very sparse due to ongoing grazing and trampling from cattle. The ground layer is dominated by the exotic grass *Axonopus fissifolius* (Narrow-leaved Carpet Grass) but also possesses native grasses such as *Themeda triandra* (Kangaroo Grass), Aristida ramosa (Purple Wiregrass) and *Cynodon dactylon* (Common couch) as well as forbs such as *Glycine tabacina* (Twining Glycine). Other exotic species present include *Paspalum dilatatum* and *Verbena bonariensis* (Purpletop).

PCT 1731 – Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - degraded

Plate 3 - PCT 1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley in the north-west corner of the site

This narrow riparian corridor located in the north west of the Subject Site is highly degraded and composed primarily of *Casuarina glauca* (Swamp Sheoak) covering approx. 0.46ha proposed to be cleared within the Subject Site, and an additional 0.29ha to be retained in adjacent land, within the Study Area. The species dominate the canopy layer as well as midstory and understory with numerous saplings and coppices. Exotic species are widespread in the lower strata of vegetation. The vine *Parsonsia straminea* (Common Silkpod) is present along with exotic species such as *Olea europaea subsp. cuspidata* (African Olive), *verbena bonariensis* (Purpletop), *Sida rhombifolia* and *Opuntia aurantiaca* (Tiger Pear). Other native species within the ground layer include *Cynodon dactylon* (Common Couch), *Themeda triandra* (Kangaroo Grass) and *Dianella revoluta var. revoluta* (Spreading Flax Lily) but occur at very low density. The creek line suffers from high level of erosion and rubbish is scattered along its length. Note that the vegetated part of the riparian corridor is not continuous with a large section toward the centre, devoid of shrubs or trees.

Exotic grassland – managed

Plate 4 - Exotic grassland

The majority of the Site (approx. 72.67ha) is composed of managed grassland used for cattle grazing where mostly exotic grasses and forbs occur. The dominant species present are *Axonopus fissifolius* (Narrow-leaved Carpet Grass) and *Paspalum dilatatum* (Paspalum) but other exotic species are also present such as *Senecio madagascariensis* (Fireweed), *Plantago lanceolata* (Plantain) and *Verbena bonariensis* (Purpletop). Native species of grasses are also present such as *Themeda triandra* (Kangaroo Grass), *Aristida ramosa* (Purple Wiregrass); however, they occur at lower densities. Native species of forbs are also scattered throughout the exotic grassland such as *Wahlenbergia communis* (Tufted Bluebell) and *Asperula conferta* (Common Woodruff) along with the shrubs *Hakea sericea* (Needlebush) and *Pimelea glauca* (Smooth Rice-flower). Two large dams and two smaller dams are present within this area. However, due to the ongoing drought and being the main source of water for cattle, all of them were dry except for the large dam in the south of the Subject Site.

Additionally, a windrow located behind the dwelling in Lot 4 and covering approx. 0.17ha has been planted with a mix of native and exotic species including *Corymbia maculata* (Spotted Gum), *Casuarina glauca* (Swamp Sheoak), *Melaleuca armillaris subsp. armillaris* (Bracelet Honey Myrtle) and *Cupressus sp.* (Cypress).

The area of each vegetation zone within the Development Lands is provided in **Table 3** and **Figure 3**.

Table 5 - Vegetation Zones

Vegetation Community	TEC	Area (ha)
PCT 1603 – Grey Box dominated	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	0.47
PCT 1603 – Narrow-leaved Ironbark dominated	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	0.23
PCT 1731 – degraded	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.75
Total – Remnant Vegetation		**1.45**
Total remnant vegetation affected by the development	PCT 1603 - 1.15ha, PCT 1731 – 0.4ha	1.16
Exotic grassland / Planted areas / Dam	N/A	69.21
Mostly cleared / Built areas	N/A	2.4
Total – Development Lands		**72.77**

1.3.4.2 Patch Size

The native vegetation present within the Development Lands and commensurate with PCT 1603 covers approx. 0.7ha and is not connected to vegetation outside the Study Area. The patch size class of "<5ha" is therefore appropriate for these vegetation zones and was entered as such within the Calculator. The vegetation commensurate with PCT 1731 is linked through a riparian corridor to larger tracts of bushland north and south of the site. For this vegetation zone the patch size is approximately 84ha and a patch size class of "25-100ha" has been allocated.

1.3.4.1 Vegetation Integrity Score

Eight (8) vegetation plots were undertaken within the Study Area in December 2019 and January 2020 exceeding the requirements within Table 4 of the BAM (see **Figure 4**). Four (4) plots were undertaken within PCT 1603 and one (1) plot within PCT 1731. Additionally, three (3) plots were undertaken within the paddocks to help determine whether the grassland was predominantly native or exotic. Plot data was used to determine the composition, structure and function condition score the Study Area, which informed the vegetation integrity score. Plot data has been tabulated (**Table 4**) and includes corresponding condition scores along with the overall vegetation integrity score. See **Figure 4** for the location of each plot

Table 6 - Vegetation Integrity Score Table

Site Attribute	PCT 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter				PCT 1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
	Grey Box dominated	Narrow-leaved Ironbark dominated			Degraded
Plot #	1	3	5	6	7
Location	354630E 6379600N	354847E 6379854N	354548E 6379896N	354365E 6380026N	354213E 6380238N
Bearing	282°	265°	237°	83°	12°
Composition					
Tree	1	1	2	1	1
Shrub	2	1	0	0	0
Grass & Grass-like	7	3	4	5	3
Forb	5	1	0	1	1
Fern	0	0	0	0	0
Other	2	3	1	1	1
Total composition score	**35.2**	**11.9**			**12.5**
Structure					
Tree	40	15	40	10	50
Shrub	2	0.1	0	0	0
Grass & Grass-like	34	30	2	7	1
Forb	1	0.1	0	0.1	0.1

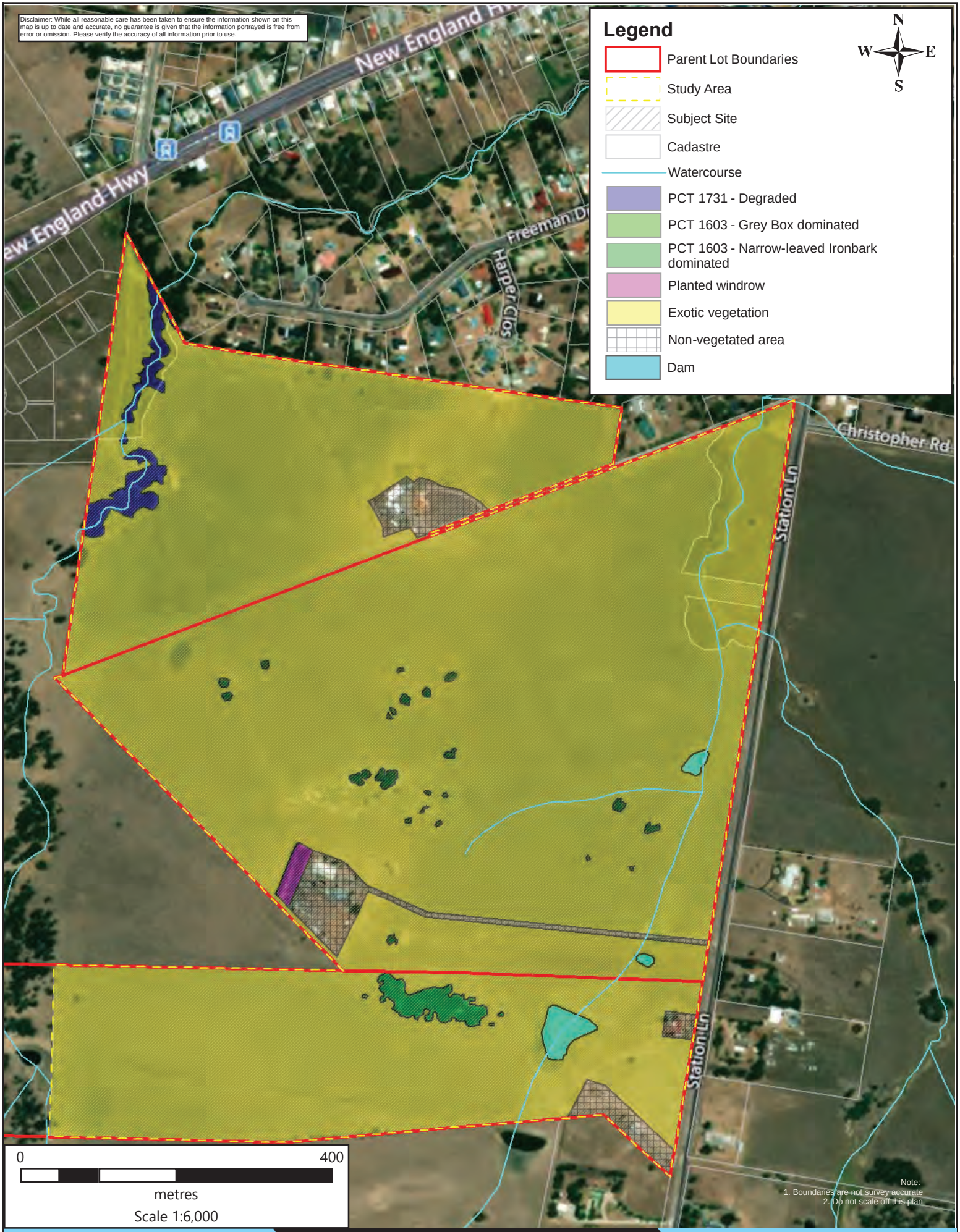
Site Attribute	PCT 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter				PCT 1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
	Grey Box dominated	Narrow-leaved Ironbark dominated			Degraded
Plot #	1	3	5	6	7
Fern	0	0	0	0	0
Other	0.2	0.3	0.1	0.1	1
Total structure score	**62**	**19.4**			**23.5**
Function					
Regenerating Stems (<5cm DBH)	Absent	Present	Present	Absent	Present
Stem Classes (cm DBH)	30-49, 50-79	50-79	10-19, 20-29, 30-49, 50-79	30-49	5-9, 10-19, 20-29, 30-49
# Large Trees	6	1	1	0	0
Hollow-bearing Trees	6	1	1	1	0
Litter Cover (%)	65	86	37.2	76	63
Coarse Woody Debris (m)	0	2	0	0	1
High Threat Weed Cover	5.4	41.2	1	70.6	0.2
Total function score	**52.2**	**35.7**			**45**
Overall Vegetation Integrity Score	**48.5**	**20.2**			**23.7**

Three (3) BAM plots were undertaken within the paddocks to help determine whether the vegetation present aligned with derived native grassland. While native components were present within this vegetation zone, results showed that the vegetation was predominantly exotic and therefore excluded from further floristic investigation including targeted threatened flora searches. The results of these exotic grassland plots are provided in **Table 7** below.

Table 7 - Results of Exotic Grassland BAM plots

Family	Scientific Name	Common Name	BAM Growth Form Group	Plot 2	Plot 4	Plot 8
Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily	Forb (FG)		0.1	
Asteraceae	*Hypochaeris radicata**	Flatweed				0.1
Asteraceae	*Senecio madagascariensis**	Fireweed		0.2	0.1	0.1
Cactaceae	*Opuntia aurantiaca**	Tiger Pear				
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	Forb (FG)	0.1		0.1
Convolvulaceae	*Dichondra repens*	Kidney Weed	Forb (FG)			0.1
Fabaceae	*Desmodium varians*	Slender Tick-trefoil	Other (OG)	0.1		
Fabaceae	*Glycine tabacina*	Twining Glycine	Other (OG)			0.1
Juncaceae	*Juncus cognatus**			0.1		
Plantaginaceae	*Plantago lanceolata**	Ribwort		0.1	0.1	0.1
Poaceae	*Aristida ramosa*	Purple Wiregrass	Grass & grasslike (GG)	5	25	5
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass		30	60	65
Poaceae	*Bothriochloa macra*	Red Grass	Grass & grasslike (GG)			
Poaceae	*Briza subaristata**				0.5	0.2
Poaceae	*Cynodon dactylon*	Common Couch	Grass & grasslike (GG)	25	5	0.5
Poaceae	*Paspalum dilatatum**	Paspalum			0.1	1
Poaceae	*Themeda triandra*	Kangaroo Grass	Grass & grasslike (GG)	20	5	0.5
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel		0.1		
Proteaceae	*Hakea sericea*	Needlebush	Shrub (SG)		0.5	2
Rubiaceae	*Asperula conferta*	Common Woodruff	Forb (FG)	0.1		
Thymelaeaceae	*Pimelea glauca*	Smooth Rice-flower	Shrub (SG)	0.5	0.1	
Verbenaceae	*Verbena rigida var. rigida**	Veined Verbena		0.1	0.1	0.2

Note that *Cynodon Dactylon* (Common Couch) is present throughout the site at varying densities. Given the site's history of cattle grazing, it is likely that Common Couch was introduced as part of a pasture improvement strategy. In this context, it is not considered native and this was taken into account when deciding the status of the grassland as native or exotic.



AEP

Title: Figure 3 - PCT Overview

Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909

1.4 Threatened Species

Under the BAM, threatened species are classified into two types; 'Ecosystem Credit' and 'Species Credit' type species, as detailed within the BioNet Atlas Threatened Species Profile Database (OEH). Ecosystem Credit species are associated with PCTs and other habitat surrogates that are used to predict their occurrence on a particular site.

The 'biodiversity risk weighting' for a species is based on the 'sensitivity to loss' and 'sensitivity to potential gain' score using criteria listed in Appendix 7 of the BAM, and are used in credit calculations to assess impacts of the proposal on a threatened species. The sensitivity to gain class is listed within the BAM calculator for Ecosystem Credit species.

Those Ecosystem Credit species predicted to occur within the site are provided in **Table 8**.

Table 8 - Predicted Ecosystem Credit Species

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Mammals				
Dasyurus maculatus	Spotted-tailed Quoll	High	Y	N
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	High	Y	Y
Miniopterus orianae oceanensis	Large Bent-winged Bat	High	Y	Y
Phascolarctos cinereus	Koala	High	N	N
Pteropus poliocephalus	Grey-headed Flying-fox	High	Y	Y
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	High	Y	Y
Birds				
Anthochaera phrygia	Regent Honeyeater	High	N	N
Callocephalon fimbriatum	Gang-gang Cockatoo	Moderate	N	N
Chthonicola sagittata	Speckled Warbler	High	Y	N
Circus assimilis	Spotted Harrier	Moderate	Y	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High	N	N
Daphoenositta chrysoptera	Varied Sittella	Moderate	Y	N
Glossopsitta pusilla	Little Lorikeet	High	Y	N

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Grantiella picta	Painted Honeyeater	Moderate	N	N
Hieraaetus morphnoides	Little Eagle	Moderate	N	N
Lathamus discolor	Swift Parrot	Moderate	N	N
Lophoictinia isura	Square-tailed Kite	Moderate	Y	N
Melanodryas cucullata	Hooded Robin (south-eastern form)	Moderate	N	N
Neophema pulchella	Turquoise Parrot	High	N	N
Ninox connivens	Barking Owl	High	N	N
Ninox strenua	Powerful Owl	High	N	N
Petroica boodang	Scarlet Robin	Moderate	N	N
Petroica phoenicea	Flame Robin	Moderate	N	N
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Moderate	Y	N
Tyto longimembris	Eastern Grass Owl	Moderate	N	N
Tyto novaehollandiae	Masked Owl	High	Y	N

In addition to the above, Species Credit species identified within the Calculator as potentially occurring within the development site are listed below in **Table 9** along with the results of targeted surveys for each within the development lands.

Table 9 - Candidate Species Credit Species

Scientific Name	Common Name	Specified Survey Period	Development Site Surveyed During Recommended Period? Y/N	Identified within the Site or Surrounds Y/N
Flora				
Acacia pendula - endangered population	Acacia pendula population in the Hunter catchment	All Year	Y	N
Cymbidium canaliculatum - endangered population	Cymbidium canaliculatum population in the Hunter Catchment	All Year	Y	N
Cynanchum elegans	White-flowered Wax Plant	All Year	Y	N
Eucalyptus glaucina	Slaty Red Gum	All Year	Y	N
Monotaxis macrophylla	Large-leafed Monotaxis	Aug - Feb	Y	N
Persicaria elatior	Tall Knotweed	Dec – May	N	N
Pomaderris queenslandica	Scant Pomaderris	All Year	Y	N
Amphibians				
Litoria aurea	Green and Golden Bell Frog	Nov - Mar	Y	N
Litoria brevipalmata	Green-thighed Frog	Oct - Mar	Y	N
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	Nov - Jan	Y	Y
Myotis macropus	Southern Myotis	Oct - March	Y	Y
Phascogale tapoatafa	Brush-tailed Phascogale	All Year	Y	N
Birds				
Anthochaera phrygia	Regent Honeyeater	All Year	Y	N
Callocephalon fimbriatum	Gang-gang Cockatoo	Oct - Jan	Y	N
Calyptorhynchus lathami	Glossy Black-Cockatoo	Mar - Aug	Y	N
Hieraaetus morphnoides	Little Eagle	Aug - Oct	Y	N
Lathamus discolor	Swift Parrot	All Year	Y	N
Lophoictinia isura	Square-tailed Kite	Sep - Jan	Y	N
Ninox connivens	Barking Owl	May - Dec	Y	N
Ninox strenua	Powerful Owl	All Year	Y	N
Tyto novaehollandiae	Masked Owl	All Year	Y	N

1.4.1 Threatened Species Survey Efforts

The fauna survey effort has been guided by the following:

- The predicted and candidate threatened species from within the Biodiversity Assessment Method Calculator (BAM-C);
- *The Threatened Species Survey and Assessment Guidelines for developments and activities* (working draft), NSW Department of Environment and Conservation (2004);
- *Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method*. NSW Office of Environment and Heritage (2018);
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians*, NSW Department of Environment and Conservation (2009); and
- The NSW Threatened Biodiversity Data Collection (TBDC).

1.4.2 Survey Methodology

All required fauna survey techniques were utilised for targeted survey of the species listed in **Table 9** above and guided by the *Threatened Species Survey and Assessment Guidelines* (2004) and *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (2009). The fauna survey effort is shown in **Figure 5**.

1.4.2.1 Bat Call Recording

Bat echolocation calls were recorded using an Anabat Detector within the site. Call recording was undertaken by stationary units set for all night recording over three (3) nights at one location and four (4) nights at a second location giving a total of seven (7) full nights of Anabat Recordings. Transformed calls were analysed by AEP using commercially available software.

