BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

FOR A

PROPOSED RESIDENTIAL SUBDIVISION

AT

213 STATION LANE (LOT 1308 DP 1141533) LOCHINVAR

Prepared by:

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Site Details:	213 Station Lane, Lochinvar (Lot 1308 DP 1141533)				
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Executive Summary

Introduction

Firebird ecoSultants Pty Ltd has been engaged by the Perception Planning, to provide a Biodiversity Development Assessment Report (BDAR) for a proposed residential subdivision ('the proposal') at 213 Station Lane, Lochinvar (Lot 1308 DP 1141533) ('the site' or 'the subject site').

The proposal includes a Torrens title subdivision (2 lots into 221 residential lots) of 213 Station Lane, Lochinvar (Lot 1308 DP 1141533) to provide development space for the construction of 221 dwellings as well as associated infrastructure such as site access, services and asset protection zones (APZ). The proposed lots ranging in size from 455 m^2 to 1428 m^2. The development will be implemented over 8 stages.

The site is located in a rural area in the southern part of Lochinvar and totals an area of ~20 ha. The site is zoned as R1 General Residential and E3 Environmental Management. The site is predominantly covered in exotic pasture grasses with scattered remnant native trees. A large patch of regenerating forest occurs within the northern portion of the site. Two drainage canals occur within the site that join into one another; these drainage canals drain through the site to toward the north and form part of Lochinvar Creek which eventually drains into the Hunter River. These canals would be classed as a 1st and 2nd order watercourses (in accordance with the Strahler stream ordering system in Appendix 3 of the BAM). The site is surrounded by similar rural land with large open areas of exotic pasture and patches of regenerating forest. The site does not contain important mapped areas for threatened species or any mapped biodiversity values.

Landscape features

Details	Response
IBRA Region and Subregion	Dominant landscape forms have been used to divide Australia into bioregions. The site is within the Sydney Basin IBRA bioregion and the Hunter IBRA subregion. The Upper Hunter IBRA subregion occurs close to the site, with the nearest adjacent subregion boundary being approximately ~5 km north of the site. See previous Figure 1-1 for the locations of IBRA regions/subregions within 1.5 km of the site.
Mitchell Landscape	Mitchell Landscapes are used to describe areas in NSW in a broad sense and group together areas with relatively homogenous geomorphology, soils and broad vegetation types and are mapped at a scale of 1:250000. The subject site is within the Newcastle Coastal Ramp landscape. This landscape region has an estimated cleared fraction of 0.54. See previous Figure 1-1 for the locations of Mitchell Landscapes within 1.5 km of the site.
Percent Native Vegetation Cover	All areas of native vegetation cover, within the site and within a 1,500 m buffer area surrounding the site, have been mapped; see Figure 2-1. It is estimated, from this mapping, that the native vegetation cover would be 23%.

Wetlands, Rivers, Streams and Estuaries	Two drainage canals occur within the site that join into one another; these drainage canals drain through the site to toward the north and form part of Lochinvar Creek which eventually drains into the Hunter River. These canals would be classed as a 1st and 2nd order watercourses (in accordance with the Strahler stream ordering system in Appendix 3 of the BAM). See previous Figure 1-1 for watercourses within 1.5 km of the site.
Connectivity Features	The site's native vegetation is one of many patches of regenerating forest in the Lochinvar area. Lochinvar and the surrounding areas have been extensively cleared for agricultural purposes. The nearest relatively large area of intact bushland occurs ~1.2 km to the south of the site.
Areas of Geological Significance and Soil Hazard Features	No karst, caves, crevices or cliffs were located on the site or within a 1,500 m buffer around the site. No soil hazards were identified on the site or within a 1,500 m buffer around the site.
Areas of Outstanding Biodiversity Value	Under the BC Act, the Minister for the Environment may declare Areas of Outstanding Biodiversity Value (AOBV). These are special areas that contain irreplaceable biodiversity values that are considered important to NSW, Australia or globally. No listed AOBV occur within the site or within a 1,500 m buffer around the site.

Patch Size

Although there are patches of native vegetation within 100 m of the site's native vegetation, these patches (including the site) are missing vegetation structural layers that are typical of the site's PCTs, such as the upper and lower mid stratums. Although shrubs/small trees do occur in the mid stratum within the site and the surrounding in the area, these are *Olea europaea subsp. cuspidata* (African olive), an exotic shrub/small tree. As such, no native shrub/small tree layer occurs within the site or within surrounding patches of native vegetation. This is likely due to the historic agricultural land practices in the Lochinvar area. Therefore, it has been determined that the patch size for the site's impacted native vegetation is ≤5 ha.

Plant Community Types

Attribute	Details
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	
Formation	Grassy Woodlands
Vegetation Class	Coastal Valley Grassy Woodlands
TEC status	Part of the endangered BC Act listing of 'Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions'
PCT Percent Cleared	71%

Justification for PCT Selection	Surveys undertaken by Firebird ecoSultants have confirmed the presence of several typical species associated with PCT 1604, including; *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Cymbopogon refractus* (Barbed Wire Grass), *Aristida ramosa* (Purple Wire Grass), *Aristida vagans* (Threeawn speargrass), *Microlaena stipoides* (Weeping grass), *Lomandra multiflora* (Many-flowered Mat-rush) and *Cheilanthes sieberi* (Poison Rock Fern). *Corymbia maculata* (Spotted Gum), although not observed within the site, was observed in adjoining properties. This PCT is also mapped as occurring within the area Lochinvar on *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855*.
Other PCTs considered	PCT 1691 – This PCT is similar to the chosen PCT 1604, but differs slightly in typical diagnostic species. *Brachychiton populneus* (Kurrajong) is one such diagnostic species associated with PCT 1691; this species does not occur within the site, despite the site's canopy stratum being relatively intact. Furthermore, as mentioned above, *Corymbia maculata* (Spotted Gum), although not observed within the site, was observed in adjoining properties; this species is typically associated with PCT 1604. PCT 623 – This PCT is more similar to PCT 1691, in that *Brachychiton populneus* (Kurrajong) is a diagnostic species associated with this PCT, but is absent from the site. This vegetation community is also typically found further to the west of Lochinvar in the Central and Upper Hunter regions.
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	
Formation	Freshwater Wetlands
Vegetation Class	Coastal Freshwater Lagoons
TEC status	Not considered a TEC – the site's PCT 1071 occurs as a small artificial dam in an otherwise rural / agricultural landscape.
PCT Percent Cleared	71%
Justification for PCT Selection	This vegetation occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. Surveys undertaken by Firebird ecoSultants have confirmed the presence of two typical species associated with PCT 1071, including; *Typha orientalis* (Native Bulrush) and *Ludwigia peploides* (Water Primrose). It is noted that *Phragmites australis* (Common Reed), which is a diagnostic species for PCT 1071, does not occur within the site, however PCT 1071 is described as being often associated with man-made water bodies, drainage lines and depressions across a wide variety of environments. This vegetation

	community within the site does occur as a highly modified man-made drainage canal. The presence of *Typha orientalis* (Native Bulrush) and *Ludwigia peploides* (Water Primrose) in this highly modified environment suggest that PCT 1071 is the best fit for this vegetation community.
Other PCTs considered	PCT 1737 Typha Rushland – This plant community type was considered because *Typha orientalis* is the dominate species within the site, which is also a diagnostic species of PCT 1737. *Cynodon dactylon*, which is also a diagnostic species for PCT 1737, also occurs around the edge this community within the site. However as described above, PCT 1071 is considered the best fit PCT. No other PCTs were considered because *Typha orientalis* does not appear to be a diagnostic species for any other 'Coastal Freshwater Lagoon' in the Sydney Basin and Hunter IBRA region/sub-region.
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal
Exotic grassland	
Formation	N/A
Vegetation Class	N/A
TEC status	N/A
PCT Percent Cleared	N/A
Justification for PCT Selection	The 'Interim Grasslands and other Groundcover Assessment Method' was used to assess the grassland areas. Refer to Appendix H for the Grassland Report. This vegetation is dominated by the following; *Paspalum dilatatum* (Paspalum), *Axonopus compressus* (Carpet Grass), *Stenotaphrum secundatum* (Buffalo grass), *Hypochoeris radicata* (Catsear), *Senecio madagascariensis* (Fireweed) and *Plantago lanceolata* (Lambs Tongue).
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal

Vegetation Integrity

PCT	Vegetation Zone (VZ)	Composition Score	Structure Condition Score	Function Condition Score	Vegetation Integrity Score
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	58.4	72.9	74.2	68.1
	VZ 2: Regenerating	27.1	57	30.5	36.6
	VZ 3: Derived Grassland	28.8	26.8	0.1	3.6
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1: Intact	31.2	87.8	N/A	52.3

Habitat Assessment

The following describes the habitat attributes of the study area;

- The study area provides open grassland habitat within the site's cleared exotic grassland area which may provide habitat for species adapted to open areas.
- The site's PCT 1071 only occurs as a small artificial dam in an otherwise pastural landscape. It may provide habitat for common / resilient species of frog and some small common wetland bird species such as *Porphyrio porphyrio* (Purple Swamp Hen) that prefer habitat with dense reeds and rushes.
- No Allocasuarinas or casuarinas occur within the study area which are a food source for species such as *Calyptorhynchus lathami* (Glossy Black-Cockatoo) – as such, the site provides limited habitat for these species.
- The site contains many hollow-bearing trees with variable hollow sizes which would likely provide habitat for a wide range of species, including microbats, hollow-dependant arboreal mammals, woodland birds and in some cases owls; however, none occur within the development footprint.
- The study area contains fallen logs and timber which may provide habitat for reptiles and foraging birds.
- No caves, tunnels, mines or culverts occur within the study area or the site.
- No stick nests occur within the study area or the site (at the time of surveys)

- No flying fox camps occur within or near the site.

Avoidance of Impacts to the site's biodiversity values

Of the site's two identified PCT's, one is considered to be associated with a threatened ecological community (TEC); PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter is considered to be associated with the BC Act TEC listing of 'Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions'; PCT 1071 within the site is not considered to be threatened. The proposal largely avoids impacts to these two communities by positioning the construction and operational development footprint within a large area of the site that has already been predominantly cleared of native vegetation and now consists of mostly exotic pasture grasses and weeds.

PCT 1604 covers an area of 8.85 ha within the site and it has been separated into three vegetation zones;

- Vegetation zone 1 – Moderate: This vegetation zone occurs in a moderate condition, with an intact canopy stratum, numerous hollow-bearing trees and ground hollows, high density of native ground cover. This area also contains a moderate density of African Olive in the shrub layer and some exotic grasses and forbs in the ground layer.

- Vegetation zone 2 – Regenerating: This vegetation zone is in a state of regeneration, with trees predominately of a young age class and numerous saplings of canopy species occurring. The ground layer is roughly 50% native species to 50% exotic species.

- Vegetation zone 3 – Derived grassland: This vegetation zone is lacking a canopy and shrub layer, but contains many of the native ground species found in vegetation zones 1 and 2. This veg zone acts as an ecotone between PCT 1604 and the exotic pasture grassland within the site.