1.4.2.2 Diurnal Avifauna Surveys

The targeted species for diurnal avifauna surveys was the White-bellied Sea Eagle, Little Eagle, Square-tailed Kite, Glossy Black-Cockatoo and Gang-gang Cockatoo. The presence of avifauna on site was carried out via diurnal survey as well as incidental observations during all other phases of fieldwork. A total of approx. 19 person hours were dedicated to targeted and incidental diurnal avifauna surveys as well as habitat assessment including a hollow-bearing tree search and search for stick nests.

1.4.3 Frog Surveys

Specific frog searches were carried out in potential habitat on site and in the immediate vicinity. Nocturnal searches were made in areas of appropriate habitat. Such habitat included areas of thicker vegetation, in ground litter, near and under fallen timber, around piles of refuse, and wet / damp areas such as drainage lines, creek lines, dams and areas of poor infiltration capacity and / or periodic inundation.

Physical frog searches were augmented by call recognition. Any calls unable to be clarified in the field were recorded for later comparison with commercially available recordings.

A targeted search was undertaken for *Litoria brevipalmata* (Green-thighed Frog) and *Litoria aurea* (Green and Golden Bell Frog) following a period of significant wet weather in early February 2020. Surveys totalled two hours and 30 minutes of survey. Opportunistic encounters during all other phases of fieldwork were also noted.

Physical frog searches were augmented by call recognition. Any calls unable to be clarified in the field were recorded for later comparison with commercially available recordings.

1.4.4 Incidental Observations & Secondary Indications

Incidental records of any fauna species observed during fieldwork were noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of any resident or migratory species. Searches were also conducted for whitewash, regurgitation pellets and prey remains from Owls, chewed *Casuarina* cones from Black-Cockatoos, chewed fruit remains from frugivorous birds etc.

Given the amount of field survey time spent in the Study Area, survey intensity coverage was sufficient, which led to several additions to site records via incidental observations. Overall survey efforts within the Subject Site include eight (8) BAM plots, targeted searches within the remnant vegetation for threatened flora, habitat assessments (including hollow-bearing tree survey), deployment of camera traps (2 terrestrial and 2 arboreal), Anabat and Songmeter as well as amphibian searches within the large dam in the southern part of the site, along the disturbed drainage line in the eastern part of the site as well as within the riparian corridor in the north west of the site. These surveys are deemed to fulfill minimum survey requirement given the highly degraded nature of the site. Details of the flora and fauna survey are presented in **Table 9** and was conducted using relevant guidelines, in particular OEH survey guidelines for plants (2016) and amphibians (2009), along with applicable EPBC guidelines (2010; 2011). Survey effort is shown in **Figure 4**.

Table 10 - Field Survey Periods

Date	Time	Field Activity	No. of Persons on Site
18 Dec 19	9:00 – 16:00	Vegetation mapping, habitat assessment (HBT), incidental bird survey, BAM plots, installation of camera traps, targeted threatened flora searches	1
13 Jan 20	8:30 – 13:00	Vegetation mapping, habitat assessment (HBT), installation of Anabat and songmeter, targeted threatened flora searches	1
17 Jan 20	08:45 - 15:30	BAM plots, targeted threatened flora searches	2
7 Feb 20	19:30 - 22:00	Nocturnal survey, including frog survey	1

The following Species Credit Species were identified as requiring survey for the Subject Site:

- Green and Golden Bell Frog (*Litoria aurea);*
- Green-thighed Frog (*Litoria brevipalmata);*
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Southern Myotis (*Myotis macropus*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Little Eagle (*Hieraaetus morphnoides*); and
- Square-tailed Kite (*Lophoictinia isura*).

As part of the field surveys, targeted flora searches were undertaken within patches of remnant vegetation targeting:

- *Eucalyptus glaucina*
- *Cynanchum elegans*
- *Monotaxis macrophylla*
- *Pomaderris queenslandica*
- *Acacia pendula*
- *Cymbidium canaliculatum*
- *Persicaria elatior*

None of the flora "Credit Species" were detected within the Study Area. Note that one individual of Eucalyptus within the southern part of the site presented traits usually associated with *Eucalyptus glaucina* and the species has been recorded in bushland directly west of the Subject Site. Samples were sent to the Royal Botanic Garden for positive identification. The individual was identified as a hybrid between *E. tereticornis* and *E. glaucina*. Hybrids are not covered by the scientific determination. Therefore, this individual is not considered vulnerable under State and Federal legislation and does not incur Species Credits.

Further Candidate Species Credit Species indicated by the calculator were not targeted during surveys.

- *Angophora inopina* (Charmhaven Apple): the species was discarded on the basis of the geographical limitation "*east of Kurri Kurri"*;

- *Asperula asthenes* (Trailing Woodruff): the riparian corridor was assessed to be highly degraded and not suitable habitat for the species;

- *Anthochaera phrygia* (Regent Honeyeater): An enquiry with the Biodiversity Offset Scheme support confirmed that the Subject Site is not within mapped areas of important habitat for this species, therefore no further survey is required. Appendix I features such confirmation from BOS support;

- *Burhinus grallarius* (Bush Stone-curlew): Habitat onsite was considered too degraded for the species including the lack of log and fallen/standing timber as well as the mostly cleared nature of the site;

- *Cercartetus nanus* (Eastern Pygmy-possum): Habitat onsite was considered too degraded to be suitable for the species due to a lack of shrub layer and isolated patches of vegetation;

- *Delma impar* (Stiped Legless Lizard): Due to the lack of shelter feature such as rocks and fallen logs as well as mostly cleared nature of the site, habitat for was considered unsuitable for the species to occur onsite;

- Habitat for the orchids *Diuris tricolor* (Pine Donkey Orchid), *Pterostylis gibbosa* (Illawarra Greenhood) and *Pterostylis chaetophora* was considered too degraded given that the remnant patches of vegetation represent the only shade onsite and cattle are continuously disturbing the ground layer;

- *Grevillea parviflora subsp. parviflora* (Small-flowered Grevillea): Habitat present onsite is considered too degraded for the species due to the lack of shrub layer;

- *Haliaeetus leucogaster* (White-bellied Sea-Eagle): Due to the lack of large areas of open water within the Subject Site, habitat present was considered unsuitable and the species unlikely to occur. No large stick nests were observed;

- *Hoplocephalus bitorquatus* (Pale-headed Snake): Due to the sparse and highly degraded nature of the vegetation present onsite, habitat was considered unsuitable for the species.

- *Lathamus discolor* (Swift Parrot): An enquiry with the Biodiversity Offset Scheme support confirmed that the Subject Site is not within draft mapped areas of important habitat for this species, therefore no further survey is required. Appendix I features such confirmation from BOS support;

- *Miniopterus orianae oceanensis* (Large Bent-winged Bat): While the species was recorded onsite, breeding habitat present was considered unsuitable for the species due to the lack of caves, tunnels, mines and culverts.

- Habitat onsite for the forest owls *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl) was considered unsuitable due to the lack of significant vegetated areas and suitable hollows.

- *Phascolarctos cinereus* (Koala): While portions of the Study Area are included in the Koala Development Application Map (SEPP Koala Habitat Protection 2019), desktop research into the NSW BioNet Atlas showed no records of the species in the locality;

- *Pteropus poliocephalus* (Grey-headed Flying-fox): Habitat constraints (breeding camp) not met;

- *Planigale maculata* (Common planigale) is considered vagrant and there are no records of the species within the IBRA subregion.

Given the works conducted on the development site and adjacent lands as detailed in **Appendix A**, it is considered that sufficient information exists to determine the presence of species or otherwise, and relative impact levels from development.

1.4.5 Species presence

All candidate species as identified in **Table 9** were included for presence analysis based on targeted surveys. Species credit species are assessed for potential to occur on site in **Table 11**.

Fauna surveys to date have identified 59 species within the Study Area consisting of 29 bird, 23 mammal, one (1) reptile and six (6) amphibian species. A full species list for fauna recorded on the site is provided in **Appendix A1**. The Bat Call Identification Results are attached in **Appendix A2**.

Of these 59 species, three (3) are not native to Australia (European Red Fox, European Rabbit and Common Myna). The most notable records are the eight (8) threatened bat species recorded within the Subject Site:

- Little Bentwing-bat (*Miniopterus australis*) – potential foraging habitat present on the site for the local population and roosting habitat available in the form of hollow trees. No maternity habitat (caves) present. Habitat to be removed as part of development (noting larger home range).

- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) – potential foraging habitat present on the site for local population. No roosting or maternity habitat (caves) present. Habitat to be removed as part of development (noting larger home range).

- East-coast Freetail-bat (*Micronomus norfolkensis*) - potential foraging habitat present on the site for local population and breeding habitat tin the form of hollow bearing trees is present. Habitat to be removed as part of development (noting larger home range).

- Greater Broad-nosed Bat (*Scoteanax rueppellii*) - potential foraging habitat present on the site for local population and breeding habitat tin the form of hollow bearing trees is present. Habitat to be removed as part of development (noting larger home range).

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) - potential foraging habitat present on the site for local population and breeding habitat tin the form of hollow bearing trees is present. Habitat to be removed as part of development (noting larger home range).

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) - potential foraging habitat present on the site for local population and breeding habitat tin the form of hollow bearing trees is present. Habitat to be removed as part of development (noting larger home range).

- Southern Myotis (*Myotis macropus*) – potential foraging habitat in the form of farm dam in the southern part of the site. Potential roosting and breeding habitat present in the form of hollow bearing trees. **Species credits required.**

- Large-eared Pied Bat (*Chalinolobus dwyeri*) – potential foraging habitat present on the site for local population. No roosting or maternity habitat (caves or other structures) present. Habitat to be removed as part of development (noting larger home range). **Species credits required.**

Table 11 - Species Credit Species

Species Biodiversity Risk Weighting (BRW)	Survey Technique	Timing and Effort	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Conclusion
Fauna					
Green and Golden Bell Frog *Litoria aurea* **BRW-2**	Habitat Assessment Targeted Searches after rain Spotlighting	Spotlighting / Habitat Searches after rain. February 2020	Habitat for the species includes semipermanent/ephemeral wet areas, within 1km of swamps, waterbodies or wet areas. In high altitude populations calling seasons are restricted to summer months. While chytrid is a potential threat to some populations of the species, other populations are subject to manageable threats. The survey efforts were considered adequate given the highly disturbed nature of the site and low quality of the habitat present. Additionally, the only two records of the species within the Atlas search are located 4km south west of the Subject Site and date back to January 2000.	Systematic day habitat search – one hour per stratification unit Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights BAM-C/TBDC Survey Period: Nov to Mar	Highly degraded habitat within the site including a partially vegetated creekline and another creekline devoid of vegetation. Two large dams and two smaller dams are present onsite but before the rain event, only one had marginal amount of water. The species was not detected during field surveys and is considered unlikely to occur within the Subject Site. Around two and a half hours of seasonal surveys were undertaken following a wet weather event. Based on the surveys' results and the low quality of the habitat present, is it unlikely that Green and Golden Bell Frog is present within the Subject Site. Therefore, no further Species Credit considerations apply.
Green-thighed Frog *Litoria brevipalmata* **BRW-1.5**	Targeted Searches after rain Spotlighting	Targeted searches and spotlighting after rain. February 2020	The species was allocated to species credit species because presence cannot be predicted from vegetation or landscape surrogates. Experts noted that it is difficult to detect from survey, detection could be optimised by detailed/strict survey guidelines. Survey: reliant on rainfall events for calling/breeding when it is usually detected/surveyed, strongly suggest >75 mm in 24 hrs or 150 mm over 72 hrs as the most probable time to survey and detect the species. Note that tadpoles are susceptible to injury during netting, and can be identified from observation. Whilst there is some information on the species ecology, little is known about the species response to management. A ground-dwelling frog that inhabits coastal forest and bushland. Calling males gather around temporary or semi-permanent ponds and flooded ditches after heavy rain. Egg masses are often laid in temporary ponds. Tadpoles are predominately surface dwellers, but feed throughout the water body. Green-thighed Frogs occur 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.	Systematic day habitat search – one hour per stratification unit Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights BAM-C/TBDC Survey Period: Oct to Mar	The exotic grassland on the Subject Site is considered unlikely to provide suitable habitat for the species. Non-breeding habitat is present across the site in the form of four dams. However, all but one dam were dry at the time of the surveys. Around two and a half hours of seasonal surveys were undertaken following a wet weather event. An appropriate amount of survey work has been undertaken to conclude that Green-thighed Frog is unlikely to be present on the Subject Site and no further Species Credit considerations apply.
Large-eared Pied Bat *Chalinolobus dwyeri* **BRW-3**	Habitat Assessment Echolocation Recordings	Habitat Assessment / Echolocation Recordings – Dec 2019 - Jan 2020	The habitat constraint for the species is *within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.* *The species is a full species credit because it can not be reliably predicted to occur on a site based on vegetation and other landscape features (either foraging or breeding). This species usually gives birth to twins.* *SAII threshold is potential breeding habitat and presence of breeding individuals. Potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat.* *Species mapping polygon for breeding habitat must use high resolution aerial imagery and topographic maps to identify features on the subject land (caves, scarps, cliffs etc). Polygon must be at least 100m wide (or 50m radius for point locations such as caves) with the breeding habitat features (may be multiple) as the centroid (see Threatened Bat Survey Guide). All breeding habitat*	16 nights with a minimum four nights of recording, ultrasonic recorders located in areas of greatest potential activity BAM-C/ TBDC Survey Period: Oct to Mar	Large-eared Pied Bat is **present** within the Subject Site and the site occurs within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels. Both PCT 1731 and 1603 present within the Subject Site have been assigned species polygon. **SPECIES CREDIT SPECIES**

Species Biodiversity Risk Weighting (BRW)	Survey Technique	Timing and Effort	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Conclusion
			on or within 100m of the subject land and the area immediately surrounding the feature must be identified. *All habitat on the subject land should also be mapped if present. Use high resolution aerial imagery and topographic maps to identify potential roost habitat features on the subject land within 2km caves, scarps, cliffs etc. Species polygon boundary should align with PCTs on the subject land to which the species is associated that are within 2km of identified potential roost habitat features.*		
Southern Myotis *Myotis macropus* **BRW-2**	Habitat Assessment Echolocation Recordings	Habitat Assessment / Echolocation Recordings – Dec 2019 - Jan 2020	The habitat constraints for the species are *hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone riparian zones and waterbodies including rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site.* The species was allocated to species credit because it is dependent on waterways with pools of 3m wide or greater for foraging (which will be protected under legislation), habitat surrounding waterways is used for breeding and roosting. The species can be detected via survey using appropriate techniques (see Threatened Bat Survey Guide). All habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200m of waterbodies mapped.	16 nights with a minimum four nights of recording, ultrasonic recorders located in areas of greatest potential activity BAM-C/ TBDC Survey Period: Oct to Mar	Southern Myotis is **present** and HBTs occur within 200m of the associated water body, therefore species credits are incurred for this site. Species polygon have been assigned to vegetation present within 200m of the large Dam present in the southern part of the site and a smaller one to the north. **SPECIES CREDIT SPECIES**
Brush-tailed Phascogale *Phascogale tapoatafa* **BRW-2**	Habitat assessment Camera trapping Spotlighting	Camera trapping – 26 nights in Dec 2019 – Feb 2020 Spotlighting 1night - Feb 2020	The species preferred habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. The species prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf-litter; however, they can also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. They feed mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. They nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and can use many different hollows over a short time span. Mating occurs May – July. Species is difficult to detect. It may be more appropriate to seek an expert report to determine presence or absence. Survey Dec – Jun, noting that Dec – Feb is the main juvenile dispersal period and May – Jun is the peak mating season, when males are most likely to be detected particularly as deceased individuals towards the end of the season. Species polygon: If detected or presence is assumed (impact site only) the species polygon is drawn around the outer-edge of the PCTs that the species is associated, as defined in the TBDC. Other general information: Populations fluctuate greatly year to year. The species is associated with a wide range of PCTs across NSW and may occur in habitat without any hollow-bearing trees.	While the DECC 2004 guidelines do not make reference to camera trapping, the technique has been previously acknowledged as a suitable mammal survey method (S. Lewer pers. comm.). Reference to the Wyong Shire Council Flora & Fauna Survey guidelines, Table 3 indicates for all mammals that remote camera survey technique is preferred over trapping). The minimum survey effort for site under 100ha should be 2 per vegetation community or habitat type for 14 consecutive nights. Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights BAM-C/TBDC Survey Period: All Year	Camera trapping recorded scansorial mammals including Brown Antechinus and European Fox. As such, it is considered likely that the Brush-tailed Phascogale would have been recorded if present within the Subject Site. Based on the results of the surveys is it considered unlikely that *Phascogale tapoatafa* are present within the Subject Site and as such Species Credits are not incurred.
Gang-gang Cockatoo *Callocephalon fimbriatum* **BRW-2**	Habitat assessment & diurnal bird census	4 Bird surveys and incidentals during other fieldwork - Dec 2019 – Jan 2020 Songmeter left for 5 days – Jan 2020	The species favours tall mountain forests and woodlands (particularly heavily timbered/mature wet sclerophyll forests) in spring and summer. In winter and autumn, the species moves to lower latitudes and occupies drier more open eucalypt forests and woodlands including dry forest in coastal areas and is often found in urban areas. Habitat constrain is *Eucalypt tree species with hollows greater than 9 cm diameter*. Breeding should be identified by the presence of suitable habitat AND 1. presence of nest OR; 2. observation indicates a pair of birds on site.	Area based survey methods BAM-C/TBDC Survey Period: Oct to Jan.	The species was not detected during field surveys, or recorded within the immediately locality. While suitable hollows are present, in the absence of the species or observed breeding activity no further species credit considerations apply.
Glossy Black-Cockatoo	Habitat assessment & diurnal bird census	4 Bird surveys and incidentals during	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the	Area based survey methods BAM-C/TBDC Survey Period: March to Aug.	This species is shy and reclusive, while suitable hollows are present within the Subject Site, Glossy Black-Cockatoo are unlikely to breed within open habitat with regular human activity. Given the local absence of this widely distributed species it is unlikely