PCT 1604 will be directly impacted by the proposal by vegetation clearing (4.76 ha) and may be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.83 ha). Most of the direct impacts to this PCT occur within vegetation zones 2 and 3 which are lower condition than vegetation zone 1; impacts to vegetation zone 1 have largely been avoided by the positioning of the development footprint within the southern portion of the site.

All of the hollow-bearing trees and most of the ground hollows within vegetation zone 1 (PCT 1604) have been avoided. As such, the proposal has avoided significant impacts to nesting habitat for hollow-dependant threatened species.

PCT 1071 will only be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.25 ha); there will be no

vegetation removal of PCT 1071. As such, the proposal will avoid significant impacts to any potentially occurring threatened wetland species.

Direct Impacts

PCT	BC Act Name / Listing Status	EPBC Act Name / Listing Status	Vegetation Zone (VZ) Name	Direct Impact
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	Central Hunter Valley eucalypt forest and woodland	VZ 1: Moderate	1.99 ha
			VZ 2: Regenerating	1.84 ha
			VZ 3: Derived Grassland	1.24 ha
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	Not a TEC	VZ1: Intact	0 ha

To offset residual impacts of the proposal upon identified biodiversity values, the proposal would require a total of **1 x PCT 1071** and **98 x PCT 1604 Ecosystem Credits** (or equivalent).

Abbreviations

Abbreviation	Meaning
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Methodology 2020
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
DCP	Development Control Plan
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEE	Department of Environment and Energy
DoE	Department of Environment
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Ha	Hectare
LEP	Local Environmental Plan
LGA	Local Government Area
MU	Map Unit
NPWS	NSW National Parks and Wildlife Service
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PFC	Projected Foliage Cover
SAII	Serious and Irreversible Impacts
TBCD	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community

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TABLES

FIGURES

1 INTRODUCTION

Firebird ecoSultants Pty Ltd has been engaged by the Perception Planning, to provide a Biodiversity Development Assessment Report (BDAR) for a proposed residential subdivision ('the proposal') at 213 Station Lane, Lochinvar (Lot 1308 DP 1141533) ('the site' or 'the subject site'). See Figure 1-1 for the Location Map and Figure 1-2 for the Site Map. This BDAR has been prepared to satisfy the requirements of the *Biodiversity Conservation Act 2016* (BC Act). This assessment has been undertaken in accordance with the Biodiversity Assessment Method 2020.

1.1 Description of the Proposal

The proposal includes a Torrens title subdivision (2 lots into 221 residential lots) of 213 Station Lane, Lochinvar (Lot 1308 DP 1141533) to provide development space for the construction of 221 dwellings as well as associated infrastructure such as site access, services and asset protection zones (APZ). The proposed lots ranging in size from 455 m^2 to 1428 m^2.

The development will be implemented over 8 stages;

- **Stage 1 –** 32 Lots and provide two access road connection points onto Station lane to satisfy RFS PBP requirements, the northern most drainage basin storage infrastructure as per the wider URA drainage catchment plan;
- **Stage 2 –** 16 Lots and connection of the main loop road to Station lane
- **Stage 3 –** 36 Lots
- **Stage 4 –** 35 Lots
- **Stage 5 –** 39 lots
- **Stage 6** - 21 lots
- **Stage 7** - 29 lots
- **Stage 8** - 13 lots

The development footprint has largely been located in the southern portion of the site, which is predominately covered by exotic pasture grasses and weeds.

The proposed development footprint is indicated in Figure 1-2. It totals an area of 19.26 ha of land/vegetation and encompasses the following areas:

  - The designated area for residential lots, building envelopes and site access (18.3 ha)
  - The designated bushfire asset protection zones (outside the area stated above) (0.96 ha)

- The proposed operational footprint would include the same areas as the construction footprint indicated in Figure 1-2; that being the developed areas for the residential lots and site access and the APZs.

Refer to Appendix A for Site Plans.

1.2 General Site Description

The site is located in a rural area in the southern part of Lochinvar and totals an area of ~20 ha. The site is zoned as R1 General Residential and E3 Environmental Management. The site is predominantly covered in exotic pasture grasses with scattered remnant native trees. A large patch of regenerating forest occurs within the northern portion of the site. Two drainage canals occur within the site that join into one another; these drainage canals drain through the site to toward the north and form part of Lochinvar Creek which eventually drains into the Hunter River. These canals would be classed as a 1st and 2nd order watercourses (in accordance with the Strahler stream ordering system in Appendix 3 of the BAM). The site is surrounded by similar rural land with large open areas of exotic pasture and patches of regenerating forest. The site does not contain important mapped areas for threatened species or any mapped biodiversity values.

See Figure 1-1 for the site location.

1.3 The Study Area

The study area is the area of land within the site that has been assessed in this report, which is the area of vegetation within the site that is relevant to this BDAR i.e. the area of vegetation within or potentially impacted by the construction and operational footprint. Land within the site that is not considered to be impacted by the proposal (either directly or indirectly) is considered to be outside the study area. In this case however, the entire site was surveyed.

1.4 Information sources

1.4.1 Database Searches

The following database searches were undertaken, in order to compile a list of threatened flora and fauna species predicted to occur in the area:

- Review of threatened fauna and flora records within a 10 km radius of the site, contained in the OEH *Atlas of NSW Wildlife* (NSW BioNet).
- Review of the MNES records within a 10 km radius of the site, using the Commonwealth Department of Environment and Energy (DEE), EPBC Act Protected Matters Search Tool.

1.4.2 Regional Vegetation Mapping

Regional scale vegetation mapping, previously undertaken in the area, was reviewed. This included a review of *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855*.

1.4.3 Literature Review

Information sources reviewed included, but were not limited to:

- Aerial Photograph Interpretation (API)
- Relevant guidelines, including:
    - OEH *Biodiversity Assessment Method*, 2020
    - *NSW Guide to Surveying Threatened Plants* (OEH, 2016)
    - *'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method* (OEH, 2018)
    - *NSW Survey Guide for Threatened Frogs: A guide for the survey of frogs and their habitats for the Biodiversity Assessment Method (DPI&E, 2020)*
    - *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation (DEC), 2004)
- Environmental / planning reports relevant to the site / area, including:
    - *Maitland LEP 2011*;
    - *Maitland (DCP) 2011*;
- Any environmental / ecological reports relevant to the site or area, including vegetation mapping.
- Online tools and resources, including:
    - BAM Calculator (OEH, 2020)
    - BioNet Vegetation Classification (OEH, 2020)
    - BioNet Threatened Biodiversity Data Collection (OEH, 2020)
    - Directory of Important Wetlands in Australia (Department of Environment and Energy (DEE), 2010)
    - NSW Scientific Committee Final Determinations (NSW Scientific Committee various dates)
    - Commonwealth Threatened Species Scientific Committee (TSSC) Final Determinations for threatened species (TSSC Various Dates)
    - OEH Threatened Species, Populations and Ecological Communities website
    - Commonwealth DEE Species, Profile and Threats Database
    - PlantNET NSW (Botanic Gardens Trust, 2018).

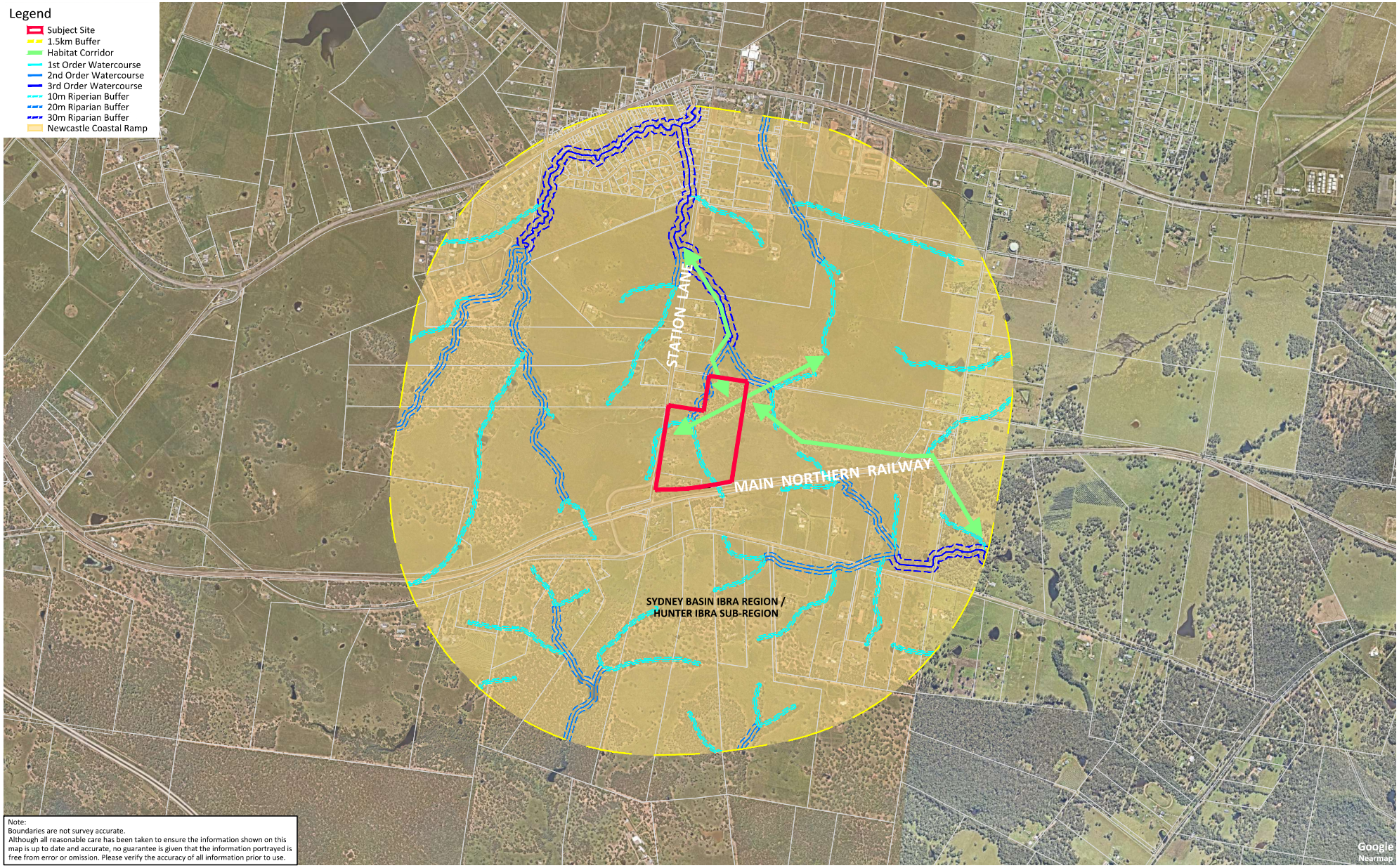

FIGURE 1-1: LOCATION MAP

Ref No 2813 H

CLIENT	Client
SITE DETAILS	Lots 1307 & 1308 DP 1141533 Lochinvar
DATE	21 July 2022

NORTH

0 250 500 1000

SCALE 20 000 @ A3

Firebird ecoSultants Pty Ltd
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Level 1, 146 Hunter Street, Newcastle NSW 2300
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Figure 1-2: Site Map

Figure 1-3: Biodiversity Values & Important Habitat Map

2 STAGE 1 – BIODIVERSITY ASSESSMENT

2.1 Landscape features

This section details the landscape features occurring on the Subject Land or within the assessment area (i.e. a 1.5 km buffer) surrounding the Subject Land; see Table 2-1.

Table 2-1: Landscape Features

Details	Response
IBRA Region and Subregion	Dominant landscape forms have been used to divide Australia into bioregions. The site is within the Sydney Basin IBRA bioregion and the Hunter IBRA subregion. The Upper Hunter IBRA subregion occurs close to the site, with the nearest adjacent subregion boundary being approximately ~5 km north of the site. See previous Figure 1-1 for the locations of IBRA regions/subregions within 1.5 km of the site.
Mitchell Landscape	Mitchell Landscapes are used to describe areas in NSW in a broad sense and group together areas with relatively homogenous geomorphology, soils and broad vegetation types and are mapped at a scale of 1:250000. The subject site is within the Newcastle Coastal Ramp landscape. This landscape region has an estimated cleared fraction of 0.54. See previous Figure 1-1 for the locations of Mitchell Landscapes within 1.5 km of the site.
Percent Native Vegetation Cover	All areas of native vegetation cover, within the site and within a 1,500 m buffer area surrounding the site, have been mapped; see Figure 2-1. It is estimated, from this mapping, that the native vegetation cover would be 23%.
Wetlands, Rivers, Streams and Estuaries	Two drainage canals occur within the site that join into one another; these drainage canals drain through the site to toward the north and form part of Lochinvar Creek which eventually drains into the Hunter River. These canals would be classed as a 1st and 2nd order watercourses (in accordance with the Strahler stream ordering system in Appendix 3 of the BAM). See previous Figure 1-1 for watercourses within 1.5 km of the site.
Connectivity Features	The site's native vegetation is one of many patches of regenerating forest in the Lochinvar area. Lochinvar and the surrounding areas have been extensively cleared for agricultural purposes. The nearest relatively large area of intact bushland occurs ~1.2 km to the south of the site.
Areas of Geological Significance and Soil Hazard Features	No karst, caves, crevices or cliffs were located on the site or within a 1,500 m buffer around the site. No soil hazards were identified on the site or within a 1,500 m buffer around the site.
Areas of Outstanding Biodiversity Value	Under the BC Act, the Minister for the Environment may declare Areas of Outstanding Biodiversity Value (AOBV). These are special areas that contain irreplaceable biodiversity values that are considered important to NSW, Australia or globally. No listed AOBV occur within the site or within a 1,500 m buffer around the site.

2.2 Native vegetation

2.2.1 Native Vegetation Cover Within the Site

The site contains just under 9.1 ha of native vegetation. The extent of native vegetation relevant to this BDAR (i.e. the area of native vegetation within or potentially impacted by the construction and operational footprint) is 6.13 ha; see Figure 2-2 for the native vegetation extent within the site.

2.2.2 Patch Size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land. The patch may extend onto adjoining land beyond the footprint of the subject land, and for woody ecosystems, includes native vegetation separated by ≤100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 metres. Intact vegetation must contain all structural layers (strata) characteristic of the PCT. Plot data should not be solely relied upon when determining whether vegetation is intact. If all structural growth form groups expected to exist within the community are present within the vegetation zone and/or adjoining off-site native vegetation, then the vegetation meets the definition of intact. For example, if all structural growth form groups except the shrub layer are present in the plots but species that belong to the shrub growth form group occur elsewhere within the vegetation zone, then the shrub growth form group is present, and the vegetation is intact.

Although there are patches of native vegetation within 100 m of the site's native vegetation, these patches (including the site) are missing vegetation structural layers that are typical of the site's PCTs, such as the upper and lower mid stratums. Although shrubs/small trees do occur in the mid stratum within the site and the surrounding in the area, these are *Olea europaea subsp. cuspidata* (African olive), an exotic shrub/small tree. As such, no native shrub/small tree layer occurs within the site or within surrounding patches of native vegetation. This is likely due to the historic agricultural land practices in the Lochinvar area. In any case the patch size has been assessed as >100ha.

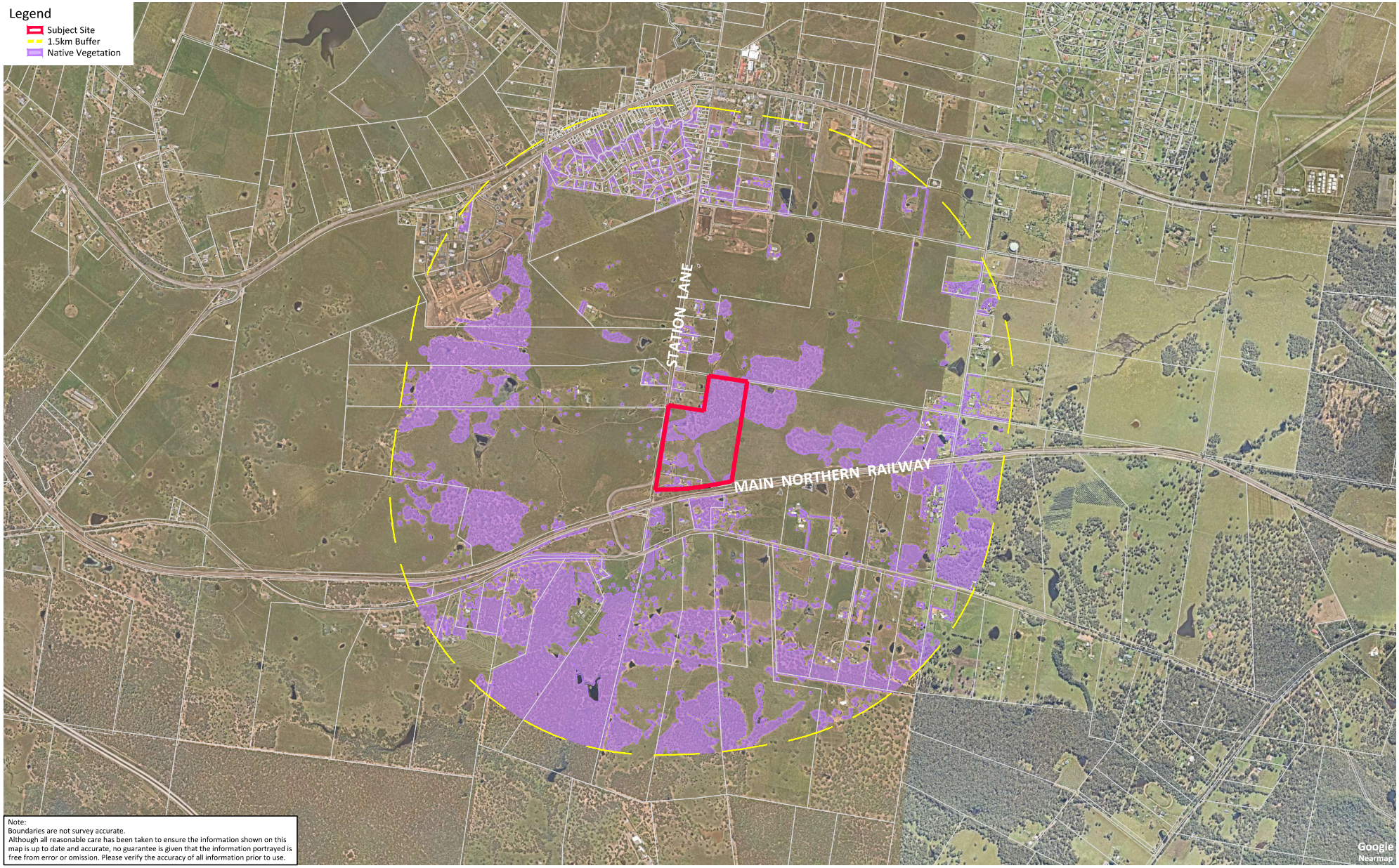

FIGURE 2-3: NATIVE VEGETATION EXTENT

Ref No 2813 H

CLIENT Client
SITE DETAILS Lots 1307 & 1308 DP 1141533 Lochinvar
DATE 21 July 2022

NORTH

0 250 500 1000

SCALE 20 000 @ A3

PIXELDRAFTING

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firebird

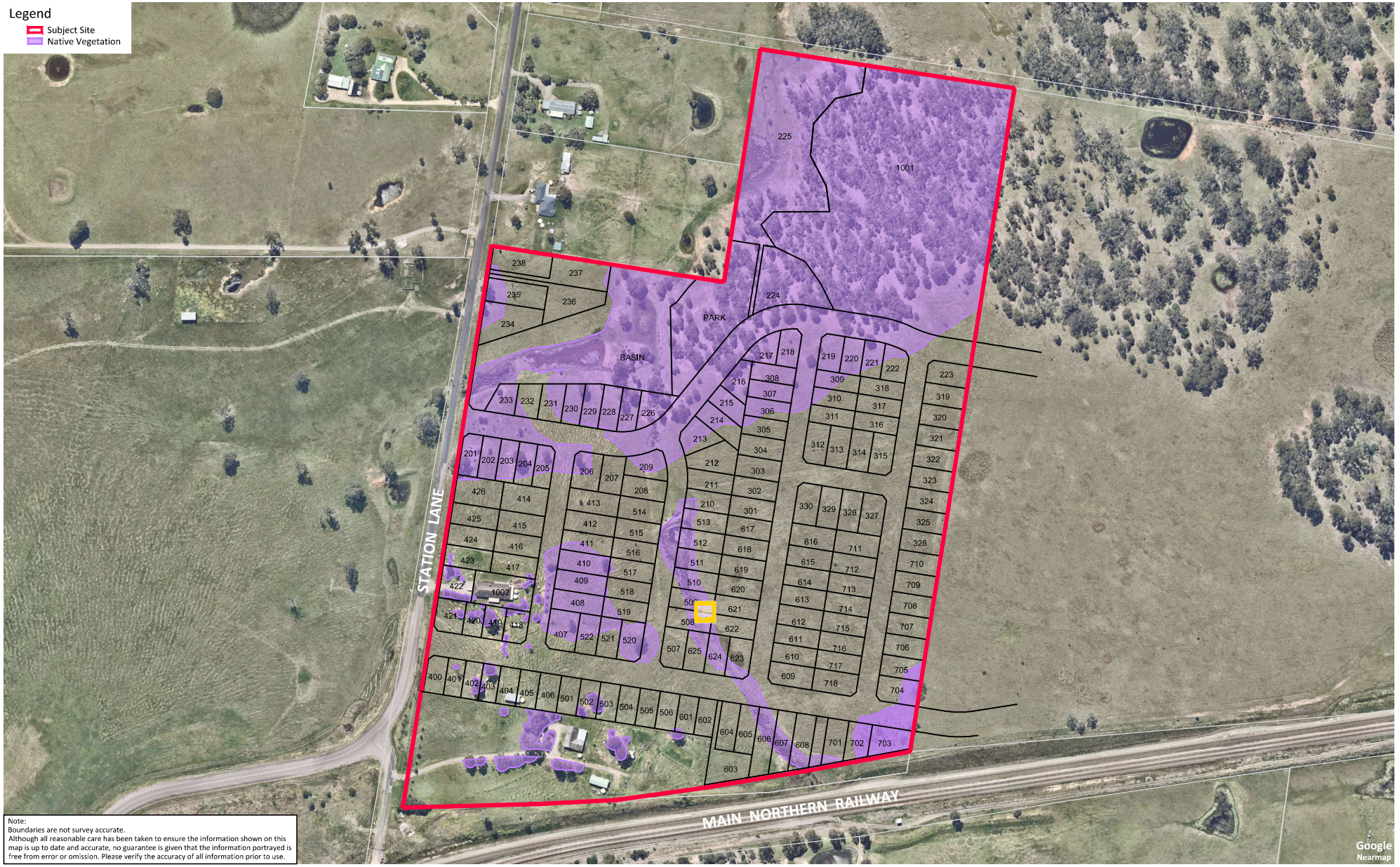

FIGURE 2-2: NATIVE VEGETATION WITHIN THE SITE

Ref No 2813 H

CLIENT	Client
SITE DETAILS	Lots 1307 & 1308 DP 1141533 Lochinvar
DATE	21 July 2022

NORTH

0 50 100 150

SCALE 3000 @ A3

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2.2.3 Identifying Plant Community Types

Review of Existing Information

Table 2-3 details the review on existing information on the site's PCTs/vegetation communities.