Species Biodiversity Risk Weighting (BRW)	Survey Technique	Timing and Effort	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Conclusion
Calyptorhynchus lathami **BRW-2**		other fieldwork - Dec 2019 – Jan 2020 Songmeter left for 5 days – Jan 2020	southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. The species inhabits open forest and woodlands of the coast where stands of She-oak occur. The species is dependent on large hollow-bearing eucalypts for nest sites where the animals will lay a single egg between March and May. Glossy Black-Cockatoos feed almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina*), shredding the cones with the massive bill. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, but also recorded in open woodlands dominated by Belah (*Casuarina cristata*).		to utilise the vegetation present onsite. As no breeding activity or presence has been established, species credits do not apply.
Little Eagle *Hieraaetus morphnoides* **BRW-1.5**	Habitat Assessment Diurnal Bird Census Songmeter	4 Bird surveys and incidentals during other fieldwork - Dec 2019 – Feb 2020 Songmeter left for 5 days – Jan 2020	Little Eagle are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit. The species nest in live (occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat (there are examples of nest trees in ACT). Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND 1. the presence of a male and female; or 2. female with nesting material; or 3. an individual on a large stick nest in the top half of the tree canopy. Where a breeding site has been identified in accordance with the BAM the species polygon should be established by providing a circular buffer of 300m around the nest tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. Little eagles are less likely than urban-adapted raptors to readily cross urban or peri-urban spaces to hunt. The 300m buffer is in accordance with the ACT offset guidelines for this species.	Habitat assessment – 30 minutes searching each relevant habitat. This matter has not been resolved as yet but it is likely that a species-time curve approach should be utilised for surveying diurnal birds. For example, the survey session for a particular day may cease when no additional species are identified within a set time period. This approach better accommodates the variety of habitat types and birds found in NSW. Per stratification unit. BAM-C/ TBDC Survey Period: Aug to Oct	While surveys were conducted outside of recommended survey period, area-based searches were indicative that Little Eagle is not utilising the site for foraging. Where suitable trees were identified, no large stick nest was found. No evidence of site use for breeding purposes was found, as such Species Credits are not incurred for this site
Square-tailed Kite *Lophoictinia isura* **BRW-1.5**	Habitat Assessment Diurnal Bird Census	4 Bird surveys and incidentals during other fieldwork - Dec 2019 – Feb 2020 Songmeter left for 5 days – Jan 2020	Found in a variety of timbered habitats including dry woodlands and open forests. Nesting sites generally located along or near water courses, in a fork or on large horizontal limbs. The species is allocated to dual credit because they tend to be sensitive to disturbance around nests. It will be difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites.	Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat. BAM-C/ TBDC Survey Period: Sep – Jan.	Area based searches failed to detect Square-tailed Kite utilising the site for foraging. While suitable trees occur on site, no stick nests were detected No suitable nest was observed within the Study Area, as such Species Credits are not incurred for this site.
White-bellied Sea-Eagle Haliaeetus leucogaster **BRW-2**	Habitat Assessment Diurnal Bird Census Targeted Surveys	4 Bird surveys and incidentals during other fieldwork - Dec 2019 – Feb 2020 Songmeter left for 5 days – Jan 2020	Terrestrial habitat includes coastal dunes, tidal flats, grassland, heathland, woodland and forest. Requires large emergent eucalypts for nesting. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat. BAM-C Survey Period: Jul to Dec.	While surveys were conducted outside of recommended survey period, area-based searches were indicative that White-bellied Sea-Eagle is not utilising the site for foraging. Where suitable trees were identified, no large stick nest was found. No evidence of site use for breeding purposes was found, as such Species Credits are not incurred for this site
Flora					
Acacia pendula population in the Hunter catchment *Acacia pendula - endangered*	Habitat Assessment Targeted Search Parallel Transects	Dec 2019 – Jan 2020; targeted flora survey	This Hunter population is known to occur naturally as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Only recorded to date at 6 locations: Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. These locations occur within the Muswellbrook and Singleton Local Government Areas, with the population potentially also occurring within the Mid-Western Regional and Upper Hunter LGA's.	Parallel walking transects –20m apart BAM-C/ TBDC Survey Period: All year.	The species was not detected during field surveys. Marginal habitat present within the Subject Site. Species Credits are not incurred for this site.

Species Biodiversity Risk Weighting (BRW)	Survey Technique	Timing and Effort	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Conclusion
population			Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.		
Cymbidium canaliculatum - endangered population Cymbidium canaliculatum population in the Hunter Catchment	Habitat Assessment Targeted Search	Dec 2019 – Jan 2020; targeted flora survey	Typically grows in the hollows, fissures, trunks and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. It usually occurs singly or as a single clump, which can form large colonies on trees, between two and six metres from the ground. Within the Hunter Catchment, *Cymbidium canaliculatum* is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands (including those dominated by the intergrade *E. albens-moluccana*), much of which may constitute the endangered ecological community (EEC) 'White Box Yellow Box Blakely's Red Gum Woodland'. It has been found, less commonly, to grow on *E. dawsonii* (Slaty Box), *E. crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box), *Angophora floribunda* (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species, including dead stags. It is also known to use man-made structures, such as fence posts and wooden bridges as its host.	Targeted survey within suitable habitat. BAM-C/ TBDC Survey Period: All year.	The species was not detected during field surveys. Marginal habitat present within the Subject Site. Species Credits are not incurred for this site.
Cynanchum elegans White-flowered Wax Plant **BRW-2**	Habitat Assessment Targeted Search Parallel Transects	Dec 2019 – Jan 2020; targeted flora survey	Austral Toadflax is a small, straggling herb to 40 cm tall. Leaves are pale green to yellow-green, somewhat succulent, 1 - 4 cm long and 0.5 - 1.5 mm wide. Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The fruit is small and nut-like, developing in summer. This species is often hidden amongst grasses and herbs. 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.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C/ TBDC Survey Period: All year	Targeted flora survey failed to detect the species within remnant vegetation. Due to the species' conspicuous nature, it is unlikely to remain undetected. Therefore, Species Credits are not incurred for this site.
Eucalyptus glaucina Slaty Red Gum **BRW-2**	Habitat Assessment Targeted Search Parallel Transects	Dec 2019 – Jan 2020; targeted flora survey	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, west of Maitland. Grows in grassy woodland and dry eucalypt forest, on deep, moderately fertile and well-watered soils.	Parallel walking transects – Maximum distance between transects 40m in open vegetation, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation. BAM-C/TBDC Survey Period: All year	One individual of Eucalyptus within the southern part of the site presented traits usually associated with *Eucalyptus glaucina* and the species has been recorded in bushland directly west of the Subject Site. Samples were sent to the Royal Botanic Garden for positive identification. The individual was identified as a hybrid between E. tereticornis and *E. glaucina*. Hybrids are not covered by the scientific determination and therefore, this individual is not considered vulnerable under state and federal legislation. Species Credits are not incurred for this site.
Monotaxis macrophylla Large-leafed Monotaxis **BRW-2**	Habitat Assessment Targeted Search Parallel Transects	Dec 2019 – Jan 2020; targeted flora survey	The distribution and supposed rarity of *Monotaxis macrophylla* within NSW is related to the occurrence of fire. At least within NSW, the species has not been found in the absence of fire. There is a great diversity in the associated vegetation within NSW (less though in Queensland), encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude.	Survey within 6 months of disturbance or fire, if possible. Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation.	The species was not detected during field surveys and is not known from the locality. It is unlikely to occur onsite due to highly degraded habitat. Therefore, Species Credits are not incurred for this site.
Persicaria elatior Tall Knotweed **BRW-2**	Habitat Assessment Targeted Search Parallel	Feb 2020 Targeted survey	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Sometimes this species dies off above ground off in winter, but in other situations can persist through winter. It can be identified from its leaves without flowers.	Targeted survey in suitable habitat including damp places, especially beside streams and lakes. BAM-C/ TBDC Survey Period: Dec to May	Targeted surveys within potentially suitable habitat failed to detect the species. There are no records within the locality and the species is unlikely to occur within the Subject Site. Therefore, species credits are not incurred.

Species Biodiversity Risk Weighting (BRW)	Survey Technique	Timing and Effort	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Conclusion
Pomaderris queenslandica Scant Pomaderris **BRW-2**	Habitat Assessment Targeted Search Parallel Transects	Dec 2019 – Jan 2020 Target surveys	Limited information is available on this species. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation. BAM-C/ TBDC Survey Period: All year	The species was not detected within the Subject Site despite targeted searches. Potential habitat present is highly degraded. Therefore, species credits are not incurred.

Key: Survey Guidelines Utilised:

- *The Threatened Species Survey and Assessment Guidelines for developments and activities (working draft),* NSW Department of Environment and Conservation (2004)
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians*, Department of Environment and Climate Change NSW (2009)
- *The NSW Threatened Biodiversity Data Collection*

AEP

Title: Figure 4 - Flora Survey Effort

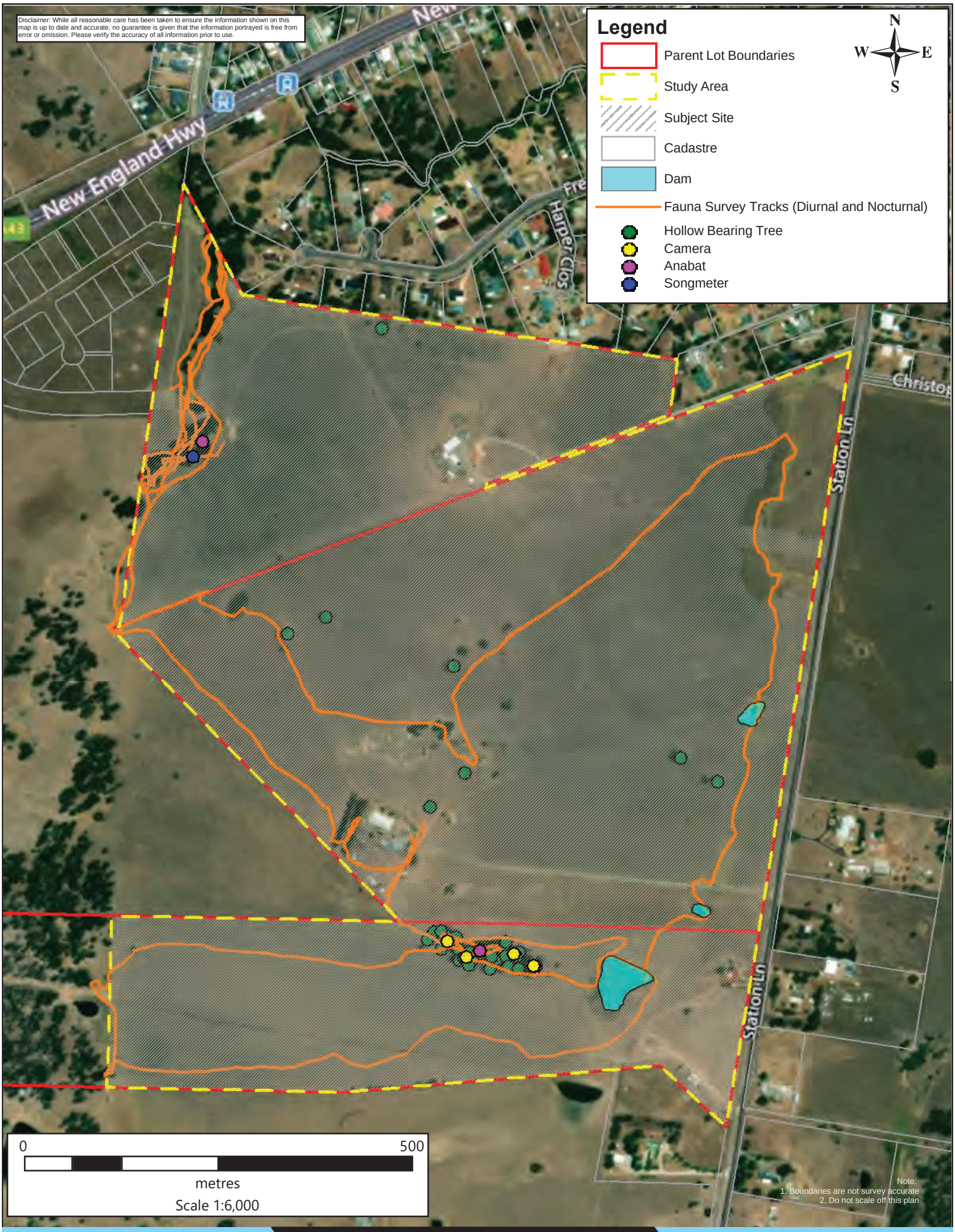
Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909



AEP

Title: Figure 5 - Fauna Survey Effort

Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

Section 8 of the BAM provides a list of measures that need to be taken into consideration during project planning and design, to minimise impacts upon native vegetation, habitat and other prescribed biodiversity values. Applicable measures taken as part of this project to minimise impacts are provided below.

2.1 Avoid and Minimise Impacts

The proposed development will occur in a broader area of former farmland subsequently rezoned for residential purposes. It features highly disturbed vegetation, with mostly grazing paddocks and degraded riparian zones with very limited native vegetation. Within a radius of 1500m, several patches of likely native woodland were identified mainly east and south west of the Subject Site as well as a riparian corridor north of the site. Many of these patches of woodlands appear to be isolated from each other (**Figure 2**).

It is to be noted that the vegetation present onsite is partially isolated from these other areas of native vegetative habitat, being surrounded by grazing properties, residential dwellings and swamp creek to the north. Only the vegetation in the north west of the site is directly linked to the riparian corridor of Lochinvar Creek. The vegetation located in the western part of Lot 2 DP 634523 is not part of the proposed subdivision.

Site specific avoid and minimise measures are discussed in **Tables 12** and **13**, while **Tables 14** and **15** outline the direct and indirect impacts associated with the development and how they are to be mitigated.

Table 12 - Impact avoidance and minimisation

Locating a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
Objectives/Requirements	**Evidence of compliance**
Project location decisions should be informed by knowledge of biodiversity values. The assessment requirements set out in Stage 1 of the BAM may be used to provide an initial desktop assessment of biodiversity values for early consideration in planning the route or location of a project.	Under the *Maitland Local Environment Plan 2011* (the LEP), the Subject Site is zoned R1 - General Residential. Land directly south and east of the Subject Site is also zoned R1 and comprises similar pastureland. The western section of Lot 2 DP 634523 is currently zoned RU2 – Rural Landscape and is not subject to this assessment. Residential development to the north is zoned R5 – Large Lot Residential and part of Lochinvar Creek west of the Subject Site is zoned E3 – Environmental Management. The remnant vegetation present onsite is not viably connected to any patches of vegetation except for the riparian corridor in the north west of the site which will only be marginally affected by the development during the construction phase and will be enhanced post construction with the establishment of a wider riparian corridor. The vegetation within the site has not been identified as being of high conservation value during the current assessment and is noted to be highly degraded and heavily grazed (cattle and horse). It is noted that while the PCTs found on site may theoretically contain threatened species habitat the degraded nature of the site (as indicated by the low VIS score) indicates that usage is highly unlikely. The project avoids part of the vegetation directly west of the site within Lot 2 DP 634523 which consists of the riparian corridor of Lochinvar Creek while mostly utilising the degraded and disturbed paddock and grasslands within the rest of the Subject Site. The proposed development follows the principles of *Lochinvar Structure Plan* (2007) and the biodiversity consideration highlighted in the *Maitland Greening Plan* (2002) which identifies "opportunity corridors" within the Maitland area and identifies sections of the Study Area as potential wildlife corridors and drainage line corridors. The vision of the Greening Plan in terms of revegetation is to "increase the presence of native vegetation in the landscape so as to improve habitat for biodiversity in the local area and begin the process of reducing the impact of land degradation".
Final selection of project location may be an iterative process. Location decisions may need to be revisited when all field surveys have been completed.	The Subject Site has been rezoned as R1 – General Residential and is part of a wider plan for development of Lochinvar, following on from the *Maitland City Wide Development Control Plan – Lochinvar Structure Plan (2007)*.
Direct impacts on clearing of native vegetation and habitat can be avoided and minimised by: *(a) locating the project in areas where there are no biodiversity values* *(b) locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)* *(c) locating the project in areas that avoid habitat for species that have a high biodiversity risk weighting or native vegetation that is a critically endangered ecological community (CEEC) or an endangered ecological community (EEC)* *(d) locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.*	a) As reflected in the Biodiversity Values Map, the Subject Land is devoid of any areas containing biodiversity values. b) The Development Footprint has been located over areas containing both native remnant vegetation and areas of cleared land. Areas of remnant vegetation exist in highly degraded and disturbed condition across the site. Remnant vegetated portions of the Subject Site offer ground habitat associated with PCT 1603 and PCT 1731. However, the lack of shrub layer and ongoing disturbance from cattle grazing has greatly diminished this value. Both PCTs have an overall low Vegetation Integrity Score therefore offering reduced/no habitat value to resident fauna. c) Two Species Credit Species are present within the Subject Site. *Myotis macropus* and *Chalinolobus dwyeri* are present within the Subject Site and may utilise the area for foraging habitat but there are no caves or other structures that would be used as breeding habitat. Two EECs are present within the site. Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregion and Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. Due to the highly disturbed nature of the vegetation present onsite, result of previous and current management practices, the vegetation within the site has not been identified as of high conservation value during current detailed surveys and is zoned under the Maitland LEP for low density residential development. The direct impacts on the vegetation are considered acceptable due to the highly degraded nature of the vegetation present, including the past and current usage by grazing livestock. d) Given the degraded landscape within the locality, the Subject Site currently provides connectivity for species that have high mobility. A sparse canopy layer and a highly degraded, mostly open understory and isolation from areas of remnant vegetation precludes the movement of low mobility species through the landscape. Development of the site will likely increase connectivity due to landscaping and planting of street trees increasing habitat opportunities to those animals that are currently able to utilise the site.
In selecting a project location, the following should be addressed, as they apply to the project: *(a) an analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology* *(b) an analysis of alternative routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route* *(c) an analysis of alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location* *(d) an analysis of alternative sites within a property on which the project is proposed that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.*	a) The removal of vegetation will occur within areas zoned R1. Land in the west of Lot 2 DP 634523 zoned RU2 which acts as a riparian corridor will not be developed. As explained above, the site is deemed appropriate in accordance with the LEP and for the most part is degraded pasturelands. Consideration of alternative modes or technologies to minimise impacts on biodiversity is limited at this site, given current access from existing roads, surrounding developed areas and the need to establish Water Sensitive Urban Design (WSUD). WSUD will be implemented within proposed detention ponds. For a relatively short period of time development will modify the water regime throughout the site – potentially reducing the availability of water to fauna. However, in the long term the detention basins are likely to provide better quality water habitat and foraging to those species temporarily affected. b) As discussed, the roads (entrances and exits) have been determined by the surrounding developments. It is therefore not feasible for the development to proceed with alternatives routes for roads and linear services. c) The Development Footprint was considered an appropriate location as determined by the zoning of the land and the surrounding land use. During this process, biodiversity values within the locality were assessed, and given the low biodiversity value and degraded nature of the site it was considered development of the site would not impacts on any area of high biodiversity value. Instead, the establishment of riparian corridors will enhance the biodiversity value of Lochinvar creek through the revegetation of the riparian corridor present onsite that currently possesses a disturbed and patchy vegetation. d) As per section c).
Justifications for project location decisions should identify any other site constraints that the proponent has considered in determining the location and design of the project, e.g. bushfire protection requirements including clearing for asset protection zones, flood planning levels, servicing constraints.	Flood modelling has been taken into consideration in the design phase and the low-lying areas within the Study Area will not be developed to provide for the establishment of riparian corridors avoiding flooding within the future development. Additionally, bushfire protection requirements have been taken into consideration as the proposed development within Lot 2 DP 634523 currently located 30-60m from the existing vegetation directly west with paddocks providing a buffer against potential bushfire threat.
Actions taken to avoid and minimise impacts through locating the project, or selecting the land to be biodiversity certified must be documented and justified in the BDAR or BCAR.	The proposed development has a low impact on biodiversity values, native vegetation, connectivity routes and fauna movements whilst still being located on appropriately residentially zoned land which has access to services.

Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
Project design, including the location of temporary and permanent ancillary construction and maintenance facilities, should avoid and minimise clearing of native vegetation and habitat by: *(a) reducing the clearing footprint of the project* *(b) locating ancillary facilities in areas where there are no biodiversity values* *(c) locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)* *(d) locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)* *(e) providing structures to enable species and genetic material to move across barriers or hostile gaps* *(f) making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.*	a) – d) The removal of vegetation will occur across the entire Subject Site. As explained above, the site was deemed appropriate for development as a result of the land zoning, the ability to link into surrounding developments services, and the degraded nature of the site. e) – f) Given the current lack of connectivity it is likely that landscaping associated with the development, including the establishment of a riparian corridor, on a drainage channel currently devoid of native vegetation and suffering from erosion will increase connectivity in the long term. Additionally, the existing disturbed riparian corridor located in the north west of the site will be enhanced and widened. The detention basins are also likely to increase the habitat available to species that might utilise aquatic areas.
Efforts to avoid and minimise impacts through design must be documented and justified in the BDAR or BCAR.	As discussed above, the development and its subsequent impacts were deemed unavoidable to meet the development standards, WSUD and connection to existing services such as roads. Section 2 of the BDAR explains in detail how the 'avoid and minimise principles' have been implemented as part of the biodiversity impact assessment for the project. Development of the degraded pastureland on site rather than other areas of better-quality habitat within the region is a valid way to minimise the impacts of development within the region while still allowing growth. The native vegetation proposed for removal totals 1.16ha. The establishment of the two riparian corridors within the Study Area, will effectively result in a net gain to biodiversity. The riparian corridor in the north east will cover an area of approx. 2.5ha and the riparian corridor within the north west will increase by approx. 1.3ha. The 3.8ha of newly created riparian vegetation will generate a net gain for biodiversity of approx. 2.3ha. Additionally, the two Onsite Detention Basin will create aquatic habitat covering approx. 3ha.

Table 13 - Prescribed impact avoidance and minimisation

Avoiding and Minimising Prescribed Biodiversity Impacts during Project Planning	
Objectives/Requirements	**Evidence of compliance**
Some types of projects may have impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical.	No biodiversity values in addition to those noted in the BDAR i.e. direct and indirect impacts to biodiversity were identified for the Subject DA Footprint. Direct and indirect impacts are considered in S**ection 2.2** of the BDAR in relation to impacts that could not be avoided or minimised.
The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme: *(a) impacts of development on the habitat of threatened species or ecological communities associated with:* *(i) karst, caves, crevices, cliffs and other geological features of significance, or* *(ii) rocks, or* *(iii) human made structures, or* *(iv) non-native vegetation* *(b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range* *(c) impacts of development on movement of threatened species that maintains their life cycle* *(d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)* *(e) impacts of wind turbine strikes on protected animals* *(f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.*	a) The Subject Site: (i) Does not contain karsts, caves, crevices, cliffs and other features of geological significance supporting the habitat of threatened species or ecological communities; (ii) Does not contain significant amount of rocks. Scattered rocks occur within the centre of Lot 4; however, they represent a small amount of the total habitat present onsite and do not provide habitat for threatened species or ecological communities (iii) Does not contain human made structures containing habitat for threatened species and ecological communities; (iv) Does not contain non-native vegetation supporting threatened species and ecological communities; b) Current corridor function is considered to be very low, given the Subject Site is bordered to the east and south by open, pastureland, and residential development to the north. The only corridor present is the Lochinvar Creek in the north west of the Study Area which will be increased by approx. 1.3ha as a result of the proposed development. Additionally, this area is likely only be utilised by highly mobile groups, including birds and bats. The development works should increase the use of this area by allowing less mobile species to move through the gardens and landscaped areas of the residences and amenities in the long term. c) Threatened species identified as utilising the site are considered highly mobile species, it is therefore considered unlikely that movement throughout the landscape will be hindered by the proposed development. d) The development will provide enhanced water quality through the use of WSUD treatments throughout the design. These will reduce the development impacts on water quality, water bodies and the hydrological process. This will reduce the impacts of this development on the previously listed elements. e) Wind turbines are not a feature of the development proposed. f) Given that the development will be for local roads with a maximum speed limit of 50-60km/hr, the likelihood of vehicle strike is considered much lower than higher speed roads.
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
Objectives/Requirements	**Evidence of compliance**
Prescribed biodiversity impacts can be avoided and minimised by: *(a) locating the envelope of surface works to avoid direct impacts on the habitat features identified in Paragraph 8.2.1.2* *(b) locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features identified in Paragraph 8.2.1.2, e.g. locating longwall panels away from geological features of significance or water dependent plant communities and their supporting aquifers* *(c) locating the project to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or local movement pathways* *(d) optimising project layout to minimise interactions with threatened species and ecological communities, e.g. designing turbine layout to allow buffers around features that attract and support aerial species, such as forest edges, riparian corridors and wetlands, ridgetops and gullies* *(e) locating the project to avoid direct impacts on water bodies.*	a) The Subject Site: (i) Does not contain karsts, caves, crevices, cliffs and other features of geological significance supporting threatened species and ecological communities. (ii) Minimal amount of rocks is present within the Subject Site; however, they do not support habitat for threatened species and ecological communities; (iii) Does not contain human made structures containing habitat for threatened species and ecological communities; (iv) Does not contain non-native vegetation supporting threatened species and ecological communities; As described in 8.2.1.2 (b) above, connectivity for threatened species will not be significantly changed and may eventually become more connected due to the increase of an existing corridor in the north west of the Study Area, the creation of a new one in the north east as well as landscaping of the new residential development. Identified threatened species (nine microbats) are considered highly mobile and have the ability to disperse across the urban landscape and as such are not likely to be affected significantly. As described in 8.2.1.2 (c) above, the project envelope will not affect the movement of threatened species critical to their life cycle.

	As described in 8.2.1.2 (d) above, the project will provide enhanced water quality through the use of water quality basins and WSUD to reduce the development impacts on water quality, water bodies and hydrological processes that may support threatened species or communities. As described in 8.2.1.2 (e) above, wind turbines are not a feature of the development proposed. As described in 8.2.1.2 (f) above, the project incorporates low speed local roads, to avoid and minimise the potential for fauna vehicle strike. b) As discussed previously the total developmental potential of the site is to be utilised to realise the aims and objectives of the low-density residential zone while avoiding flood prone areas (based around tow creek lines) to the north east and north west of the Subject Site. Consideration of sub-surface works and their impacts to habitat features is therefore considered unnecessary. c) As discussed above threatened species identified as utilising the site are considered highly mobile species, it is therefore considered unlikely that movement throughout the landscape will be hindered by the proposed development. The proposed landscape plantings and construction of detention basins may aid in creating movement pathways for these species. No structures will be developed that would interfere with migratory birds (wind turbines or similar structures extending above 2-3 storeys in height). d) The project layout aims to maximise development potential of the site. As explained above, the site has not been identified as of high conservation value during current detailed surveys and is zoned under Maitland LEP for low density residential development. The direct impacts upon the vegetation that are associated with the proposal are considered negligible in terms of impact. The project has sought to minimise the impacts on biodiversity by developing the lands zoned as residential and avoiding areas that are the floodplain associated with Swamp Creek. Developing on areas of land which have been or currently are areas used for livestock grazing with degraded vegetation should help avoid development in areas with higher biodiversity value. e) While the development will impact upon four dams and one degraded drainage line, given the highly degraded nature of the drainage line and dams within the site, as well as the current standards for water quality and quantity it is likely water quality and quantity along with aquatic habitat will increase.
In selecting a project location, the following should be addressed, as they apply to the project: *(a) an analysis of alternative modes or technologies that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed mode or technology* *(b) an analysis of alternative routes that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed route* *(c) an analysis of alternative locations that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed location* *(d) an analysis of alternative sites within a property on which the project is proposed that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed site.*	a)- d) Removal of vegetation will occur across the entire Subject Site. In addition, removal of vegetation will occur within the north west riparian corridor. As explained above, the site has not been identified as being of high conservation value during current detailed surveys and is zoned under the Maitland LEP for general residential development. The direct impacts upon the vegetation that are associated with the proposal are considered negligible due to the degraded and highly disturbed nature of the habitat present onsite. Clearance of this area to allow for the site to be developed to meet Maitland Council residential development standards, to provide the character and visual amenity consistent with surrounding developments as well as providing a high level of water quality treatment for any water running into Lochinvar Creek should minimise the impacts of development within the region and allow avoidance of development on areas that have higher biodiversity values.
Justifications for project location decisions should identify any other site constraints that the proponent has considered in determining the location and design of the project, e.g. bushfire protection requirements including clearing for asset protection zones, flood planning levels, servicing constraints.	Flood modelling has been taken into consideration in the design phase and the low-lying areas within the Study Area will not be developed to provide for the establishment of riparian corridors avoiding flooding within the future development. Additionally, bushfire protection requirements have been taken into consideration as the proposed development within Lot 2 DP 634523 currently located 30-60m from the existing vegetation directly west with paddocks providing a buffer against potential bushfire threat. The development will provide enhanced water quality through the use of WSUD treatments within the development. These will reduce the development impacts on water quality, water bodies and the hydrological process. This will reduce the downstream impacts of this development on the previously listed elements with relation to Lochinvar Creek and the wider catchment area.
Efforts to avoid and minimise impacts through locating the project must be documented and justified in the BDAR or BCAR.	Refer to **Section 2.1** of the BDAR.

Designing a Project to Avoid and Minimise Prescribed Biodiversity Impacts

Objectives/Requirements	Evidence of compliance
Prescribed biodiversity impacts can be avoided and minimised by: *(a) engineering solutions, e.g. proven techniques to minimise fracturing of bedrock underlying features of geological significance, water dependent communities and their supporting aquifers, proven engineering solutions to restore connectivity and favoured movement pathways* *(b) design of project elements to minimise interactions with threatened and protected species and ecological communities, e.g. designing turbines to dissuade perching and minimise the diameter of the rotor swept area, designing fencing to prevent animal entry to transport corridors* *(c) design of the project to maintain environmental processes critical to the formation and persistence of habitat features not associated with native vegetation* *(d) design of the project to maintain hydrological processes that sustain threatened species and TECs* *(e) design of the project to avoid and minimise downstream impacts on rivers, wetlands and estuaries by control of the quality of water released from the site.*	a)– e) Water Sensitive Urban Design (WSUD) will be implemented to ensure that water quality and runoff are appropriately similar to existing conditions on site and minimise prescribed impacts on biodiversity values linked to hydrology and water quality.
Efforts to avoid and minimise impacts through design must be documented and justified in the BDAR or BCAR.	Refer to **Section 2.1** of the BDAR.

2.2 Assessment of Impacts

Impacts that are not subject to avoid and minimise measures are assessed as follows.

Table 14 - Prescribed / Direct Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Native vegetation	Construction and Operation	Removal of native vegetation	Street planting and landscaping to include native species known from the Maitland LGA (preferably species belonging to the vegetation being affected by the proposed development).	Post-development	Council Project coordinator Ecologists	MR	LR
Fauna home range and connectivity	Pre-Construction and Construction	Disturbance and removal of low-quality foraging habitat in the form of scattered trees and mostly non-native grassland.	Highly unlikely fauna would utilise the site in a permanent manner. Any native vegetation and habitat tree clearance should be covered within an approved Clearing Methods Statement. The farm dams provide habitat for frogs and should be subject to a dewatering plan. Dewatering activities should be supervised by the project ecologist.	Pre-, during and post-development	Project coordinator Construction staff Site manager Project Ecologist	LR	LR
Reduction of biodiversity values	Construction	Sediment run-off into adjacent vegetation area	Best practice erosion and sedimentation (ERSED) control methods to be adopted, enforced and maintained throughout vegetation works, so as to avoid any movement of sediment off site resulting from clearing and construction into the adjacent vegetation lands.	During development	Project coordinator Construction staff Site manager Project Ecologist	MR	LR
Reduction of biodiversity values	Construction	Changes to stormwater evacuation into third-order streams flowing into Lochinvar Creek and Maitland floodway	Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise hydrology changes including systems to remove waste before water enters the creek.	During development	Project coordinator Construction staff Site manager Project Ecologist	MR	LR

Table 15 - Residual / Indirect Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation*	Risk after mitigation*
Noise	Construction	Noise during construction due to construction works and construction traffic. Potential reduced viability of adjacent retained habitat zone	Timing of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP) which will include a Noise Mitigation Plan.	Duration of construction works	Project coordinator Site manager Construction staff	LR	LR
	Operation	Noise due to traffic. Potential reduced viability of adjacent retained habitat	Noise levels will be managed in accordance with an approved Operational Environmental Management Plan (OEMP), detailing all safeguards in accordance with *POEO Regulation 2017*.	During operations	The Bathla Group	LR	LR
Vibration	Construction	Disturbance to ground-dwelling fauna which may lead to displacement to adjacent areas	Conditions of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP) which will include a Vibration Mitigation Plan.	During construction	Project coordinator Site manager Construction staff	LR	LR
Light spill	Construction	Disturbance to nocturnal fauna, thus reducing viability of adjacent retained habitat zone	Optimal construction methods as per an approved CEMP will aim at reducing instances of light spill. Such measures will include limiting use of lights where absolutely necessary, and directing lights in such a way as to limit impact on adjacent retained vegetation lands. Light-sensitive threatened species are unlikely to occur on site.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Disturbance to nocturnal fauna, thus reducing viability of adjacent retained habitat zone	Provision of lighting will be in accordance with an approved OEMP. Light-sensitive threatened species are unlikely to occur on site.	During operations	The Bathla Group	LR	LR
Visual amenity	Construction	Rubbish and waste retained onsite attracting native fauna	Activities on the Site will be managed in accordance with an approved CEMP, and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	During construction	Project coordinator Site manager	LR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation*	Risk after mitigation*
					Construction staff		
	Operation	Rubbish and waste retained onsite attracting native fauna	Activities on the Site will be managed in accordance with an approved OEMP, and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	During operations	The Bathla Group	LR	LR
Dust	Construction	Dust deposits on native flora and fauna habitat, resulting in disturbance to and reduced viability of adjacent habitat	Dust levels during operations managed according to an approved CEMP: • Daily monitoring of dust generated by construction activities. • Dust suppression measures (setting maximum speed limits and application of dust suppressants) will be implemented during construction works to limit dust on site • Commence revegetation as soon as practicable to minimise areas likely to create dust	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Dust deposits on native flora and fauna habitat, resulting in disturbance to and reduced viability of adjacent habitat	Adaptive dust monitoring programs to control air quality, in accordance with an approved CEMP.	During operations	The Bathla Group	LR	LR
Non native vegetation	Construction	Soil disturbance may lead to proliferation of exotic flora (including invasive weeds) through seeds and vegetation fragments	As per an approved CEMP: • Appropriate disposal of mulch with exotic vegetation propagules through approved waste facility • Cleaning of all construction equipment to limit the risk of weed seed and fragments leaving site • Chemical and manual treatment of weeds where applicable	During construction	Project coordinator Site manager Construction staff	MR	LR

* Refer to risk matrix for definition of risk rating

Maximum reasonable consequence	Probability				
	A	B	C	D	E
1	CR	CR	HR	HR	MR
2	CR	HR	HR	MR	LR
3	HR	HR	MR	LR	LR
4	HR	MR	LR	LR	LR
5	MR	LR	LR	LR	LR

CRITICAL	CR
HIGH RISK	HR
MEDIUM RISK	MR
LOW RISK	LR

Table 16 - Criteria Summary

Consequence criteria: Impacts on threatened species and/or threatened species habitat
1. CRITICAL • Impact – Severe; Spatial scale – Widespread; Time scale – Long-term. • Requires consideration of whether impacts may result in a Serious and Irreversible Impact that may lead to local extinction. **2. MAJOR** • Impact – Moderate; Spatial scale – Moderate to widespread; Time scale – Mid- to long-term. • May result in temporary or long-term damage. **3. MODERATE** • Impact – Moderate; Spatial scale – Local to moderate; Time scale – Short- to mid-term. • May result in a moderate, temporary impact. However, it may be difficult to rehabilitate impact and may have negative implications on the ecosystem **4. MINOR** • Impact – Minor; Spatial scale – Local; Time scale – Short-term. • May result in minor impacts that are relatively easily rehabilitated. Not likely to have negative implications on the ecosystem. **5. NEGLIGIBLE** • Impact – Minor; Time scale – Short-term with no lasting effect. • May result in negligible impacts that can be categorised as temporary, local and reversible.
Likelihood criteria
A. ALMOST CERTAIN • Very high or certain probability that impact will occur or event is of a continuous nature. **B. LIKELY** • Likely probability that impact will occur or event is frequent (frequency 1-5 years). **C. MODERATE** • Moderate probability that impact will occur or event is infrequent (frequency 5-20 years). **D. UNLIKELY** • Low probability that impact will occur or event is very infrequent (frequency 100 years). **E. REMOTE** • Very low probability that impact will occur or may occur under extenuating circumstances. Event is very rare or stochastic in nature (frequency 1000 years)

2.3 Impact Summary

Credit requirements were quantified via the input of the site data and impacts detailed above within the BAM Calculator. Both desktop (GIS) and fieldwork data were entered into the Calculator to determine the number of credits required to offset the impacts of the development.