Table 2-2: Review of Existing Information on the Site's PCTs

Vegetation Mapping Project	Response
Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855	One PCT has been mapped within the site: • PCT 1065 Parramatta Red Gum/ Narrow-leaved Apple/ Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

2.2.3.1 Plot-based Floristic Surveys

Plot-based floristic vegetation surveys were undertaken within the study area in accordance with s.5.2.1.9 of the BAM, by one ecologist on 22nd February 2021 and 1st April 2021. The 20 m x 20 m plots were sampled for the presence of flora species; see Figure 2-3 for the plot locations undertaken within the impacted PCTs (the study area) and see Appendix I for photos. The plots were carefully examined to identify all flora species present. This search continued until it was confident that all flora species within the plots were detected. Data collected for each species included:

- Stratum and layers in which each species occurs;
- Growth form for each species;
- Scientific and common name for each species;
- Percentage foliage cover (PFC) across the plot, of each species rooted in or overhanging the plot; and
- Abundance rating for each species.

Plant Community Type/s (PCTs) on the site were identified according to the NSW PCT classification described in the BioNet Vegetation Classification. Two native PCTs have been identified within the site; these PCTs are described below. The distribution of the PCTs in the development footprint is indicated in Figure 2-4. Plot data is provided in Appendix B. A full recorded species list is provided in Appendix C.

2.2.3.2 Plant Community Types

The PCTs identified within the site were not found to be consistent with the PCTs mapped on *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855*. The distribution of the site's PCTs is indicated in Figure 2-4. See Appendix I for photos.

Table 2-3: Plant Community Types within the site that are impacted by the proposal

Attribute	Details
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	
Formation	Grassy Woodlands
Vegetation Class	Coastal Valley Grassy Woodlands
TEC status	Part of the endangered BC Act listing of 'Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions'
PCT Percent Cleared	71%
Justification for PCT Selection	Surveys undertaken by Firebird ecoSultants have confirmed the presence of several typical species associated with PCT 1604, including; *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Cymbopogon refractus* (Barbed Wire Grass), *Aristida ramosa* (Purple Wire Grass), *Aristida vagans* (Threeawn speargrass), *Microlaena stipoides* (Weeping grass), *Lomandra multiflora* (Many-flowered Mat-rush) and *Cheilanthes sieberi* (Poison Rock Fern). *Corymbia maculata* (Spotted Gum), although not observed within the site, was observed in adjoining properties. This PCT is also mapped as occurring within the area Lochinvar on *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855*.
Other PCTs considered	PCT 1691 – This PCT is similar to the chosen PCT 1604, but differs slightly in typical diagnostic species. *Brachychiton populneus* (Kurrajong) is one such diagnostic species associated with PCT 1691; this species does not occur within the site, despite the site's canopy stratum being relatively intact. Furthermore, as mentioned above, *Corymbia maculata* (Spotted Gum), although not observed within the site, was observed in adjoining properties; this species is typically associated with PCT 1604. PCT 623 – This PCT is more similar to PCT 1691, in that *Brachychiton populneus* (Kurrajong) is a diagnostic species associated with this PCT, but is absent from the site. This vegetation community is also typically found further to the west of Lochinvar in the Central and Upper Hunter regions.
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	
Formation	Freshwater Wetlands

Vegetation Class	Coastal Freshwater Lagoons
TEC status	Not considered a TEC – the site's PCT 1071 occurs as a small artificial dam in an otherwise rural / agricultural landscape.
PCT Percent Cleared	71%
Justification for PCT Selection	This vegetation occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. Surveys undertaken by Firebird ecoSultants have confirmed the presence of two typical species associated with PCT 1071, including; *Typha orientalis* (Native Bulrush) and *Ludwigia peploides* (Water Primrose). It is noted that *Phragmites australis* (Common Reed), which is a diagnostic species for PCT 1071, does not occur within the site, however PCT 1071 is described as being often associated with man-made water bodies, drainage lines and depressions across a wide variety of environments. This vegetation community within the site does occur as a highly modified man-made drainage canal. The presence of *Typha orientalis* (Native Bulrush) and *Ludwigia peploides* (Water Primrose) in this highly modified environment suggest that PCT 1071 is the best fit for this vegetation community.
Other PCTs considered	PCT 1737 Typha Rushland – This plant community type was considered because *Typha orientalis* is the dominate species within the site, which is also a diagnostic species of PCT 1737. *Cynodon dactylon*, which is also a diagnostic species for PCT 1737, also occurs around the edge this community within the site. However as described above, PCT 1071 is considered the best fit PCT. No other PCTs were considered because *Typha orientalis* does not appear to be a diagnostic species for any other 'Coastal Freshwater Lagoon' in the Sydney Basin and Hunter IBRA region/sub-region.
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal
Exotic grassland	
Formation	N/A
Vegetation Class	N/A
TEC status	N/A
PCT Percent Cleared	N/A
Justification for PCT Selection	The 'Interim Grasslands and other Groundcover Assessment Method' was used to assess the grassland areas. Refer to Appendix H for the Grassland Report. This vegetation is dominated by the following; *Paspalum dilatatum* (Paspalum), *Axonopus compressus* (Carpet Grass), *Stenotaphrum secundatum* (Buffalo grass), *Hypochoeris radicata* (Catsear), *Senecio*

	madagascariensis (Fireweed) and *Plantago lanceolata* (Lambs Tongue).
Impacted by the proposal?	Yes – Both directly and indirectly impacted by the proposal

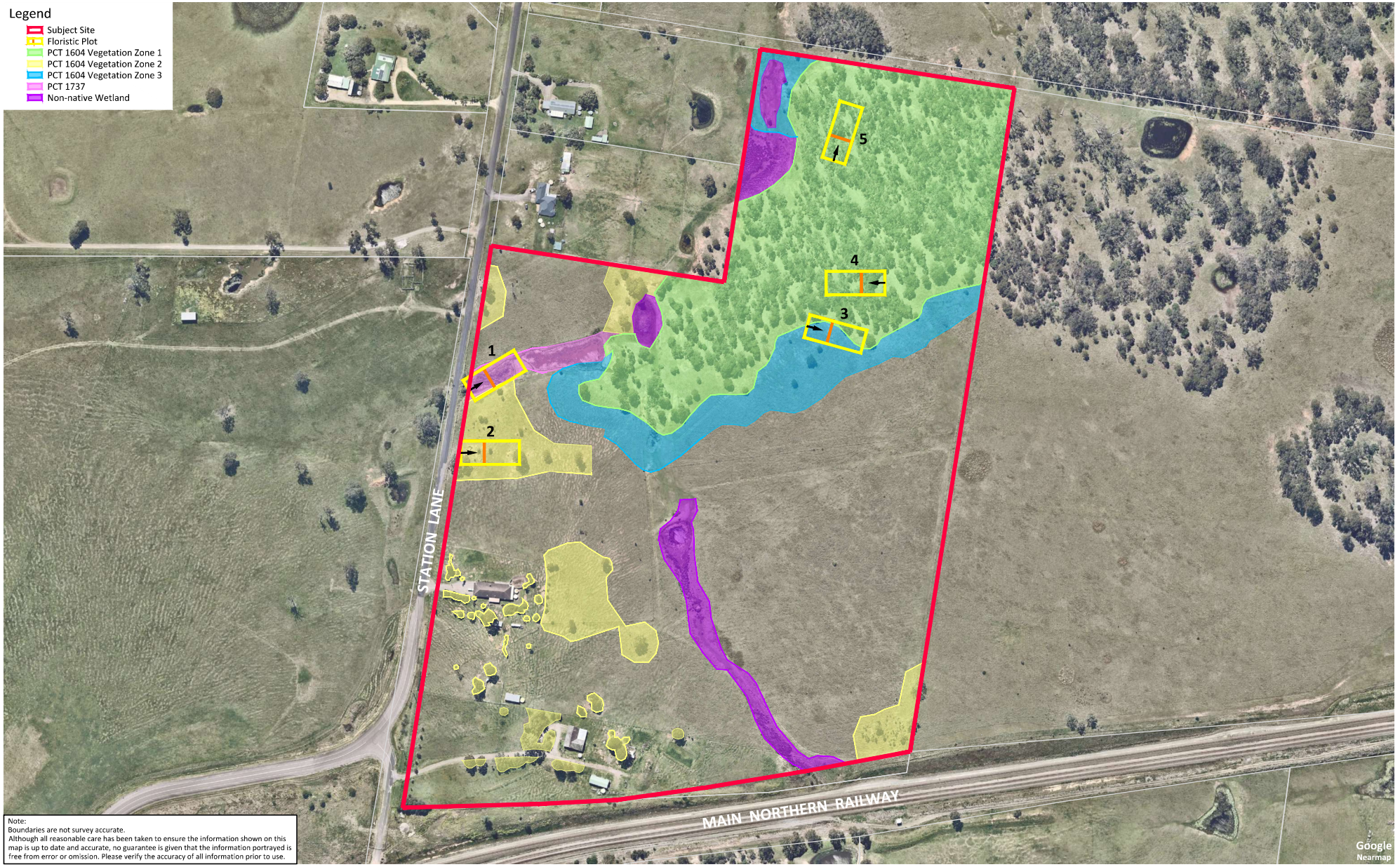

FIGURE 2-3: LOCATION OF FLORISTIC SURVEY PLOTS

Ref No 2813 H

CLIENT Client
SITE DETAILS Lots 1307 & 1308 DP 1141533 Lochinvar
DATE 21 July 2022

NORTH

0 50 100 150

SCALE 3000 @ A3

Firebird ecoSultants Pty Ltd
ABN - 16 105 985 993
Level 1, 146 Hunter Street, Newcastle NSW 2300
P O Box 354 Newcastle NSW 2300