2.3.1 Serious and Irreversible Impacts (SAIIs)

The *Guidance to assist a decision-maker to determine a serious and irreversible impact* (2017) and the BAM Calculator do not list the PCTs identified on site or any of the flora or fauna species recorded on site as a Candidate SAIIs. Candidate SAIIs are determined by decision makers (i.e. Council) for each particular threatened species / community based upon four (4) principles listed within the *Guidance and criteria to assist a decision maker to determine a serious and irreversible impact* (OEH 2017). It is considered highly unlikely that the removal of vegetation found on the site would result in a serious and irreversible impact. The following candidates SAII were predicted as occurring within the Subject Site:

- Swift Parrot (*Lathamus discolor*)
- Regent Honeyeater (*Anthochaera phrygia*)

Both Regent Honeyeater and Swift Parrot are listed as a dual credit species, occurring as an ecosystem credit species when foraging habitat is present, and as species credit species and potential candidate Serious and Irreversible Impacts (SAII) species when breeding habitat is present. Breeding habitat is determined by 'mapped important areas'. In order to determine whether the Subject Site falls within these mapped important areas, AEP enquired whether the development site fell within mapped areas. Correspondence was received from OEH/LMBC (Now DPIE) on 11 February 2020 indicating that the Subject Site does not fall within any mapped important areas for these species, and thus Swift Parrot and Regent Honeyeater are not a species credit species, or species requiring SAII consideration. A copy of the correspondence is included in **Appendix L**.

- Large-eared Pied-Bat (*Chalinolobus dwyeri*)

Potential SAII were considered in relation to the Large-eared Pied-Bat. For this species, SAIIs applies only to breeding habitat including rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Consideration was given to potential breeding habitat within 100m of the proposed development but no likely sites were identified. As such, impact from the proposal is not considered an SAII in relation to the species.

2.3.2 Impacts requiring offset

2.3.2.1 Ecosystem Credits

As per Section 10.3 of the BAM, the removal of native vegetation within the site requires offsetting to achieve the 'no net loss standard' detailed within Section 11. To calculate the required offsets in the form of ecosystem credits, the BAM Calculator has taken into consideration the impact area

and the projected loss in vegetation integrity score along with the biodiversity risk weighting of the PCTs. Details of each along with the required credit outputs is provided in **Table 17**.

Eighteen (18) Ecosystem Credits are required for the proposed development:

- 13 credits for PCT 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter; and
- 5 credits for PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.

Table 17 - Ecosystem Credit requirements

Vegetation Zone (PCT)	Impact Area (ha)	Future VIS	Vegetation Integrity Score Loss	Biodiversity Risk Weighting	Credit Requirements
1603 – Grey Box dominated	0.47	0	-48.5	2	11
1603 – Ironbark dominated	0.23	0	-20.2	2	2
1731 - degraded	0.46	0	-23.7	2	5
Total	**1.16**				**18**

2.3.2.2 Species Credits

If a Species Credit species is either identified on the site during survey, assumed to be present, or confirmed present within an expert report, a 'species polygon' is required to be produced for the area of suitable habitat within the site for the species. The size of this polygon is entered into the BAM Calculator, which determines the number of credits required to offset the removal of suitable habitat based upon the quality of habitat and biodiversity risk weighting of the species.

In addition to the Ecosystem Credits, 41 Species credits (fauna) are required including:

- 28 credits for *Chalinolobus dwyeri* (Large-eared Pied Bat); and
- 13 credits for *Myotis macropus* (Southern Myotis).

Large-eared Pied Bat (*Chalinolobus dwyeri*) was identified as present within the Study Area. Based on habitat constraints, the vegetation within the Subject Site is considered foraging habitat and its removal will incur Species Credits.

Southern Myotis (*Myotis macropus*) was identified as part of a species group based on Anabat recordings (it cannot be definitively distinguished from *Nyctophilus spp.* using acoustic surveys). Without further survey, this species must be treated as present and listed as candidate threatened species. Given that foraging habitat in the form of a large dam is present in the southern part of

the Subject Site, and HBTs occur within 200m the two dams, the removal of vegetation will incur species credits. **Figure 6** displays the location of required Credit Species polygons.

2.3.3 Impacts not requiring offset

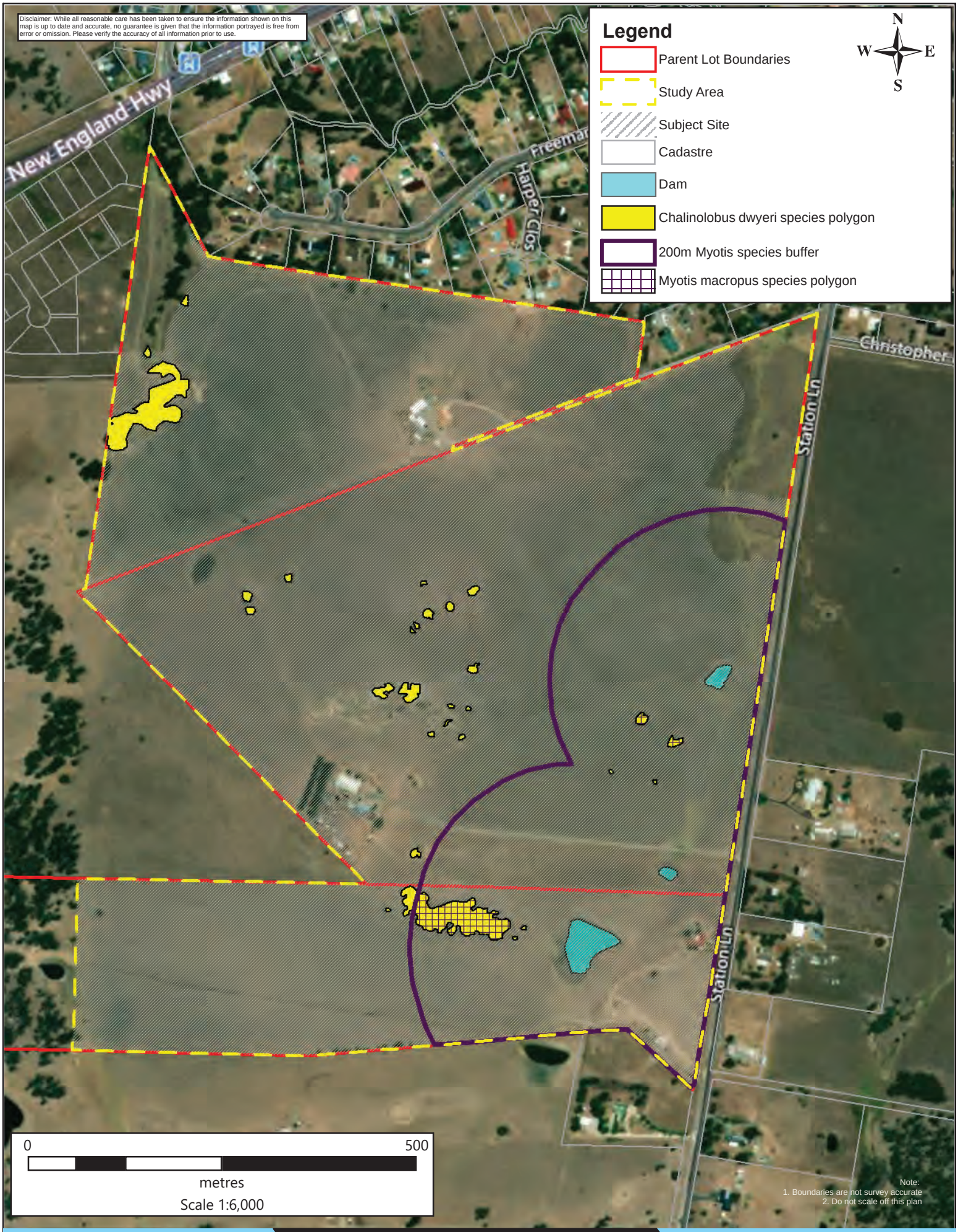
There are no vegetation zones on site with a VIS lower than 17. All impacts on native vegetation require offset.

2.3.4 Areas not requiring assessment

Approximately 71.61ha of the Subject Site is dominated by exotic vegetation, mainly paddock grasses and also contain cleared areas such as gravel tracks, dwelling and farm buildings. As per Section 10.4 of the BAM, these areas do not require assessment for credits. These areas not requiring assessment are shown in **Figure 5**.

2.4 Biodiversity Credit Report

The Biodiversity Credit Report generated within the BAM Calculator is provided in **Appendix F**.



AEP

Title: Figure 6 - Credit Species Polygons

Date: April 2020

Location: Station Lane, Lochinvar

BOAMS: 18983

Client: Bathla Group Pty Ltd

AEP Ref: 1909

3.0 Conclusion

Application of the BAM against the proposal has quantified current biodiversity values within the site and calculated offset requirements for residual impacts following avoid and mitigation efforts.

The vegetation within the site was found to be commensurate with PCT 1603 and 1731 The remainder of the site is predominantly comprised of degraded non-native grassland.

The proposal will require the total removal of vegetation within the site. As a result, the following credit requirements were calculated within the BAM Calculator to offset the residual impacts of vegetation removal and achieve a no net loss standard.

Table 18 - Ecosystem Credit Requirements

Impacted PCT	Native Vegetation to be Removed (ha)	Number of Credits
PCT 1603	0.7	13
PCT 1731	0.46	5
Total	**1.16**	**18**

Table 19 - Species Credit Requirements

Impacted Species	Native Vegetation to be Removed (ha)	Number of Credits
Myotis macropus	0.45	13
Chalinolobus dwyeri	1.16	28
Total		**41**

The full biodiversity credit report is attached as **Appendix F**.

4.0 References

Cropper S.C. (1993) *Management of Endangered Plants*. CSIRO Publications Victoria.

DECC (2009) *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for fauna – amphibians*. NSW Department of Environment and Climate Change.

DPI (2018) *Guidelines for controlled activities on waterfront land—Riparian corridors* https://www.industry.nsw.gov.au/__data/assets/pdf_file/0004/156865/NRAR-Guidelines-for-controlled-activities-on-waterfront-land-Riparian-corridors.pdf

Hill L (2009) *Update to Ecological Significance of The Natural Vegetation of Maitland LGA, Mapped in 2003.* Prepared for Maitland City Council. September 2009.

Keith D (2004) *Ocean Shores to Desert Dunes*. DEC, Sydney.

Maitland City Council (2007) *Lochinvar Structure Plan*, Maitland. *https://www.maitland.nsw.gov.au/my-council/planning-and-reporting/publications-plans-and-strategies/planning-strategies/lochinvar-structure-plan*

NPWS (2000) *Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) mapping project*. NSW National Parks and Wildlife Service.

NSW Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft, November 2004.

OEH (2019a) *BioNet Vegetation Classification.* Accessed January 2020. http://www.environment.nsw.gov.au/resources/bionet/pct-data-power-query.xlsx

OEH (2019b) *Bionet: the website for the Atlas of NSW Wildlife.* (http://www.bionet.nsw.gov.au) Accessed April 2020. NSW OEH, Sydney. NSW Office of Environment and Heritage

OEH (2017a) *Biodiversity Assessment Methodology*. August 2017. NSW Office of Environment and Heritage.

OEH (2018) '*Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method.* NSW Office of Environment and Heritage.

OEH (2017b) *Biodiversity Assessment Method (BAM) Calculator User Guide*. August 2017. NSW Office of Environment and Heritage.

OEH (2016a) *NSW Guide to Surveying Threatened Plants*. February 2016. NSW Office of Environment and Heritage.

Appendix A – Expected Fauna Species List

FAUNA SPECIES LIST

The following list includes fauna species that have been recorded on the development site adjacent proposed development sites, as well as adjacent conservation zoned lands.

"●" - Species observed or indicated by scats, tracks etc. on, over or near the site during recent surveys by AEP (2019-2020).

* - Introduced species

? - Unconfirmed record, anecdotal records etc.

Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are indicated in **bold font**.

Family	Scientific Name	Common Name	Present
Amphibians			
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	●
Myobatrachidae	*Limnodynastes dumerilii*	Eastern Banjo Frog	
Myobatrachidae	*Limnodynastes peronii*	Brown-striped Frog	●
Myobatrachidae	*Limnodynastes tasmaniensis*	Spotted Grass Frog	●
Myobatrachidae	*Platyplectrum ornatum*	Ornate Burrowing Frog	
Myobatrachidae	*Uperoleia tyleri*	Tyler's Toadlet	
Hylidae	*Litoria caerulea*	Green Tree Frog	●
Hylidae	*Litoria dentata*	Bleating Tree Frog	
Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	
Hylidae	*Litoria latopalmata*	Broad-palmed Frog	●
Hylidae	*Litoria peronii*	Peron's Tree Frog	●
Hylidae	*Litoria revelata*	Revealed Frog	
Hylidae	*Litoria tyleri*	Tyler's Tree Frog	
Hylidae	*Litoria verreauxii*	Verreaux's Frog	
Reptiles			
Scincidae	*Carlia tetradactyla*	Southern Rainbow-skink	
Scincidae	*Egernia striolata*	Tree Skink	
Scincidae	*Eulamprus quoyii*	Eastern Water-skink	
Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink	
Scincidae	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	
Scincidae	*Tiliqua scincoides*	Eastern Blue-tongue	
Agamidae	*Amphibolurus muricatus*	Jacky Lizard	
Agamidae	*Intellagama lesueurii*	Eastern Water Dragon	

Family	Scientific Name	Common Name	Present
Agamidae	*Pogona barbata*	Bearded Dragon	●
Varanidae	*Varanus varius*	Lace Monitor	
Elapidae	*Furina diadema*	Red-naped Snake	
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	
Elapidae	*Pseudonaja textilis*	Eastern Brown Snake	
Birds			
Phasianidae	*Coturnix ypsilophora*	Brown Quail	
Anatidae	*Anas castanea*	Chestnut Teal	
Anatidae	*Anas gracilis*	Grey Teal	
Anatidae	*Anas superciliosa*	Pacific Black Duck	
Anatidae	*Chenonetta jubata*	Australian Wood Duck	●
Columbidae	*Columba livia*	Rock Dove	
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove	
Columbidae	*Geopelia striata*	Peaceful Dove	
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	●
Columbidae	*Phaps chalcoptera*	Common Bronzewing	
Columbidae	*Streptopelia chinensis*	Spotted Turtle-Dove	
Podargidae	*Podargus strigoides*	Tawny Frogmouth	
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	●
Apodidae	***Hirundapus caudacutus***	**White-throated Needletail**	
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	●
Ardeidae	*Ardea ibis*	Cattle Egret	
Ardeidae	*Ardea modesta*	Eastern Great Egret	
Ardeidae	*Ardea pacifica*	White-necked Heron	●
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron	
Threskiornithidae	*Platalea regia*	Royal Spoonbill	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	●
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	
Accipitridae	***Circus assimilis***	**Spotted Harrier**	
Accipitridae	*Elanus axillaris*	Black-shouldered Kite	
Accipitridae	***Haliaeetus leucogaster***	**White-bellied Sea-Eagle**	
Falconidae	*Falco berigora*	Brown Falcon	
Falconidae	*Falco cenchroides*	Nankeen Kestrel	

Family	Scientific Name	Common Name	Present
Falconidae	*Falco longipennis*	Australian Hobby	
Rallidae	*Fulica atra*	Eurasian Coot	
Rallidae	*Gallirallus philippensis*	Buff-banded Rail	
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	
Charadriidae	*Vanellus miles*	Masked Lapwing	●
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	●
Cacatuidae	*Cacatua sanguinea*	Little Corella	
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	●
Cacatuidae	*Eolophus roseicapillus*	Galah	●
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	●
Psittacidae	*Glossopsitta concinna*	Musk Lorikeet	
Psittacidae	***Glossopsitta pusilla***	**Little Lorikeet**	
Psittacidae	*Glossopsitta/Trichoglossus sp.*	-	●
Psittacidae	*Platycercus eximius*	Eastern Rosella	●
Psittacidae	*Psephotus haematonotus*	Red-rumped Parrot	●
Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet	
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	●
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo	
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	
Cuculidae	*Eudynamys orientalis*	Eastern Koel	
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo	
Strigidae	*Ninox novaeseelandiae*	Southern Boobook	
Alcedinidae	*Ceyx azureus*	Azure Kingfisher	
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	●
Alcedinidae	*Todiramphus sanctus*	Sacred Kingfisher	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	
Coraciidae	*Eurystomus orientalis*	Dollarbird	●
Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper	
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	●
Maluridae	*Malurus lamberti*	Variegated Fairy-wren	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	
Acanthizidae	*Acanthiza lineata*	Striated Thornbill	
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill	●
Acanthizidae	***Chthonicola sagittata***	**Speckled Warbler**	
Acanthizidae	*Gerygone mouki*	Brown Gerygone	

Family	Scientific Name	Common Name	Present
Acanthizidae	*Gerygone olivacea*	White-throated Gerygone	
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	
Acanthizidae	*Smicrornis brevirostris*	Weebill	
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	●
Meliphagidae	*Caligavis chrysops*	Yellow-faced Honeyeater	
Meliphagidae	*Entomyzon cyanotis*	Blue-faced Honeyeater	
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater	
Meliphagidae	*Manorina melanocephala*	Noisy Miner	●
Meliphagidae	*Manorina melanophrys*	Bell Miner	
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	
Meliphagidae	*Melithreptus brevirostris*	Brown-headed Honeyeater	
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater	
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater	
Meliphagidae	*Nesoptilotis leucotis*	White-eared Honeyeater	
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird	●
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater	
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater	
Meliphagidae	*Plectorhyncha lanceolata*	Striped Honeyeater	
Meliphagidae	*Ptilotula fuscus*	Fuscous Honeyeater	
Meliphagidae	*Ptilotula penicillatus*	White-plumed Honeyeater	
Pomatostomidae	***Pomatostomus temporalis temporalis***	**Grey-crowned Babbler (eastern subspecies)**	
Psophodidae	*Psophodes olivaceus*	Eastern Whipbird	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	
Pachycephalidae	*Falcunculus frontatus frontatus*	Eastern Shrike-tit	
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	●
Artamidae	*Cracticus tibicen*	Australian Magpie	●
Artamidae	*Cracticus torquatus*	Grey Butcherbird	