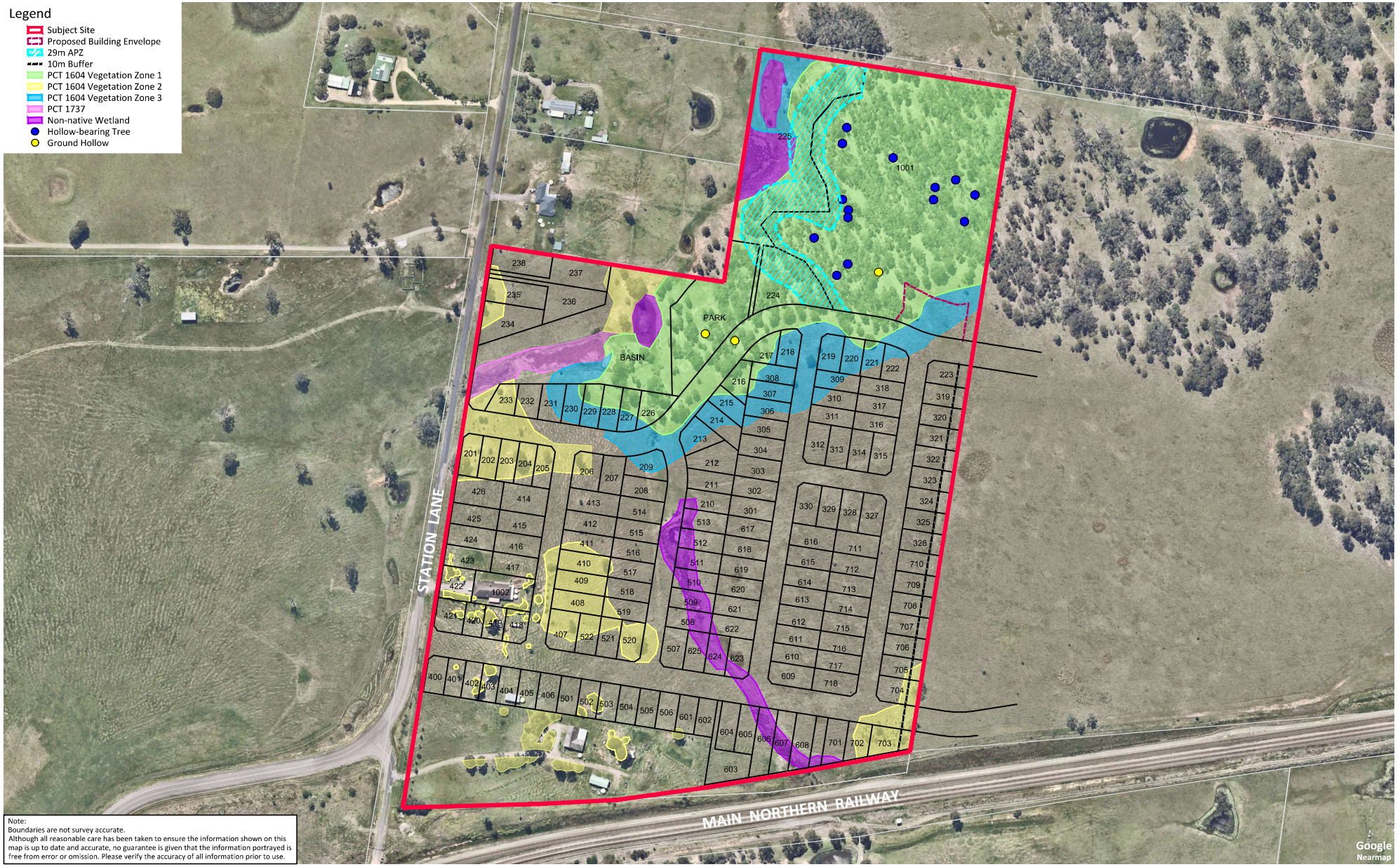

FIGURE 2-4: PLANT COMMUNITY TYPES & HABITAT

Ref No 2813 H

CLIENT Client
SITE DETAILS Lots 1307 & 1308 DP 1141533 Lochinvar
DATE 21 July 2022

NORTH

0 50 100 150
SCALE 3000 @ A3

Firebird ecoSultants Pty Ltd
ABN - 16 105 985 993
Level 1, 146 Hunter Street, Newcastle NSW 2300
P O Box 354 Newcastle NSW 2300

2.2.4 PCTs to be assessed in the BAM-C

Of the site's two identified PCT's, only one PCT is considered to be directly impacted by the proposal, this being PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter. PCT 1604 will be directly impacted by the proposal by vegetation clearing and may be indirectly impacted by changes in noise, light pollution and dust from construction phase activities and post-development activities. The following is a breakdown of the areas of PCT 1604 to be impacted by the proposal;

- 5.07 ha to be directly impacted
- 0.81 ha to be indirectly impacted
- 2.8 ha to be avoided (this area will not be assessed in the BAM-C)

The entire area of PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion will be impacted by the proposal. There will be no direct impacts to this PCT, but it will be indirectly impacted by changes in noise, light pollution and dust from construction phase activities and post-development activities. The area of this PCT is 0.25 ha.

2.2.5 Vegetation Integrity Assessment

Vegetation Zones

For the purposes of the BAM, a vegetation zone is an area of native vegetation on the site that is the same PCT and has a similar broad condition state. The site's impacted PCTs have been divided into several vegetation zones (as detailed in Table 2-4) (see Appendix I for photos). A patch size area has been assigned to each vegetation zone, as a class (as detailed in Table 2-4). See Appendix I for photos of each vegetation zone.

Table 2-4: Vegetation Zones and Patch Size Classes

PCT	Vegetation Zone (VZ) Name	Vegetation Zone Description	Patch Size Class
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	This vegetation zone occurs in a moderate condition, with an intact canopy stratum, numerous hollow-bearing trees and ground hollows, high density of native ground cover. This area also contains a moderate density of African Olive in the shrub layer and some exotic grasses and forbs in the ground layer.	≥100 ha
	VZ 2: Regenerating	This vegetation zone is in a state of regeneration, with trees predominately of a young age class and numerous saplings of canopy species occurring. The ground layer is roughly 50% native species to 50% exotic species.	≥100 ha
	VZ 3: Derived Grassland	This vegetation zone is lacking a canopy and shrub layer, but contains many of the native ground species found in vegetation zones 1 and 2. This veg zone acts as an ecotone between PCT 1604 and the exotic pasture grassland within the site.	≥100 ha
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1: Intact	This PCT occurs in only one vegetation state. It is dominated by *Typha orientalis,* with several native species occurring around the periphery of the littoral zone. The creek bank is predominately dominated by exotic grasses and weeds.	≥100 ha

Vegetation Integrity Scores

Each vegetation zone identified on the site has been surveyed to obtain a quantitative measure for each zone, of the composition, structure and function attributes listed in Table 3 of the BAM. These attributes are listed below:

- Growth form groups used to assess composition and structure:
  - Tree
  - Shrub
  - Grass and grass like
  - Forb
  - Fern
  - Other
- Attributes used to assess function:
  - Number of large trees
  - Tree regeneration
  - Tree stem size class
  - Total length of fallen logs
  - Litter cover
  - High threat exotic vegetation cover
  - Hollow-bearing trees

Plot-based surveys were conducted, in accordance with s.5.3.4 of the BAM, by one ecologist on 22nd February 2021 and 1st April 2021. Survey plots were established around a central 50 m transect and included:

- One 400 m² (20 m x 20 m) plot to assess the composition and structure attributes listed above.
- One 1000 m² (20 m x 50 m) plot to assess the function attributes: number of large trees, stem size class, tree regeneration and length of logs.
- Five 1 m² sub-plots to assess average litter cover (and other optional groundcover components).

See previous Figure 2-3 for plot locations. Plot data is provided in Appendix B. Table 2-5 details the vegetation integrity score.

Table 2-5: Vegetation Integrity Scores

PCT	Vegetation Zone (VZ)	Composition Score	Structure Condition Score	Function Condition Score	Vegetation Integrity Score
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	58.4	72.9	74.2	68.1
	VZ 2: Regenerating	27.1	57	30.5	36.6
	VZ 3: Derived Grassland	28.8	26.8	0.1	3.6
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1: Intact	31.2	87.8	N/A	52.3

2.3 Threatened Species

The following has been undertaken in accordance with section 6 of the BAM.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identified as 'species' credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

For some threatened species, they are identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, and the results of targeted surveys for candidate threatened species.

2.3.1 Identify Threatened Species for Assessment

Threatened species that require assessment are initially identified based upon the following criteria:

- the distribution of the species includes the IBRA subregion in which the subject land occurs
- the study area is within any geographic constraints of the distribution of the species within the IBRA subregion.
- the species is associated with any of the PCTs identified within the study area
- the native vegetation cover within an assessment area including a 1500m buffer around the study area is equal to or greater than the minimum required for the species.
- the patch size that each vegetation zone is part of is equal to or greater than the minimum required for that species.
- the species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

The process for identifying threatened species which meet the above criteria is completed through the BAM Calculator. The PCTs identified within the study area, patch sizes and native vegetation cover, as outlined in Section 3, were entered into the BAM Calculator and a preliminary list of threatened species were identified.

2.3.2 Ecosystem Credit Species

Ecosystem credit species are those where the likelihood of occurrence of the species or elements of the species' habitat, can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. The Threatened Biodiversity Data Collection (TBCD) has identified several ecosystem credit species as requiring assessment, for the proposal; these are listed in Table 2-6.

Table 2-6: Ecosystem Credit Species Predicted to occur within the Study Area

Ecosystem Credit Species	Habitat Constraints	Veg Zone - Confirmed Predicted Species	Justification when not confirmed for a Veg Zone	BC Act listing	EPBC Act listing
Anseranas semipalmata Magpie Goose	• East of Cessnock = yes	PCT 1071 VZ1 = Yes	N/A	V	-
Anthochaera phrygia Regent Honeyeater (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	CE	CE
Botaurus poiciloptilus Australasian Bittern	• Waterbodies = yes • Brackish or freshwater wetlands = yes • East of Cessnock = yes	PCT 1071 VZ1 = Yes	N/A	E	E
Calidris ferruginea Curlew Sandpiper (Foraging)	• As per mapped area = no	PCT 1071 VZ1 = No	The site is not within a mapped area for this species	E	CE
Calidris tenuirostris Great Knot (Foraging)	• As per mapped area = no • Within 5 km of coast or tidal influenced water bodies = no	PCT 1071 VZ1 = No	The site is not within a mapped area for this species	V	CE
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-

Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	• Presence of Allocasuarina and casuarina species = no	PCT 1604 VZ1 = No PCT 1604 VZ2 = No PCT 1604 VZ3 = No	No Allocasuarina and casuarina species present in this PCT	V	-
Chthonicola sagittata Speckled Warbler	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Circus assimilis Spotted Harrier	-	PCT 1071 VZ1 = Yes	N/A	V	-
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Daphoenositta chrysoptera Varied Sittella	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Dasyurus maculatus Spotted-tailed Quoll	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	E
Ephippiorhynchus asiaticus Black-necked Stork	• Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps. • Waterbodies, Shallow lakes, lake margins and estuaries within	PCT 1071 VZ1 = No	The sites PCT 1071 only occurs as a small artificial dam – the dam would not be considered as an open freshwater wetland.	E	-