Family	Scientific Name	Common Name	Present
Artamidae	*Strepera graculina*	Pied Currawong	
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	●
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	
Corvidae	*Corvus coronoides*	Australian Raven	●
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	●
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher	
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	
Petroicidae	*Microeca fascinans*	Jacky Winter	
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	
Acrocephalidae	*Acrocephalus australis*	Australian Reed-Warbler	
Megaluridae	*Cincloramphus cruralis*	Brown Songlark	
Timaliidae	*Zosterops lateralis*	Silvereye	●
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	
Hirundinidae	*Petrochelidon ariel*	Fairy Martin	
Sturnidae	*Sturnus tristis*	Common Myna	●
Sturnidae	*Sturnus vulgaris*	Common Starling	
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	
Estrildidae	*Neochmia temporalis*	Red-browed Finch	
Estrildidae	*Taeniopygia bichenovii*	Double-barred Finch	
Passeridae	*Passer domesticus*	House Sparrow	
Motacillidae	*Anthus novaeseelandiae*	Australian Pipit	
Mammals			
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	
Dasyuridae	*Antechinus flavipes*	Yellow-footed Antechinus	
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	●
Dasyuridae	***Dasyurus maculatus***	**Spotted-tailed Quoll**	
Dasyuridae	***Phascogale tapoatafa***	**Brush-tailed Phascogale**	
Vombatidae	*Vombatus ursinus*	Common Wombat	
Petauridae	*Petaurus breviceps*	Sugar Glider	●
Petauridae	***Petaurus norfolcensis***	**Squirrel Glider**	
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	
Acrobatidae	*Acrobates pygmaeus*	Feathertail Glider	
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	●
Macropodidae	*Macropus robustus*	Common Wallaroo	

Family	Scientific Name	Common Name	Present
Macropodidae	*Macropus rufogriseus*	Red-necked Wallaby	
Macropodidae	*Wallabia bicolor*	Swamp Wallaby	
Pteropodidae	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	?
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox	
Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	
Emballonuridae	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat**	?
Molossidae	*Austronomus australis*	White-striped Freetail-bat	●
Molossidae	***Micronomus norfolkensis***	**Eastern Coastal Free-tailed Bat**	?
Molossidae	*Ozimops planiceps*	Southern Free-tailed Bat	●
Molossidae	*Ozimops ridei*	Ride's Free-tailed Bat	●
Vespertilionidae	***Chalinolobus dwyeri***	**Large-eared Pied Bat**	?
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	●
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	●
Vespertilionidae	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**	?
Vespertilionidae	***Myotis macropus***	**Southern Myotis**	?
Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	●
Vespertilionidae	*Nyctophilus gouldi*	Gould's Long-eared Bat	●
Vespertilionidae	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	?
Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat	●
Vespertilionidae	*Vespadelus darlingtoni*	Large Forest Bat	
Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat	●
Vespertilionidae	*Vespadelus regulus*	Southern Forest Bat	
Vespertilionidae	***Vespadelus troughtoni***	**Eastern Cave Bat**	
Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	●
Muridae	*Rattus rattus*	Black Rat	
Canidae	*Canis lupus dingo*	Dingo	
Canidae	*Vulpes vulpes*	Fox	●
Leporidae	*Lepus capensis*	Brown Hare	
Leporidae	*Oryctolagus cuniculus*	Rabbit	●
Equidae	*Equus caballus*	Horse	
Bovidae	*Capra hircus*	Goat	
Miniopteridae	***Miniopterus australis***	**Little Bent-winged Bat**	?
Miniopteridae	***Miniopterus orianae oceanensis***	**Large Bent-winged Bat**	?

Appendix B – Flora species list

FLORA SPECIES LIST

The following list includes all species of vascular plants observed during BAM plot surveys and previous surveys carried out by AEP (December 2019 to February 2020) on the Subject Site and broader Study Area (AEP, 2019). It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora present on the site. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as Orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list as thus:

- specimens that could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;
- specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp." and;
- specimens that could be accurately identified to genus level, but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow the references outlined below.

Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3.* UNSW, Kensington, NSW.

Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4*. UNSW, Kensington, NSW.

Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk "*".

Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are indicated in **bold font** and marked as:

(V) = Vulnerable Species listed under the BC Act
(E) = Endangered Species listed under the BC Act
(EV) = Vulnerable Species listed under the EPBC Act 1999
(EE) = Endangered Species listed under the EPBC Act 1999

Family	*Scientific Name*	Common Name
Acanthaceae	*Brunoniella australis*	Blue Trumpet
Amaranthaceae	*Alternanthera angustifolia*	-
Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apocynaceae	*Araujia sericifera**	Moth Vine
Apocynaceae	*Gomphocarpus fruticosus**	Narrow Leaf Cotton Bush
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Asteraceae	*Calotis lappulacea*	Yellow Burr Daisy
Asteraceae	*Carthamus lanatus**	Saffron Thistle
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Cactaceae	*Opuntia aurantiaca**	Tiger Pear
Cactaceae	*Opuntia stricta**	Prickly Pear
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell
Casuarinaceae	*Casuarina glauca*	Swamp Sheoak
Chenopodiaceae	*Einadia hastata*	Berry Saltbush
Chenopodiaceae	*Einadia nutans subsp. linifolia*	Climbing Saltbush
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cupressaceae	*Cupressus sp.**	Cypress
Cyperaceae	*Cyperus gracilis*	Slender Flat Sedge
Fabaceae	*Acacia elongata*	Swamp Wattle
Fabaceae	*Acacia falcata*	Sickle Wattle
Fabaceae	*Acacia karroo**	-
Fabaceae	*Desmodium varians*	Slender Tick-trefoil
Fabaceae	*Glycine tabacina*	Twining Glycine
Juncaceae	*Juncus acutus subsp. acutus**	Sharp Rush

Family	*Scientific Name*	Common Name
Juncaceae	*Juncus cognatus**	-
Juncaceae	*Juncus usitatus*	Common Rush
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Loranthaceae	*Amyema sp.*	Mistletoe
Malvaceae	*Sida corrugata*	Corrugated Sida
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Myoporaceae	*Eremophila debilis*	Winter Apple
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Myrtaceae	*Callistemon rigidus*	Stiff Bottlebrush
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus glaucina x tereticornis*	Slaty Red Gum
Myrtaceae	*Eucalyptus moluccana*	Grey Box
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Melaleuca armillaris subsp. armillaris*	Bracelet Honey Myrtle
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree
Oleaceae	*Olea europaea subsp. cuspidata**	African Olive
Phormiaceae	*Dianella revoluta var. revoluta*	Spreading Flax Lily
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Aristida ramosa*	Purple Wiregrass
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass
Poaceae	*Bothriochloa macra*	Red Grass
Poaceae	*Briza subaristata**	-
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass

Family	*Scientific Name*	Common Name
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Poaceae	*Microlaena stipoides*	Weeping Grass
Poaceae	*Panicum effusum*	Hairy Panic
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Rytidosperma sp.*	Southern Sheep-grass
Poaceae	*Themeda triandra*	Kangaroo Grass
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polygonaceae	*Persicaria orientalis*	Princes Feathers
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel
Proteaceae	*Hakea sericea*	Needlebush
Rubiaceae	*Asperula conferta*	Common Woodruff
Solanaceae	*Lycium ferocissimum**	African Boxthorn
Thymelaeaceae	*Pimelea glauca*	Smooth Rice-flower
Verbenaceae	*Verbena bonariensis**	Purpletop
Verbenaceae	*Verbena rigida var. rigida**	Veined Verbena

Appendix C – Subdivision Master Plan

NORTH

RIPARIAN CORRIDOR A

LOT 3 DP 564361

BASIN A

LOT 2 DP 1260934

BASIN B

BASIN C

RIPARIAN CORRIDOR B

LOT 310 DP 1034674

BASIN D

BASIN E

LOT 32 DP 776491

BASIN F

LOT 2 DP 634523

TERRIERE DRIVE

ROAD No.01

ROAD No.02

ROAD No.03

ROAD No.04

ROAD No.05

ROAD No.06

ROAD No.07

ROAD No.08

ROAD No.09

ROAD No.10

ROAD No.11

ROAD No.12

ROAD No.13

ROAD No.14

ROAD No.15

ROAD No.20

ROAD No.21

ROAD No.22

ROAD No.23

ROAD No.24

ROAD No.30

ROAD No.31

ROAD No.32

ROAD No.33

ROAD No.35

ROAD No.36

ROAD No.37

ROAD No.38

ROAD No.40

STATION LANE

LEGEND

	EXISTING	PROPOSED	FUTURE
UTILITY - ELECTRICITY, GAS, SEWER, WATER, TELECOMS, NBN, OPTIC FIBRE, OVERHEAD WIRE	E G S W T NBN OF OH	E G S W T NBN OF OH	E G S W T NBN OF OH
CONTOUR LINE & LABEL	20.0	20.0	20.0
LOT NUMBER & BOUNDARY	LOT #	LOT #	LOT #
APPROXIMATE LIMIT OF WORKS			
EXISTING PAVEMENT			
BUILDING / ENVELOPE			
ROAD, NUMBER, CONTROL LINE & CHAINAGE MARK	ROAD	ROAD	ROAD
EASEMENT (REFER LEGEND)	(A) (B) (C)	(A) (B) (C)	
TREE - TO BE RETAINED			
TREE - TO BE REMOVED			
EXISTING CADASTRAL			
2ND ORDER STREAM VRZ			
3RD ORDER STREAM VRZ			
CULVERT CROSSING			
EXISTING VEGETATION TO BE REMOVED			
EXISTING VEGETATION TO BE RETAINED			

GENERAL NOTES

1 ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH MAITLAND CITY COUNCIL WORKS SPECIFICATION CIVIL (CURRENT EDITION) AND/OR AS DIRECTED BY THEIR REPRESENTATIVE.

2 THE CONTRACTOR IS TO IDENTIFY, LOCATE AND LEVEL ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS AND WHERE NECESSARY MAKE ARRANGEMENTS WITH THE RELEVANT AUTHORITY TO RELOCATE OR ADJUST WHERE NECESSARY.

3 COUNCIL'S TREE PRESERVATION ORDER MUST BE OBSERVED AND NO TREE SHALL BE FELLED, LOPPED OR REMOVED WITHOUT THE PRIOR APPROVAL OF COUNCIL.

4 DIMENSIONS SHALL NOT BE SCALED FROM THE PLANS. CLARIFICATION OF DIMENSIONS SHALL BE SOUGHT FROM THE SUPERINTENDENT OR REFERRED TO THE DESIGNER.

5 ALL NEW WORK IS TO MAKE A SMOOTH JUNCTION WITH THE EXISTING CONDITIONS.

DIAL BEFORE YOU DIG www.1100.com.au

UTILITIES SHOWN ARE DIAGRAMMATIC ONLY AND MAY NOT INCLUDE ALL SERVICES WITHIN THE LIMIT OF WORKS.

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY, LOCATE AND AVOID DAMAGE TO THEM AS SPECIFIED BY EACH UTILITIES EXCAVATION GUIDE LINES/STANDARDS.

ISSUED FOR **DEVELOPMENT APPLICATION**

NOT FOR CONSTRUCTION

Rev	Drawn	Design	Appd.	Date	Revision Description
B	MG	CS	MP	27/04/2020	ISSUED FOR MASTER PLAN DA APPROVAL
A	MG	CS	MP	20/04/2020	ISSUED FOR MASTER PLAN DA APPROVAL

Scale: 0 20 40 60 80 100 120 140 160 180 200
SCALE 1:2000 (A1) SCALE 1:4000 (A3)

For: CLIENT LINE 1 CLIENT LINE 2 CLIENT LINE 3

By: Orion Consulting — CONSULT AUSTRALIA Member Firm

ABN:25 604 069 981 PO Box:7936, BAULKHAM HILLS NSW 2153 T:(02) 8660 0035 E:info@orionconsulting.com.au

Project: No. 51, 134, 146 STATION LANE, LOCHIVAR MASTERPLAN DA

Title: GENERAL LAYOUT PLAN NOTES & LEGEND

Project No.	Set No.	Milestone	Plan	Revision
19-0042	02	DA	001	B

Plotted: File Name:D:\12d\data\ORION-SYNO\102.DA Masterplan DA_ 0184\40WGS\ref\19-0042-02-DA-D-DCE_A1_1TFLEBLOCK.dwg

Appendix D – BAM Field Sheets

Done

Date: 17.12.19	Job number: 1909	Site: Lochinvar / Strathearn Lane	Plot ID: P1	Bearing: 282	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
~~E. amplifolia/glaucina~~ E. moluccana	40	10	African boxthorn	5	10/1	Emadia (linear)	0.1	20	Sida rambi	0.1	20
Melaleuca microphylla			hard saltbush (rainha)	2	5	Cynodon dactylon	30	500	Modiola/sida 1	0.1	10
			Olea europea subsp cuspidata	0.1	5	Windmill grass 1	2	100	Paspalidium gracile	0.1	2
						Eragrostis debilis	0.1	20	Tiger pear 2	0.2	50
			1 Emadia mutans subsp linifolia			Desmodium spicatum	0.1	10	Plantago lanceolata	0.1	5
			2 Lycium ferocissimum			Dichondra repens	0.1	5	1 Sida corrugata		
						Brunoniella australis	0.1	5	2 Opuntia aurantiaca		
			digitaria brownii			small tufted grass (cyperus) 2	0.2	50			
			~~digitaria brownii~~			Themeda (digitate)	1	20			
						Bothriochloa macra	0.1	10			
						Eragrostis brownii	0.1	5			
						Aristida sp vagans	0.1	20			
			Emadia hastata			Emadia wide leaves	0.2	50			
						Alternanthera angustifolia	0.1	1			
						1 Panicum effusum					
						2 cyperus gracilis					
Total Cover DO FIRST							35%				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Done

Date: 17.12.19	Job number: 1909	Site: Lochinvar	Plot ID: P1	Bearing: 282	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 9.15am **Departure time:** 10.45 **Weather:** warm / light cloud

1000m² plot **Mapped Vegetation community:**

Transcect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm
< 5 cm	P / (A)
5 - 9 cm	P / (A)
10 – 19 cm	P / (A)
20 – 29 cm	P / (A)
30 – 49cm	(P) / A
50 -79cm	# 7 | | |
>80cm	# | |

Count of Hollow Bearing Trees

1 → 4 x 5 spouts = 6 HBT

1 → 2 x 5 spout
1 → 1 x 5 trunk crack
1 → 1 x M trunk
1 → 4 x 5 spouts + 1 x M limb
Total 1 → 1 x 5 + 1 x M spouts + limb

Length of logs (m)
Note: >10cm diameter, >50cm length

0

Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	30	
2	80	
3	70	
4	95	
5	50	
Average	65	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Rabbits digging / drought / weeds (boxthorn) + tiger pear → recently sprayed

Habitat features, comments and incidental fauna observations:

lots of HBTs → all small + few medium

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

Date: 17.12.19	Job number: 1909	Site: Lochinvar	Plot ID: P 2	Bearing: 289°	Observers: YB

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Pimelea glauca	0.5	20	Themeda triandra	20	100	Senecio mad	0.2	50
						Cymbopogon dactylon	25	100	Anagallis arvensis	0.1	10
						Whalenbergia communis	0.1	2	Juncus cognatus	0.1	20
						Desmodium varians	0.1	50	Axonopus fissi	30	1000
			Asperula conferta			← Galium	0.1	20	Verbena rigida	0.1	5
						Aristida vagans	5	100	Plantago lanceolata	0.1	10
Total Cover DO FIRST							80%				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Done

Date: 17.12.19	Job number: 1909	Site: Lochinvar station lane	Plot ID: P2	Bearing:	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 7.30 **Departure time:** 3.45 **Weather:** warm / sunny / light wind

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / (A)	0
5 - 9 cm	P / (A)	Total
10 – 19 cm	P / (A)	
20 – 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / (A)	0
50 -79cm	# 0	
>80cm	# 0	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	50	
2	70	
3	50	
4	80	
5	60	
Average	62	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

moderate weed cover

Habitat features, comments and incidental fauna observations:

heavily grazed + drought

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

Date: 17.1.2026	Job number: 1909	Site: Lochinvar	Plot ID: Plot 3	Bearing: 265°	Observers: YS+JK

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. crebra	15	2	Pmelea glauca	0.1	5	Themeda triandra	5	50	Axonopus fissifolius	40	500
Amyema	0.1	2	Olea europa cuspidata	0.1	2	Aristida vagans	20	500	Cynodon dactylon	5	100
						Whalenbergia communis	0.1	2	Verbena rigida	0.1	10
						Glycine tabacina	0.1	20	Senecio madagascariensis	0.1	20
						Emadia muirana linifolia	0.1	5	Hypochaeris radicata	0.1	2
									Paspalum dilatatum	1	50
									Plantago lanceolata	0.1	5
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Dan C

Date: 17.01.20	Job number: 1909	Site: Lochinvar	Plot ID: 3	Bearing: W	Observers: Y.B, JC.

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 10.20 **Departure time:** **Weather:** Clowdy. no rain

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	
5 - 9 cm	P / (A)	
10 – 19 cm	P / (A)	Total 1
20 – 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / (A)	
50 -79cm	# 1	
>80cm	# —	Total metres 2

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	80	Dried to senescent grasses in all sub-plots
2	90	
3	90	
4	80	
5	90	
Average	86	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 17-1-2020	Job number: 1909	Site: Cochirar	Plot ID: P 4	Bearing: 265°	Observers: YBTJC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Hakea ~~teretifolia~~ serrata	0.5	5	Themeda triandra	5	50	Axonopus fissi	60	1000
			Pimelea glauca	0.1	10	Austrodanthonia caespitosa	25	500	Cynodon dactylon	5	100
						Trachymene glaucifolia	0.1	1	Senecio madagascariensis	0.1	2
						Grass T Briza subaristata	0.5	50	Paspalum dilatatum	0.1	10
									Verbena rigida	0.1	2
									Plantago lanceolata	0.1	2
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Dan

Date: 17.12.16	Job number: 1909	Site: Lochinvar	Plot ID: PL4	Bearing:	Observers: YB+JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	0
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	P / A	
50 -79cm	#	0
>80cm	#	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	70	
2	90	
3	60	
4	80	
5	70	
Average	74	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

Date: 17.1.20	Job number: 1909	Site: Lochinvar	Plot ID: plot 5	Bearing:	Observers: YBTJC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. crebra	30	20 ✓	✓			Amsinckia vagans	0.5	20 ✓	Aristida ramosa	1	50 ✓
A. pleurandra	10	3 ✓				~~Cyperus~~ dactylon	1	50 ✓			
						Themeda triandra	0.5	20 ✓			
						Einadia nutans ssp.	0.1	10 ✓			
						Eragrostis brownii	0.1	5 ✓			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Dec

Date: 17.1.20	Job number: 1909	Site: Lothivan	Plot ID: Plot 5	Bearing: 237	Observers: YBTJC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	1
5 - 9 cm	P / (A)	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	
50 -79cm	# 1	0
>80cm	# 0	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	1	
2	5	
3	40	
4	70	
5	70	
Average	37.2	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

cows graze + nest, very little veg + litter cover

Habitat features, comments and incidental fauna observations: rabbit diggings

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

Date: 17-1-20	Job number: 1909	Site: Godwin	Plot ID: P6	Bearing: 83	Observers: YBFJC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E crebra	10	1				Cyrodia	5	100	Axonopus	~~10~~	1000
						Aristida vag	1	20	Senecio sp.	0.1	20
						Glycine tabacina	0.1	20	Verbena rigida	0.1	10
						Themeda	~~0.1~~ 1	20			
			Briza subaristata			Grass 1	0.5	50			
			~~Austrostipa~~ Rytidosperma			Grass 2	0.1	10	Rytidosperma sp.		
			Dichelachne micrantha			Plume grass	0.1	10	Dichelachne micrantha		
						Aspenula conferta	0.1	1			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Done

Date: 17.1.24	Job number: 4909	Site: Lochinvar	Plot ID: P6	Bearing: 83	Observers:

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / (A)	1 6
5 - 9 cm	P / (A)	Total
10 – 19 cm	P / (A)	Length of logs (m)
20 – 29 cm	P / (A)	**Note:** >10cm diameter, >50cm length
30 – 49cm	(P) / A	0
50 -79cm	# 0	
>80cm	# 0	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	80	~~80~~
2	70	~~40~~ 2
3	70	
4	90	
5	70	
Average	76	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

AEP

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 17.1.20	Job number: 1909	Site: Lochinvar	Plot ID: P7	Bearing: 12	Observers: YB+JC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Casuarina glauca	50	50	Pansenia stram	1	2	Cynodon dactylon	0.2	20	Verbena bona	0.1	1
						Aristida vagans	0.1	5	Plantago lanceolata	0.1	5
						Dianella rev°	0.1	1	Sida rombi	0.1	20
						Themeda triandra	0.2	10	Moth Vine	0.1	1
									Tiger pear	0.1	1
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Done

Date: 17.1.20	Job number: 1909	Site: Lochinvar	Plot ID: 7	Bearing:	Observers: BF

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	0
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	(P) / A	9
50 -79cm	#	
>80cm	#	Total metres 9m

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	100	
2	40	
3	56	
4	95	
5	30	
Average	63	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Done

Date: 17.1.20	Job number: 1909	Site: Lochinvar	Plot ID: P8	Bearing: 17	Observers: YB JC

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Hakea ~~teretifolia~~ sericea	2	10	Aristida vagans	5	100	Axonopus fissi	5	1000
						Cynodon	0.5	10	Paspalum dilatatum	1	50
						Themeda triandra	0.5	20	Verbena rigida	0.2	20
			Briza subaristata			Grass 7	0.2	20	Hypochaeris radicata	0.1	10
						Dichondra repens	0.1	2	Plantago lanceolata	0.1	10
						Wahlenbergia communis	0.1	2	Senecio madagascariensis	0.1	5
						Glycine tabacina	0.1	5			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Done

Date: 17.1.20	Job number: 1909	Site: Lochinvar	Plot ID: P 8	Bearing: 47	Observers: [illegible]

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	0
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m)
30 – 49cm	P / A	Note: >10cm diameter, >50cm length
50 -79cm	# 0	0
>80cm	# 0	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	50	
2	50	
3	100	
4	40	
5	60	
Average	60	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Appendix E – Biodiversity Credit Report

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00018980/BAAS18147/20/00018983

Proposal Name
Lochinvar subdivision

BAM data last updated *
28/04/2020

Assessor Name

Assessor Number

BAM Data version *
25

Proponent Name(s)
UPG 77 Pty Ltd

Report Created
04/05/2020

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
04/05/2020

* 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.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Additional Information for Approval

BAM Biodiversity Credit Report (Variations)

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1603-Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	0.7	13.00
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.5	5.00

1603-Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	Yes	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 3 or higher	Yes (including artificial)	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region
	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	No	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Forested Wetlands	Tier 3 or higher	No	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	1.2	28.00
Myotis macropus / Southern Myotis	0.7	13.00

Chalinolobus dwyeri/ Large-eared Pied Bat	1603_Grey_Box_dominated	**Like-for-like options**			
		Spp	IBRA region		
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW		
		Variation options			
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region	

		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1603_Ironbark_dominated	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1731_Degraded	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Myotis macropus/ Southern Myotis	1603_Grey_Box_dominated	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1603_Ironbark_dominated	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00018980/BAAS18147/20/00018983	Proposal Name Lochinvar subdivision	BAM data last updated * 28/04/2020
Assessor Name	Assessor Number	BAM Data version * 25
Proponent Names UPG 77 Pty Ltd	Report Created 04/05/2020	BAM Case Status Finalised
Assessment Revision 0	Assessment Type Part 4 Developments (General)	Date Finalised 04/05/2020

* 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.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1603-Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	0.7	13.00
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.5	5.00

1603-Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	Yes	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region
	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	No	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

Species	Area	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	1.2	28.00
Myotis macropus / Southern Myotis	0.7	13.00

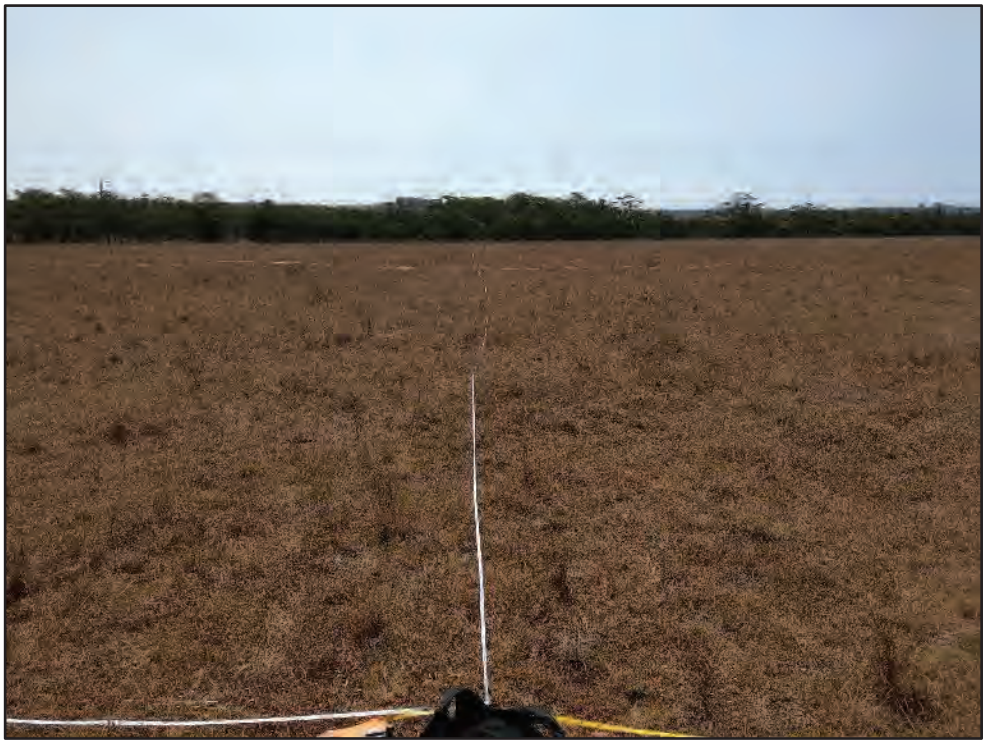
Chalinolobus dwyeri/ Large-eared Pied Bat	1603_Grey_Box_dominated	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	1603_Ironbark_dominated	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	1731_Degraded	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW

Chalinolobus dwyeri/ Large-eared Pied Bat	1731_Degraded	
Myotis macropus/ Southern Myotis	1603_Grey_Box_dominated	**Like-for-like credit retirement options**
		Spp / IBRA region
		Myotis macropus/Southern Myotis / Any in NSW
	1603_Ironbark_dominated	**Like-for-like credit retirement options**
		Spp / IBRA region
		Myotis macropus/Southern Myotis / Any in NSW

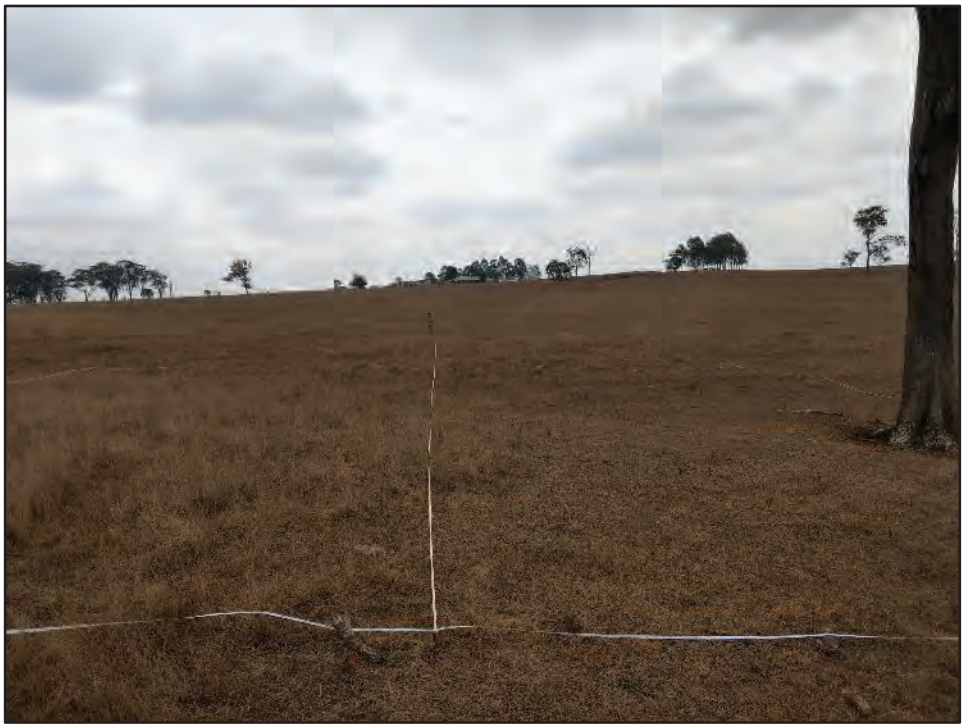
Appendix F – Site Photographs

Plot 1

Plot 2



Plot 3



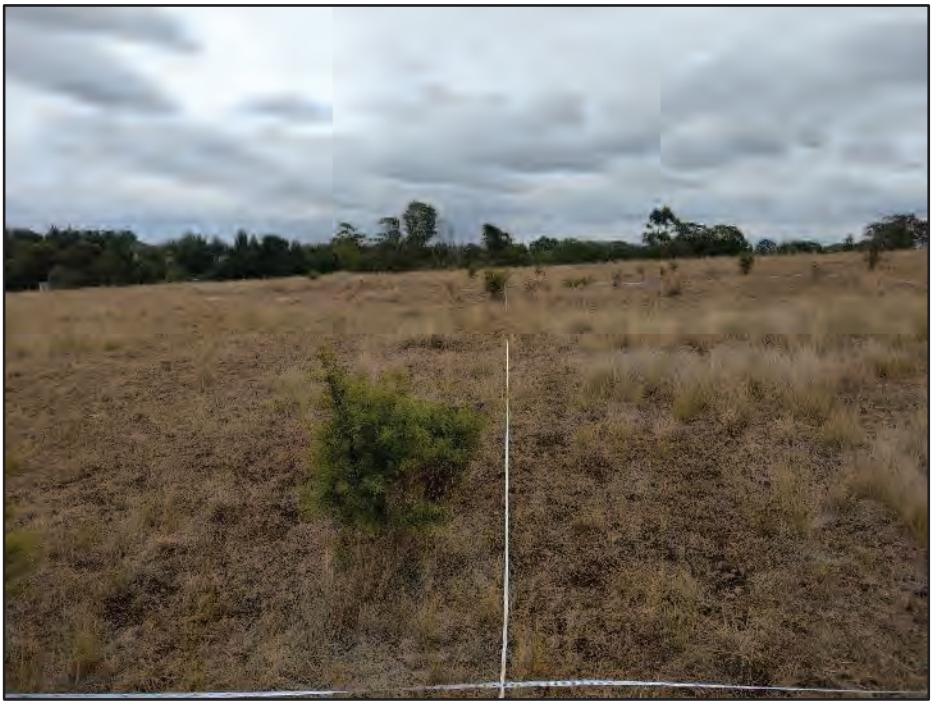
Plot 4

Plot 5

Plot 6

Plot 7

Plot 8



Above Antechinus sp., below European Red Fox

Above Green Tree Frog, below Red Wattlebird

Appendix G – Other Legislation

EPBC Act Assessment

A search was conducted in February 2020 of Matters of National Environmental Significance (MNES) as relevant to the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act). The following MNES are considered in this assessment.

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 place, and it is not in close proximity to any such place.

Wetlands of International Significance (declared Ramsar wetlands);

The site does not contain Ramsar Wetlands. It is located 25km upstream from the Hunter Estuary Wetlands and the proposed subdivision is not expected to have any impact on the Wetlands. However, indirect impacts have been considered as part of this assessment.

Great Barrier Reef Marine Park:

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

Commonwealth Marine Areas:

The site is not part of, or within close proximity to, any Commonwealth Marine Area.

Threatened Ecological Communities:

While four Threatened Ecological Communities are listed as likely to occur within the locality, only one of them is present within the Subject Site. The Critically Endangered Ecological Community (CEEC) Central Hunter Valley eucalypt forest and woodland occur onsite in a highly modified state. However, due to its highly degraded nature, the remnant vegetation present does not reach the condition threshold required to be listed. Due to the small size of the remnant, patchiness of the canopy layer, the lack of a shrub stratum and predominantly exotic understory, it is not commensurate with the EPBC listed Central Hunter Valley eucalypt forest and woodland Critically Endangered Ecological Community.

Threatened Species:

Two threatened species listed Vulnerable under the EPBC Act were recorded on site during fieldwork: Large-eared Pied Bat and Grey-headed Flying Fox. Given that these species are highly mobile and that no roosting or breeding habitat is present onsite, they are unlikely to be significantly affected by the proposal. In addition, the areas of seasonal foraging habitat to be removed are quite sparse and suboptimal, and larger areas offering similar resources remain directly west of the Study Area. Therefore, it is considered that the development of this land is unlikely to significantly impact potential habitat.

Migratory Species:

A number of EPBC listed migratory species have some potential to visit the site on an irregular basis. However, it is not considered that the development of this land as proposed is likely to significantly impact the potential habitat of such species, or disrupt migratory patterns.

EPBC Act Assessment Conclusion:

The Study Area only provides potential seasonal foraging habitat for relevant fauna species, it is not mapped as important habitat for Swift Parrot or Regent Honeyeater, and no Grey-headed Flying-fox roost camp is present within the site. Furthermore, whilst Large-eared Pied Bat was detected on site, it is not considered that the Subject Site constitutes critical habitat for the species. No impact is expected to occur to fauna species listed under the EPBC Act as a result of the proposed development and referral under the Act is likely to be unnecessary.

SEPP Koala Habitat Protection 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (the Koala SEPP) applies to land within the Maitland LGA. As the site does not have a Koala Plan of Management (KPOM) over it and parts of the land are identified on the Koala Development Application Map as highly suitable Koala Habitat (**Figure 1**) an assessment for "Core Koala Habitat" under the SEPP is required.

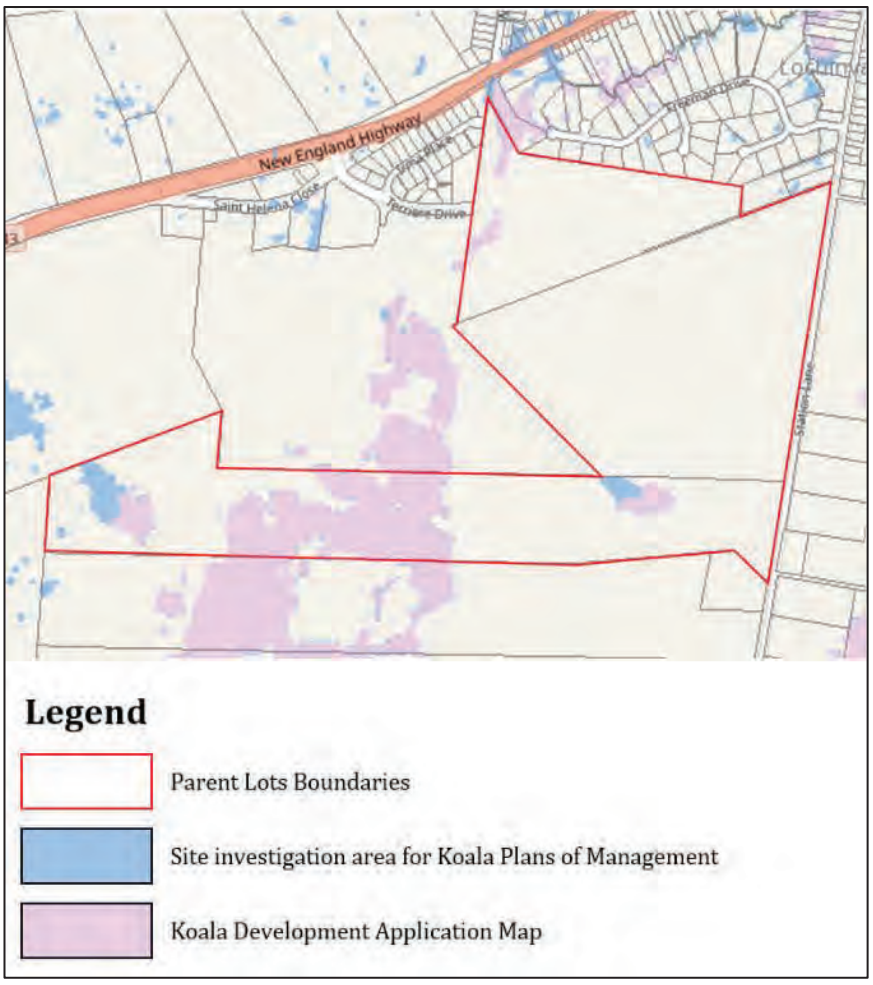


Figure 1 - Koala SEPP Mapping (accessed 22/04/2020)

Within the draft guidelines, **Core Koala Habitat** is defined as:

a) an area of land where koalas are present, or

b) an area of land –

i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and

ii) where koalas have been recorded as being present in the previous 18 years.