	300m of these waterbodies				
Epthianura albifrons White-fronted Chat	-	PCT 1071 VZ1 = Yes	N/A	V	-
Glossopsitta pusilla Little Lorikeet	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Grantiella picta Painted Honeyeater	• Mistletoes present at a density of greater than five mistletoes per hectare	PCT 1604 VZ1 = No PCT 1604 VZ2 = No PCT 1604 VZ3 = No	No mistletoes present at a density of greater than five mistletoes per hectare	V	V
Haliaeetus leucogaster White-bellied Sea Eagle (Foraging)	• Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	PCT 1071 VZ1 = No	The site is not within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines. Although there are dams in the local area, these are small farm dams only.	V	-
Hieraaetus morphnoides Little Eagle (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes PCT 1071 VZ1 = Yes	N/A	V	-
Irediparra gallinacean Comb-crested Jacana	• Freshwater wetlands with a good surface cover of floating aquatic vegetation	PCT 1071 VZ1 = No	The site does not contain freshwater wetlands with a good surface cover of floating aquatic vegetation	V	-
Ixobrychus flavicollis Black Bittern	• Land within 40 m of freshwater and estuarine wetlands, in areas of permanent	PCT 1071 VZ1 = No	The site is not within freshwater and estuarine wetlands, in areas of permanent water and dense vegetation. The sites PCT 1071 only occurs as a small artificial dam in an otherwise pastural landscape.	V	-

	water and dense vegetation				
Lathamus discolor Swift Parrot (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	E	CE
Limicola falcinellus Broad-billed Sandpiper (Foraging)	• As per mapped areas (contact OEH for maps)	PCT 1071 VZ1 = No	The site is not within a mapped area for this species	V	-
Limosa limosa Black-tailed Godwit (Foraging)	• As per mapped areas (contact OEH for maps)	PCT 1071 VZ1 = No	The site is not within a mapped area for this species	V	-
Lophoictinia isura Square-tailed Kite (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Melanodryas cucullate cucullate Hooded Robin (South-eastern form)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Miniopterus australis Little Bentwing-bat (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Miniopterus *orianae* ***oceanensis*** Large Bentwing-bat (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Neophema pulchella Turquoise Parrot	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes	N/A	V	-

		PCT 1604 VZ3 = Yes			
Ninox strenua Powerful Owl (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Oxyura australis Blue-billed Duck	-	PCT 1071 VZ1 = Yes	N/A	V	-
Pandion cristatus Eastern Osprey (Foraging)	-	PCT 1071 VZ1 = Yes	N/A	V	-
Petroica boodang Scarlet Robin	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Petroica phoenicea Flame Robin	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Phascolarctos cinereus Koala (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	V
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	V
Rostratula australis Australian Painted Snipe	-	PCT 1071 VZ1 = Yes	N/A	E	E
Saccolaimus flaviventris	-	PCT 1604 VZ1 = Yes	N/A	V	-

Yellow-bellied Sheathtail-bat		PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes			
Stagonopleura guttata Diamond Firetail	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Stictonetta naevosa Freckled Duck	-	PCT 1071 VZ1 = Yes	N/A	V	-
Tyto novaehollandiae Masked Owl (Foraging)	-	PCT 1604 VZ1 = Yes PCT 1604 VZ2 = Yes PCT 1604 VZ3 = Yes	N/A	V	-
Xenus cinereus Terek Sandpiper (Foraging)	• As per mapped areas (contact OEH for maps)	PCT 1071 VZ1 = No	The site is not within a mapped area for this species	V	-

2.3.3 Species Credit Species (Candidate Species)

Species credit species (or candidate species) are those where the likelihood of occurrence of the species or elements of suitable habitat for the species, cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey. The TBDC has identified several candidate species as requiring assessment, for the proposal; these are listed in Table 2-7. Table 2-7 also provides an assessment of habitat suitability for the candidate species, in accordance with s.6.4 of the BAM.

Table 2-7: Candidate Species Assessment

Species Credit Species	Habitat Constraints / Geographic Limitations	Confirmed Candidate Species for Further Assessment	Justification
Acacia bynoeana Bynoe's Wattle	Nil	Yes	
Anthochaera phrygia Regent Honeyeater (Breeding)	1. As per mapped area	No	**Habitat constraints not present:** The study area is not within or near a mapped area of important habitat for this species.
Aprasia parapulchella Pin-tailed Legless Lizard	1. Rocky areas 2. Or within 50m of rocky areas	No	**Habitat constraints not present:** The study area is not within or near rocky areas or within 50m of rocky areas.
Asperula asthenes Trailing Woodruff	Nil	Yes	
Burhinus grallarius Bush Stone-curlew	1. Fallen/standing dead timber including logs	Yes	**Habitat constraints present:** This study area has Fallen/standing dead timber present. **This species will be further assessed in section 2.3.5**
Calidris ferruginea Curlew Sandpiper (Breeding)	Nil	No	**Habitat substantially degraded:** The site's PCT 1071 only occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. This is not sufficient as a breeding site for this species.
Calidris tenuirostris Great Knot (Breeding)	1. Within 5 km of coast or tidal influenced water bodies	No	**Habitat constraints not present:** This study area is not Within 5km of coast or tidal influenced water bodies.
Callistemon linearifolius Netted Bottle Brush	Nil	Yes	
Callocephalon fimbriatum Gang-gang Cockatoo	1. Hollow bearing trees	Yes	**Habitat constraints present:** This study area has Hollow bearing trees and eucalypt tree species with hollows greater than 9 cm in diameter present.

(Breeding)	2. Eucalypt tree species with hollows greater than 9 cm in diameter		**This species will be further assessed in section 2.3.5**
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	1. Hollow bearing trees 2. Living or dead tree with hollows greater than 15 cm diameter and greater than 5m above the ground	Yes	**Habitat constraints present:** This study area has hollow bearing trees and living or dead trees with hollows greater than 15 cm in diameter and greater than 5m above the ground present **This species will be further assessed in section 2.3.5**
Cercartetus nanus Eastern Pygmy-possum	Nil	Yes	
Chalinolobus dwyeri Large-eared Pied Bat	1. Cliffs 2. Within two kilometers of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometers of old mines or tunnels	No	**Habitat constraints not present**: This study area is not within or near cliffs or within two kilometers of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometers of old mines or tunnels.
Crinia tinnula Wallum Froglet	Nil	Yes	
Cryptostylis hunteriana Leafless Tongue Orchid	Nil	Yes	
Cynanchum elegans *White-Flowered Wax Plant*	Nil	Yes	
Delmar impar Striped Legless Lizard	Nil	Yes	
Diuris tricolor Pine Donkey Orchid	Nil	Yes	
Eucalyptus castrensis	Nil	Yes	

Singleton Mallee			
Eucalyptus Glaucina Salty Red Gum	Nil	Yes	
Eucalyptus parramattensis subsp. Decadens Eucalyptus parramattensis subsp. Decadens	Nil	Yes	
Eucalyptus pumila Pokolbin Mallee	Nil	Yes	
Grevillea parviflora subsp. Small-flower grevillea	Nil	Yes	
Haliaeetus leucogaster White-bellied Sea Eagle (Breeding)	1. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	No	**Habitat constraints not present:** This study area is not within or near Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.
Hieraaetus morphnoides Little Eagle (Breeding)	1. Nest trees - live (occasionally dead) large old trees within vegetation)	No	**Habitat constraints not present:** This study area does not contain Nest trees - live (occasionally dead) large old trees within vegetation)
Hoplocephalus bitorquatus Pale-headed Snake	Nil	Yes	
Lathamus discolor Swift Parrot (Breeding)	1. As per mapped area	No	**Habitat constraints not present:** The study area is not within or near a mapped area of important habitat for this species.
Limicola Falcinellus Broad-billed Sandpiper (Breeding)	Nil	No	**Habitat substantially degraded:** The site's PCT 1071 only occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. This is not sufficient as a breeding site for this species.

Limosa limosa Black-tailed Godwit (Breeding)	Nil	No	**Habitat substantially degraded:** The site's PCT 1071 only occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. This is not sufficient as a breeding site for this species.
Litoria aurea Green and Golden Bell Frog	1. Semi-permanent/ephemeral wet areas 2. Within 1km of wet areas|Swamps 3. Within 1km of swamp|Waterbodies 4. Within 1km of waterbody	Yes	**Habitat constraints present:** The study area is within 1km of a waterbody / wet area / swamp/semi-permanent/ephemeral wet areas. **This species will be further assessed in section 2.3.5**
Litoria brevipalmata Green-thighed Frog	Nil	Yes	
Lophoictinia isura Square-tailed Kite (Breeding)	1. Nest trees	No	**Habitat constraints not present:** This study area does not contain any nest trees.
Maundia triglochinoides Maundia triglochinoides	1. Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep|Semi-permanent/ephemeral wet areas|Swamps 2. Shallow swamps up to 1 m deep|Waterbodies 3. Shallow waterbodies up to 1 m deep	Yes	**Habitat constraints present**: This study area has Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep|Semi-permanent/ephemeral wet areas|Swamps, Shallow swamps up to 1 m deep|Waterbodies, Shallow waterbodies up to 1 m deep present. **This species will be further assessed in section 2.3.5**
Melaleuca biconvexa Biconvex Paperbark	Nil	Yes	

Miniopterus australis Little Bentwing-bat (Breeding)	1. Caves 2. Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave' 3. observation type code 'E nest-roost' 4. with numbers of individuals >500 5. or from the scientific literature	No	**Habitat constraints not present:** This study area does not contain cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'. No observation type code 'E nest-roost'. **Refer to section 2.3.4 for the habitat assessment.**
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	1. Caves 2. Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave' 3. observation type code 'E nest-roost' 4. with numbers of individuals >500	No	**Habitat constraints not present:** This study area does not contain cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'. No observation type code 'E nest-roost'. **Refer to section 2.3.4 for the habitat assessment.**
Monotaxis macrophylla ***Large-leafed Monotaxis***	Nil	Yes	

Myotis macropus Southern Myotis	1. Hollow bearing trees 2. Within 200 m of riparian zone 3. Bridges, caves or artificial structures within 200 m of riparian zone 4. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site	Yes	**Habitat constraints present:** The study area is within 200 m of a riparian zone and contains hollows, Bridges, caves or artificial structures within 200 m of riparian zone and This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site. **This species will be further assessed in section 2.3.5**
Ninox strenua Powerful Owl (Breeding)	1. Hollow bearing trees 2. Living or dead trees with hollow greater than 20cm diameter	Yes	**Habitat constraints present:** The study area contains hollow bearing trees, although none are suitable for breeding. In any case, targeted surveys were undertaken for this species. **This species will be further assessed in section 2.3.5**
Ozothamnus tesselatus Ozothamnus tesselatus	Nil	Yes	
Pandion cristatus Eastern Osprey (Breeding)	1. Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting)	No	**Habitat constraints not present:** The study area does not contain stick nests. **Refer to section 2.3.4 for the habitat assessment.**
Persicaria elatior Tall Knotweed	1. Semi-permanent/ephemeral wet areas 2. Or within 50m|Swamps 3. Or within 50 m|Waterbodies 4. Including Wetlands, or within 50 m	Yes	**Habitat constrains present:** The study area is within 50m of swamps, wetlands, waterbodies and semi-permanent/ephemeral wet areas. **This species will be further assessed in section 2.3.5**
Persoonia pauciflora North Rothbury Persoonia	1. Within 10km of North Rothbury	No	**Habitat constraints not present:** The study area is not within 10km of North Rothbury

Phascogale tapoatafa Brush-tailed Phascogale	Nil	Yes	
Phascolarctos cinereus Koala (Breeding)	1. Areas identified via survey as important habitat*	Yes	**Habitat constraints present:** The study area is identified via survey as important habitat. **Refer to section 2.3.4 for the habitat assessment.**
Planigale maculata Common Planigale	Nil	Yes	
Prostanthera cineolifera Singleton Mint Bush	Nil	Yes	
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	1. Breeding camps	No	**Habitat constraints not present:** The study area does not contain any breeding camps. **Refer to section 2.3.4 for the habitat assessment.**
Pterostylis chaetophora Pterostylis chaeterophora	Nil	Yes	
Rutidosis heterogams Heath Wrinklewort	Nil	Yes	
Thesium austral Austral Toadflax	Nil	Yes	
Tyto novaehollandiae Masked Owl (Breeding)	1. Hollow bearing trees 2. Living or dead trees with hollows greater than 20cm diameter	Yes	**Habitat constraints present:** The study area does contain hollow bearing trees, living or dead trees with hollows greater than 20cm diameter. **This species will be further assessed in section 2.3.5**
Uperoleia mahonyi Mahony's Toadlet	Nil	Yes	
Xenus cinereus Terek Sandpiper (Breeding)	Nil	No	**Habitat substantially degraded:** The site's PCT 1071 only occurs as a small artificial farm dam in an otherwise rural / pastoral landscape. This is not sufficient as a breeding site for this species.
Zannichellia palustris	1. Waterbodies	No	**Habitat constraints not present**: The study area does not contain waterbodies that are freshwater or slightly brackish estuarine areas (10%)

Zannichellia palustris	2. Freshwater or slightly brackish estuarine areas (10%)		

2.3.4 Habitat Assessment

The following describes the habitat attributes of the study area;

- The study area provides open grassland habitat within the site's cleared exotic grassland area which may provide habitat for species adapted to open areas.
- The site's PCT 1071 only occurs as a small artificial dam in an otherwise pastural landscape. It may provide habitat for common / resilient species of frog and some small common wetland bird species such as *Porphyrio porphyrio* (Purple Swamp Hen) that prefer habitat with dense reeds and rushes.
- No Allocasuarinas or casuarinas occur within the study area which are a food source for species such as *Calyptorhynchus lathami* (Glossy Black-Cockatoo) – as such, the site provides limited habitat for these species.
- The site contains many hollow-bearing trees with variable hollow sizes which would likely provide habitat for a wide range of species, including microbats, hollow-dependant arboreal mammals, woodland birds and in some cases owls; however, none occur within the development footprint.
- The study area contains fallen logs and timber which may provide habitat for reptiles and foraging birds.
- No caves, tunnels, mines or culverts occur within the study area or the site.
- No stick nests occur within the study area or the site (at the time of surveys)
- No flying fox camps occur within or near the site.

See Appendix I for photos of the site's hollow-bearing trees and ground hollows.

2.3.4.1 Koala Habitat Protection SEPP 2021

A development proposal must be assessed under the development assessment process under the SEPP in LGAs where no approved Koala Plan of Management is in place. This includes all land;

a. with an area of at least 1 hectare, including adjoining land (meaning land the next cadastre over) within the same ownership, and

b. that is within an LGA to which the SEPP applies.

The site is greater than 1 hectare and Lochinvar occurs within the Maitland LGA which lies within the Central Coast Koala Management Area. There is no Koala Plan of Management for the Maitland LGA and so this development proposal must be assessed

under the development assessment process under the Koala Habitat Protection SEPP 2021.

Because the proposal is likely to impact on koala habitat (i.e. koala feed trees) a suitably experienced and qualified person must undertake a survey for core koala habitat and prepare a Koala Assessment Report which must accompany the development application.

Firebird ecoSultants conducted the survey for core koala habitat and prepared a Koala Assessment Report. It was found that the site does not contain core koala habitat, no further provisions of the Koala Habitat Protection SEPP 2021 apply. Refer to Appendix G.

2.3.5 Targeted Threatened Flora & Fauna Surveys

Targeted species surveys have been undertaken for some of the candidate species credit species in accordance with section 5.3 of the BAM.

The following Table 2-8 identifies whether each of the confirmed candidate species are present or absent, based on the results of the targeted surveys (or assumed presence where targeted surveys have not been undertaken); species highlighted in yellow are confirmed to be present. The following sections 2.4.4.1 to 2.4.4.6 outline the survey effort and results for each species. Table 2-9 shows the weather conditions for each day during the survey effort.

Table 2-8: Presence or Absence of Candidate Species

Species Presence	Confirmed presence
Acacia bynoeana Bynoe's Wattle	No – surveyed
Asperula asthenes Trailing Woodruff	No – Surveyed
Burhinus grallarius Bush Stone-curlew	No – surveyed
Callistemon linearifolius Netted Bottle Brush	No – surveyed
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	No – surveyed
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	No – surveyed
Cercartetus nanus Eastern Pygmy-possum	No – surveyed
Crinia tinnula Wallum Froglet	No – surveyed
Cryptostylis hunteriana Leafless Tongue Orchid	No – surveyed
Cynanchum elegans	No – surveyed

White-Flowered Wax Plant	
Delmar impar Striped Legless Lizard	No – surveyed
Diuris tricolor Pine Donkey Orchid	No – surveyed
Eucalyptus castrensis Singleton Mallee	No – surveyed
Eucalyptus Glaucina Salty Red Gum	No – surveyed
Eucalyptus parramattensis subsp. Decadens Eucalyptus parramattensis subsp. Decadens	No – surveyed
Eucalyptus pumila Pokolbin Mallee	No – surveyed
Grevillea parviflora subsp. Small-flower grevillea	No – surveyed
Hoplocephalus bitorquatus Pale-headed Snake	No – surveyed
Litoria aurea Green and Golden Bell Frog	No – surveyed
Litoria brevipalmata Green-thighed Frog	No – surveyed
Maundia triglochinoides Maundia triglochinoides	No – surveyed
Melaleuca biconvexa Biconvex Paperbark	No – surveyed
Monotaxis macrophylla ***Large-leafed Monotaxis***	No – surveyed
Myotis macropus Southern Myotis	No – surveyed
Ninox strenua Powerful Owl (Breeding)	No – surveyed
Ozothamnus tesselatus Ozothamnus tesselatus	No – surveyed
Persicaria elatior Tall Knotweed	No – surveyed
Phascogale tapoatafa Brush-tailed Phascogale	No – Surveyed
Planigale maculata Common Planigale	Yes – assumed present
Prostanthera cineolifera Singleton Mint Bush	No – surveyed
Pterostylis chaetophora Pterostylis chaeterophora	No – surveyed
Rutidosis heterogams Heath Wrinklewort	No – surveyed
Thesium austral	No – surveyed

Austral Toadflax	
Tyto novaehollandiae Masked Owl (Breeding)	No – surveyed
Uperoleia mahonyi Mahony's Toadlet	No – surveyed

Table 2-9: Survey Period Weather Conditions

Survey Date	Conditions
February 1 – 4 march 2021	Camera traps set
February 15th 2021	Temperature was 19-22°C and rain was 0 ml.
March 4th 2021	Temperature was 14.2-28.3°C and rain was 0 ml. Calm breeze.
March 16th 2021	Temperature was 11.6-27.9°C and rain was 0 ml. Calm Breeze.
March 17th 2021	Temperature was 15.4-23.0°C and rain was 8.8 ml. Strong Breeze. Swamp water-logged, vegetation healthy.
March 23th 2021	Temperature was 17.6-23.4°C and rain was 19.4 ml.
March 25th 2021	Temperature was 16.5-27.4°C and rain was 0.2 ml.
April 1st 2021	Temperature was 17 -23°C
August 16 2021	Temperature was 6-21°C and Partly Cloudy
August 17 2021	Temperature was 6-17°C and Partly Cloudy
August 18 2021	Temperature was 6-18°C and Partly Cloudy
August 19 2021	Temperature was 7-20°C
8 September 2021	Temperature was 6-22°C
22 November 2021	Temperature was 15-16°C Light rain shower
23 November 2021	Temperature was 16-24°C
14 January 2022	Temperature was 17-31°C Cloudy

2.3.5.1 Targeted Flora Survey

Areas of Potential Habitat in the Site:

Table 2-10 details the areas of potential habitat on the site for the threatened flora species confirmed as candidate species.

Table 2-10: Potential Habitat on the Site for Threatened Flora Species

	Associated PCT				Survey Period	Surveyed
	PCT 1071	PCT 1604				
Species	VZ1	VZ1	VZ2	VZ3		
Cynanchum elegans	N	Y	Y	Y	All Year	YES – 14th January 2022
Ozothamnus tesselatus	N	Y	Y	Y	September to October	YES- 8th September
Rutidosis heterogama	N	Y	Y	Y	All Year	YES – 14 January
Monotaxis macrophylla	N	Y	Y	Y	August to February	YES – 8th September
Acacia bynoeana	N	Y	Y	Y	All Year	YES – 4th March
Maundia triglochinoides	Y	N	N	N	November to March	YES – 22 November 2021
Prostanthera cineolifera	N	Y	Y	Y	September to October	YES – 4th March
Callistemon linearifolius	N	Y	Y	Y	October to January	YES – 22nd November 2022
Eucalyptus castrensis	N	Y	Y	Y	All Year	YES – 23rd March 2022
Eucalyptus glaucina	N	Y	Y	Y	All Year	YES – 15th February
Eucalyptus parramattensis subsp. decadens	N	Y	Y	Y	All Year	YES – 15th February
Eucalyptus pumila	N	Y	Y	Y	All Year	YES – 15th February
Melaleuca biconvexa	Y	N	N	N	All Year	YES – 15th February
Cryptostylis hunteriana	N	Y	Y	Y	November to January	YES – 22nd November 2021

Diuris tricolor	N	Y	Y	Y	September to October	YES – 8th September
Pterostylis chaetophora	N	Y	Y	Y	September to November	YES – 8th September
Persicaria elatior	Y	N	N	N	December to May	YES – 23rd November 2021
Grevillea parviflora subsp. parviflora	N	Y	Y	Y	August to November	YES – 16th August
Asperula asthenes	Y	N	N	N	October to December	YES -22 November
Thesium australe	N	Y	Y	Y	November to February	YES – 4th March

Survey Timing:

The TBCD specifies the appropriate times/months to survey for each flora species (See Table 2-11)

The targeted surveys were conducted over several dates to ensure appropriate timing for each species. The parallel field-transverse method was undertaken and all species with active survey periods were targeted. Species not able to be surveyed are assumed present (See Figure 2-5)

Some species were also surveyed outside of the survey periods, the names and justifications are listed below (see Table 2-11)

Table 2-11: Species Surveyed

Species	Survey Period	Surveyed Date	Justification
Prostanthera cineolifera	September to October	4th March	No *Prostanthera* species were seen on site during surveys. Due to the low diversity and abundance of shrub species present it is highly unlikely potential individuals of this species would be overlooked during systematic surveys
Callistemon linearifolius	October to January	4th March	No *Callistemon* species were seen on site during surveys. Due to the low diversity and abundance of shrub species present it is highly unlikely potential individuals of this species would be overlooked during systematic surveys

Grevillea parviflora subsp. parviflora	August to November	16th August 2021	No *Grevillea* species were seen on site during surveys. Due to the low diversity and abundance of shrub species present it is highly unlikely potential individuals of this species would be overlooked during systematic surveys. This species was not recorded on site.
Monotaxis macrophylla	August to February	4th March	This species was surveyed only four days outside of the survey period and it would likely be persisting on site. This species was not recorded on site.
Thesium australe	November to February	4th March 2021	This species was surveyed only a matter of day outside the allotted survey period. At this time of year the species would be a bright yellow colour and highly visible. As such it would be unlikely to be overlooked during systematic surveys. This species was not recorded on site.