Noting that "**An area of land**" is defined as including both the development footprint and broader area of land on which the development is proposed (i.e. the Parent Lots).

A desktop search in the NSW BioNet Atlas of threatened species revealed that there were no records of Koala within a 10km x 10km area around the Subject Site in the last 18 years.

Therefore, as per the draft guidelines, the Subject Site does not qualify as Core Koala Habitat and no further assessment against Koala SEPP 2019 is required.

Appendix H – LMBC Correspondence

Yann Buissiere

From: Denise Wallace <Denise.Wallace@environment.nsw.gov.au> on behalf of OEH ROD BAM Support Mailbox <bam.support@environment.nsw.gov.au>
Sent: Tuesday, 11 February 2020 3:35 PM
To: Yann Buissiere
Subject: BSM-505 regent honeyeater and swift parrot critical habitat

Hi Yann

The lots are not within regent honeyeater important areas or draft swift parrot important areas

This call is now closed.

Regards
The BAM Support Team

From: Denise Wallace <Denise.Wallace@environment.nsw.gov.au> **On Behalf Of** OEH ROD BAM Support Mailbox
Sent: Tuesday, 4 February 2020 3:47 PM
To: yann@andersonep.com.au
Subject: BSM-505 regent honeyeater and swift parrot critical habitat

Yann

Thank you for your enquiry which has been received by the BAM Support Team. Your reference number is BSM-505. Your enquiry has been forwarded to a subject matter expert for attention.

Subject Matter Expert
Please respond to the bam.support@environment.nsw.gov.au mailbox

Regards
The BAM Support Team

From: Yann Buissiere <yann@andersonep.com.au>
Sent: Tuesday, 4 February 2020 12:41 PM
To: OEH ROD BAM Support Mailbox <bam.support@environment.nsw.gov.au>
Subject: regent honeyeater and swift parrot critical habitat

Good afternoon.

I am writing a BDAR for a subdivision within the locality of Lochinvar (Maitland LGA).
The proposal is located on Lot 3 DP 564631, Lot 4 and the eastern section of Lot 2 DP 634523.
The addresses are No 51, 134 and 146 Station Lane, Lochinvar NSW

I would like to inquire about Swift Parrot and Regent Honeyeater critical habitat as part of my assessment.
Thanks.

Regards,

Yann Buissiere
Ecologist
Mob: 0424544466

Appendix I – Riparian Corridors

Background

Controlled activities carried out in, on, or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). Under the Act, "*the impact of any proposed controlled activity needs to be assessed to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity*". Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

The following two figures show the Vegetated Riparian Zone (VRZ) and total Riparian Corridors (RC) present within the Study Area. The top of the banks for each watercourse was mapped by a surveyor contracted by Bathla group Pty Ltd. Note that the Hydroline Spatial Data no longer matches entirely the actual creek bed. This is probably due to ongoing erosion issues associated with disturbance from current land management practices such as cattle grazing and lack of deep-rooted riparian vegetation.

Methodology

The methodology used follows the Department of Primary Industry's *Guidelines for controlled activities on waterfront land* (2018):

- The Strahler System of ordering watercourses was used to determine the order of streams present within the Study Area.
- The VRZ was determined according to **Table 1** of the guidelines below and a 30m buffer was applied to the top of the bank for both 3rd order streams.
- the 50% Riparian Zone was determined by applying a 15m buffer to the top of the bank on either side.

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 metres + channel width
2nd order	20 metres	40 metres + channel width
3rd order	30 metres	60 metres + channel width
4th order and greater (includes estuaries, wetlands and parts of rivers influence by tidal waters)	40 metres	80 metres + channel width

Only 3rd order streams were included in this assessment. While the 1st and 2nd order streams within the eastern part of the site have been mapped within the Maitland Hydroline Spatial Data, no clearly defined channels or banks were observed on the ground. These streams possess one large dam and two minor dams and occur mostly as grassy swales. Therefore, both were excluded from this assessment.

Appendix J – CVs

Yann Buissiere
Curriculum Vitae

Yann works with AEP in the role of Ecologist. Over the past 10 years, he has developed extensive experience in restoration ecology and land management including flora and fauna pest management, fire hazard reduction and community engagement.

Qualifications

- Diploma of Conservation and Land Management, TAFE (2013)
- Bachelor of Resources and Environmental Management, Macquarie University (2008)

Further Education & Training (select summary)

- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence.
- Operate and Maintain a Four-Wheel Drive Vehicle and undertake Winch Recovery
- Work Health & Safety White Card
- First Aid Certificate
- Vertebrate Pest Control
- Local Control Authority Officer – Biosecurity Act 2015
- Working Safely at Heights

Fields of Special Competence

- Vegetation community and weed mapping.
- Ecological field surveys including habitat assessment, hollow bearing tree surveys, bird surveys and fauna trapping.
- Botanical surveys including vegetation monitoring, targeted threatened flora search and undertaking BAM plots.
- Bush regeneration and habitat restoration
- Planning and undertaking fire hazard reduction work
- Feral animal control

Relevant Employment History

2019 - Current	**Ecologist (botanist)** Anderson Environment & Planning, Newcastle
2018 - 2019	**Ecologist (botanist)** Kleinfelder, Newcastle
2015 - 2018	**Bushland Team Coordinator** Northern Beaches Council (formerly Manly Council)
2010 - 2015	**Project Manager/Team Leader** Australian Bushland Restoration, Sydney
2010 - 2013	**Bushcare Supervisor** Mosman Council
2008 - 2010	**Bush regenerator** Australian Bushland Restoration, Sydney

IAN BENSON
Curriculum Vitae

Ian works with AEP in the role of Principal Ecologist. He is an experienced field ecologist, bird watcher and a regular participant in wader surveys. Ian has previously had a successful career as a project manager with a local geotechnical engineering firm. His background in project management and soil sciences combined with his ecological knowledge is utilised in a diverse array of applications in his current role.

Qualifications

- Graduate Diploma in Science (Ecology) University of New England (2014)
- Bachelor Engineering (Civil) University of Newcastle (2008)

Further Education & Training (select summary)

- Biobank and Biocertification Assessors Training Course
- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence. Experienced 4WD operator
- Occupational Health & Safety Training
- Rail Industry Worker
- ARTC Safety Induction for Contractors (NSW)
- ARTC Hunter Bulk Terminal Induction

Fields of Special Competence

- Biobanking & Biodiversity Offset Commissions – initial scoping and feasibility, BAM impact assessments and BDAR reporting, biobank calculations, Stewardship site creation
- Detailed knowledge of environmental legislation and approval pathways
- Ecological field survey and habitat assessment covering terrestrial and aquatic flora and fauna. Experienced in camera trap methods particularly targeting cryptic and difficult to identify mammal species.
- Highly proficient at avifauna surveys, including challenging wetland and shorebird environs
- Project Management
- Soil science

Professional Affiliations / Memberships (past / present)

- Hunter Bird Observers Club (HBOC)
- Australasian Seabird Group
- Graduate Member of The Institution of Engineers Australia in the Civil College

Relevant Employment History

2019-Current **Principal Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning in the role of Principal Ecologist overseeing a team of 15 professional ecology staff and all aspects of the business including training and management of field and office staff undertaking ecology and bushfire works to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2018-2019 **Senior Ecologist**
Anderson Environment & Planning, Newcastle

2016-2018 **Ecologist**
Anderson Environment & Planning, Newcastle

2012-2016 **Project Manager**
Douglas Partners, Newcastle

As a project manager with Douglas Partners I was responsible for proposal and tender preparation, planning, implementation and reporting of geotechnical and geo-environmental investigations for a broad range of projects including site classification, foundations, pavements, bridges and slope stability. I was required to liaise with clients regarding project requirements, project goals and deadlines. I was responsible for the development and implementation of Work Health and Safety Plans as well as Environmental Plans and documentation. This included the development of safe work procedures, safety inspections on site and implementing improved safety procedures with staff. I was responsible for ensuring projects were completed on time and on budget whilst meeting the clients' expectations and achieving quality assurance standards.

2008-2012 **Geotechnical Engineer**
Douglas Partners, Newcastle

As a geotechnical engineer for Douglas Partners I was involved in the planning and implementation of geotechnical investigations for a wide range of development in the Hunter Valley area. I was primarily involved in site supervision of geotechnical investigations using drilling rigs for boreholes, truck mounted cone penetration testing and test pit excavations using excavators and backhoes. My role also included site inspections involving the assessment of conditions for piles, piers and shallow footings. I also undertook site walkovers for assessment of mine subsidence and slope stability.

2007-2008 **Undergraduate Geotechnical Engineer**
Douglas Partners, Newcastle

Whilst an undergraduate engineer with Douglas Partners I experienced a broad range of practice areas and developed a diverse range of engineering skills.

Relevant Ecological Experience

2013 - Current **Bird Surveyor**
Hunter Bird Observers Club

Volunteer survey work for Hunter Bird Observers Club for regular wader and water bird counts and Tomago and Kooragang Island.

2017 – Current **Birdata Moderator**
Birdlife Australia

Volunteer moderating and vetting bird surveys from *Birdata* which is the Birdlife Australia Atlas to ensure a robust database for both the Hunter Valley and Central Coast reporting areas totalling approximately 5000 surveys per year.

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

AEP Ref: 1909
Date: 6 February 2020

Bathla Group

Attention: **Sakawat Hossain**

Via Email: sakawat@bathla.com.au

Dear Sakawat,

Re: **Preliminary Constraints Advice – Proposed Subdivision**
Various Lots, Lochinvar

1.0 Preliminary Findings

1.1 Vegetation communities

Two native vegetation communities were identified within the study area that are commensurate to two Plant Community Types (PCTs):

- PCT 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter (1.15ha); and
- PCT 1731 - Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (1.02ha).

PCT 1603 correspond to the remnant treed areas within Lot 2 and Lot 4 DP 634523 and PCT 1731 correspond to the riparian vegetation in the north west section of the subject site (Lot 3 DP 564631). These two PCTs are commensurate with State listed Endangered Ecological Communities (EECs), respectively:

- Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions; and
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

1.2 Threatened species

Field surveys have identified two State listed threatened fauna species onsite:

- Large-eared Pied Bat - *Chalinolobus dwyeri* (Vulnerable); and
- Southern Myotis - *Myotis macropus* (Vulnerable).

Large-eared Pied Bat is also listed under the Federal EPBC Act.

Due to lack of significant rainfall, amphibian and reptile surveys have not been undertaken yet. However, rainfall forecast for the end of the week provide us with a window of opportunity to conduct the survey this weekend or early next week targeting the following fauna species:

- Green and Golden Bell Frog - *Litoria aurea* (Endangered);
- Green-thighed Frog - *Litoria brevipalmata* (Vulnerable); and
- Stephen's Banded Snake - *Hoplocephalus stephensii* (Vulnerable).

It is considered highly unlikely that these species will be recorded on site during the surveys.

Additionally, samples of a red gum found onsite have been sent to the Royal Botanic Garden for identification and could potentially be Slaty Red Gum (*Eucalyptus glaucina*) listed Vulnerable under the Biodiversity Conservation Act 2016. At this stage, we are still waiting on positive identification.

A request was sent to the OEH for mapping of critical habitat for two threatened species:

- Swift Parrot – *Lathamus discolor* (Endangered); and
- Regent Honeyeater - *Anthochaera phrygia* (Critically Endangered).

We are still awaiting the results of this request; however, we consider it unlikely that the site will be mapped as import habitat for these species.

1.3 Ecosystem Credits

The proposed development, in its current form, will require the clearing of 1.15ha of PCT 1603 and 0.3ha of PCT 1731 and as such, these values were entered in the calculator. This clearing of vegetation requires 21 ecosystem credits for PCT 1603 and 4 ecosystem credits for PCT 1731 to be retired prior to clearing for the project in the relevant stages.

1.4 Species Credits

Due to the highly degraded nature of potential habitat for threatened species of amphibians, the likelihood of them occurring onsite is low. Lack of suitable habitat onsite was presumed and at this point in time the two threatened species of frogs were omitted from the calculator,

subject to the results of the survey. While we wait for the critical habitat mapping, presence of habitat onsite for Swift Parrot and Regent honeyeater was assumed.

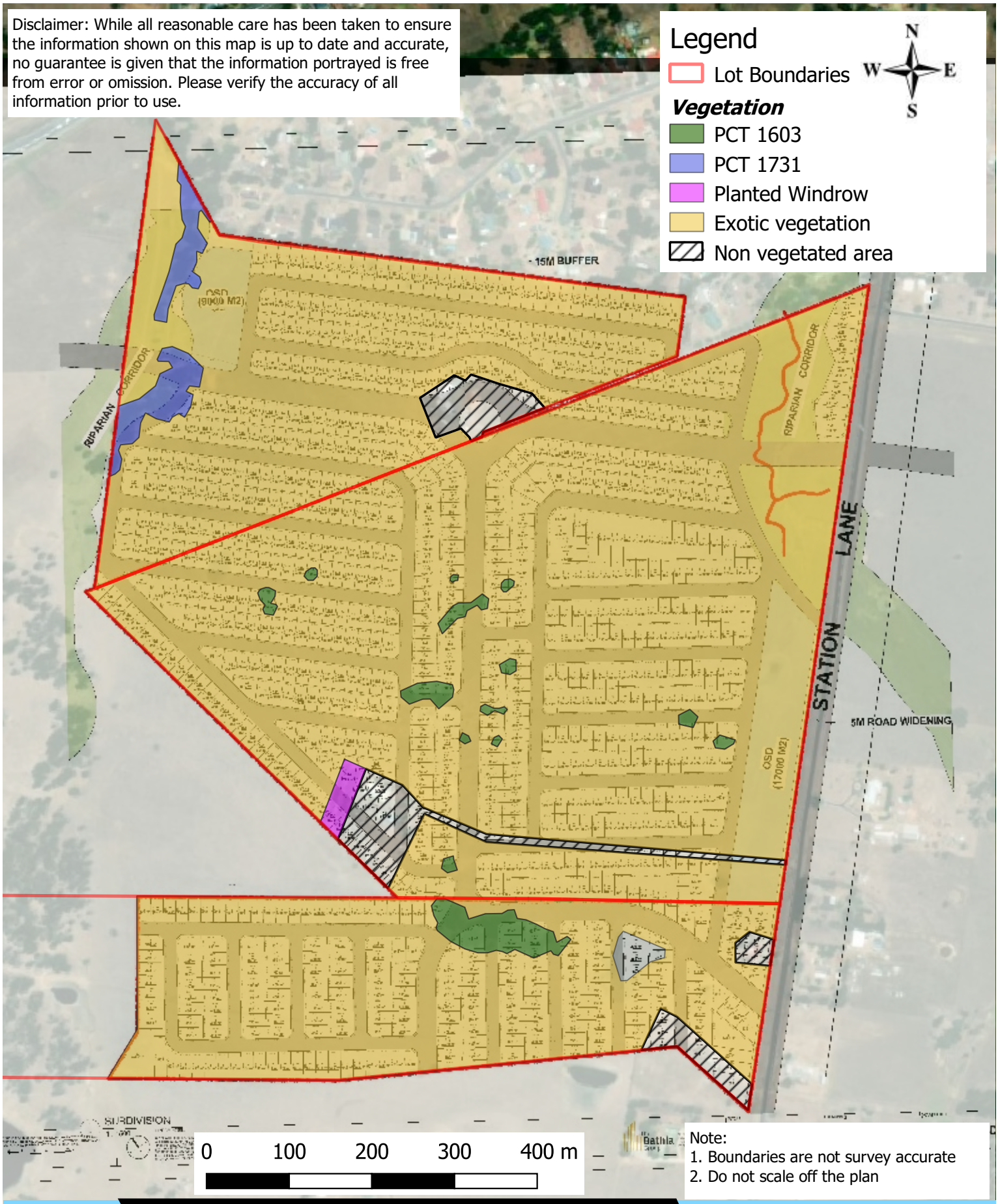
- Regent Honeyeater will require 37 species credits
- Swift Parrot will require 37 species credits
- Large-eared Pied Bat will require 37 species credits
- Southern Myotis will require 15 credits

The following table provides a breakdown of the costs for credits required. These costs are based on payments made to the Biodiversity Conservation Trust (BCT) and are subject to change on a quarterly basis.

Item	**Credits required**	**Total cost**	**Ecosystem credits (incl. GST)**
PCT 1603	21	$54,754.66	
PCT 1731	4	$77,170.86	**$145K**
Large-eared Pied Bat	37	$34,008.56	**Species credits (Incl. GST)**
Southern Myotis	37	$13,787.25	
Swift Parrot	37	$23,945.59	
Regent Honeyeater	15	$19,943.18	**$101K**
		Grand Total^	**$246K**

^ This cost is for payment into the Biodiversity Conservation Fund. It is likely that the total cost of required credits would be less if credits were sourced on the open market, subject to availability.

If critical habitat for Swift Parrot and Regent Honeyeater is not present onsite and these species are removed from the calculator. The total cost for ecosystem and species credit required for the proposed development decreases to approx. **$200K.** These findings are preliminary and are subject to change upon the completion of fieldwork and the provision of further information from OEH and the Royal Botanic Garden.



AEP

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Preliminary Ecological Constraints — Date: Feb 2020

Location: Station Lane, Lochinvar NSW

Client: Bathla Group Pty Ltd — AEP ref: 1909

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

We thank you for the opportunity to assist on this project. Should you require any further details or clarification, please do not hesitate to contact the writer or Yann Buissiere (AEP Botanist – 0424 544 466).

Yours faithfully,

ANDERSON ENVIRONMENT & PLANNING

Ian Benson
Principal Ecologist
Biodiversity Accredited Assessor BAAS: 18147
M: 0420 624 707