Survey Method and Effort:

The parallel field-transverse method was used; this requires walking a series of parallel transects that are close enough to allow observation of the entire site and is recommended in the *NSW Guide to Surveying Threatened Plants* (OEH 2016). Detectability of threatened plants is considered to be high using the parallel field-traverse method, because it systematically covers the entire area of potential habitat within a site and can be applied to a diverse range of species, habitats and sites. GPS tracking was uundertaken (See Figure 2-6) showing the path walked. Additionally, the site was traversed on foot and surveyed with the random meander technique across all other days of survey on the site.

Results

No targeted species were recorded on site during any of the surveys despite an adequate survey effort.

Figure 2-5: Targeted Flora Surveys

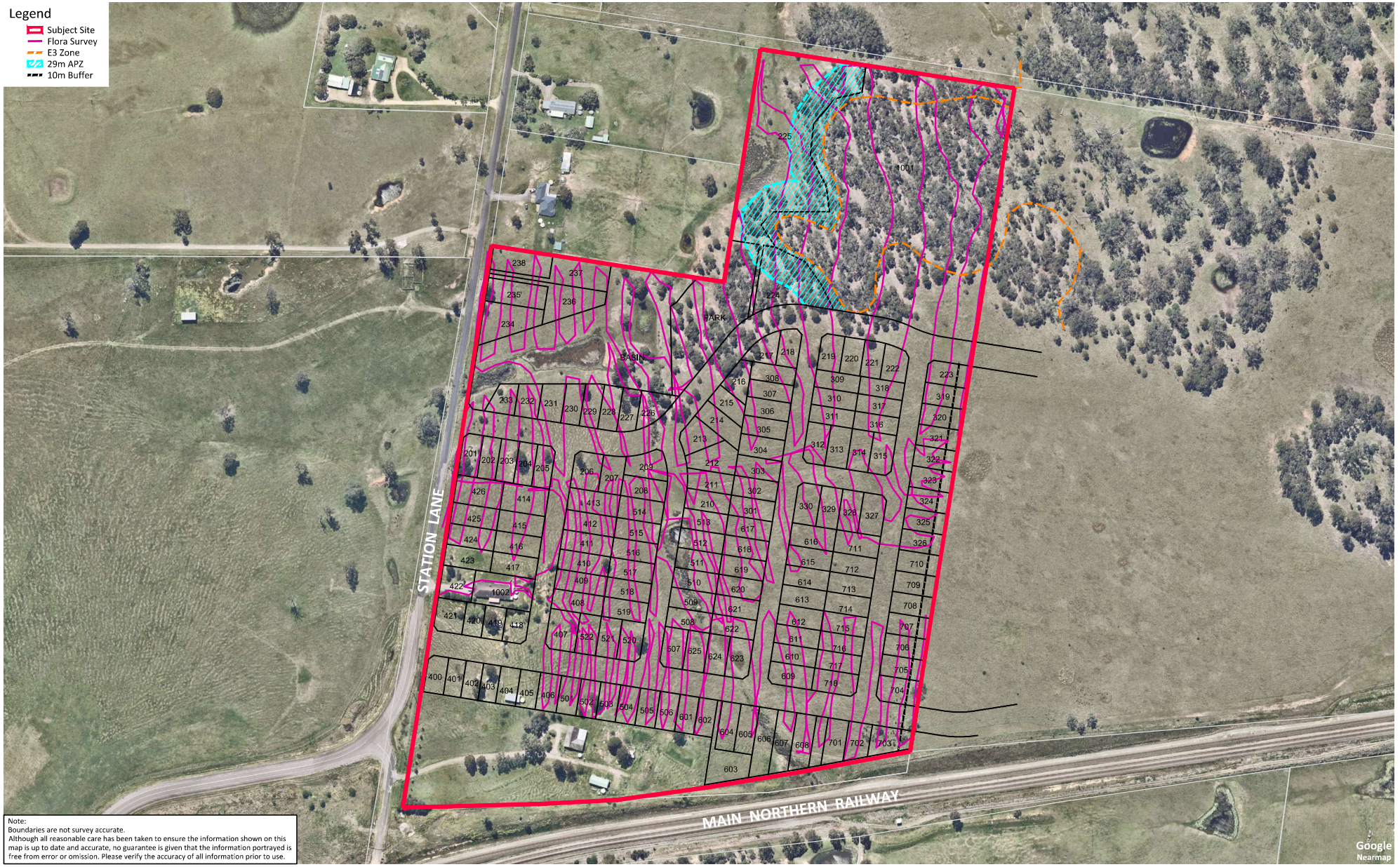

FIGURE 2-6: FLORA SPECIES SURVEY

Ref No 2813 H

CLIENT	Client
SITE DETAILS	Lots 1307 & 1308 DP 1141533 Lochinvar
DATE	21 July 2022

NORTH

0 50 100 150

SCALE 3000 @ A3

Firebird ecoSultants Pty Ltd
ABN - 16 105 985 993
Level 1, 146 Hunter Street, Newcastle NSW 2300
P O Box 354 Newcastle NSW 2300

2.3.6 Targeted surveys for Large Forest Owls; *Ninox strenua* (Powerful Owl), *Ninox connivens* (Barking Owl) and *Tyto novaehollandiae* (Masked Owl).

Areas of Potential Habitat in the Site:

Table 2-12 details the areas of potential habitat on the site for *Ninox strenua* (Powerful Owl), *Ninox connivens* (Barking Owl) and *Tyto novaehollandiae* (Masked Owl).

Survey Timing:
The TBCD specifies the appropriate times/months to survey for the above Owls (See Table 2-9) for when survey effort was undertaken for the threatened owl species refer to Table 2-11.

Table 2-12 Survey Effort

Species	Date Surveyed
Ninox strenua (Powerful Owl)	16 -19th August 2021 from 5.00pm to 9pm
Ninox connivens (Barking Owl)	16 -19th August 2021from 5.00pm to 9pm
Tyto novaehollandiae (Masked Owl)	16 -19th August 2021 from 5.00pm to 9pm

Survey Effort:
Stag watching and quiet listening – Stag watching and quiet listening was undertaken on four (4) separate nights.

Results – No targeted owl species were seen or heard.

- **Call Playback Surveys** – Targeted call-playback surveys were undertaken for each owl species over two (2) separate nights. This survey method was only used over two (2) nights so as to limit the risk of potentially disrupting the breeding behaviour of any potentially occurring owls. The call playback method is also known to be unreliable because owls may choose to not respond to the call playback. If owls do respond to call playback the results are potentially misleading because the calls have drawn to bird into or near the site, thus giving misleading results as to the bird's home base.
Results – No targeted owl species were seen or heard.

- **Nocturnal Spotlighting** – The entire site was traversed during night hours on four (4) separate occasions. The purpose of this survey effort was to search for individuals within the site using a hand-held spotlight.
Results – No targeted owl species were seen or heard.

2.3.7 Targeted surveys for arboreal mammals (excluding micobats); *Cercartetus nanus* (Eastern Pygmy Possum) *Petaurus norfolcensis* (Squirrel Glider) and *Phascogale tapoatafa* (Brush-tailed Phascogale), *Cercartetus nanus* (Greater Glider).

- **Nocturnal Spotlighting** – The entire site was traversed during night hours on four (4) separate occasions. The purpose of this survey effort was to search for individuals within the site using a hand-held spotlight.

Results – No targeted species were observed during this time.

- **Camera Trapping** – Twenty (20) camera traps were placed within trees scattered around the site, with the cameras facing trees that may be potentially used by these species. Bait canisters were used to attract these species; the canisters were placed onto trees directly opposite the camera traps. Each canister contained a bait made with oats, peanut butter and honey. Honey water was also used as an attractant. The camera traps were placed on the 1st of February 2021 and were left recording until 4 March 2021. During this time the baits were changed fortnightly.

Results – No targeted species were observed during this time.

Conclusion

None of these species were recorded during any of the survey efforts.

2.3.8 Diurnal Avifauna Surveys - *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Haliaeetus leucogaster* (White-bellied Sea Eagle), *Lophoictinia isura* (Square-tailed Kite)

The targeted species for diurnal avifauna surveys was the White-bellied Sea 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. 15 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.

Results

These species were not recorded on site during any of the surveys despite an adequate effort.

2.3.8.1 Targeted survey for Frog Species; *Litoria brevipalmata* (Green-thighed Frog), *Litoria aurea (Green and Golden Bell Frog), Crinia tinnula (Wallum Froglet) & Uperoleia mahonyi (Mahoney Toadlet)*

Multiple frog species were considered potential credits, these included; *Litoria brevipalmata* (Green-thighed Frog), *Litoria aurea* (Green and Golden Bell Frog), *Crinia tinnula* (Wallum Froglet) & *Uperoleia mahonyi* (Mahoney Toadlet). Surveys were conducted in accordance with the DPIE (2020) *NSW Survey Guide for Threatened Frogs - A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method, 2020*

Areas of Potential Habitat in the Site:

The habitat present on site was deemed suitable for *L. brevipalmata* & *L. aurea*, but did not constitute preferred wallum swamps on low nutrient sandy soil habitat preferred by both for *C. tinnula* & *U. mahonyi*. Regardless, due to shared surveys periods and requirements, these species were targeted during surveys.

Table 2-12 details the areas of potential habitat on the site for *L. brevipalmata, L. aurea*, *C. tinnula*.

Table 2-13: Potential Habitat on the Site for *L. brevipalmata, L. aurea, C. tinnula* & *U. mahonyi.*

PCT	Vegetation Zone (VZ)	Potential Habitat?
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1: Intact	*L. brevipalmata* – YES *L. aurea* – YES *U. mahonyi* – POSSIBLE *C. tinnula* – POSSIBLE
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	*L. brevipalmata* – YES
	VZ 2: Regenerating	*L. brevipalmata* – YES
	VZ 3: Derived Grassland	*L. brevipalmata* – YES

Survey Timing:

The TBCD specifies the appropriate times/months to survey for –

L. brevipalmata: All months.

L. aurea: November to March

U. mahonyi: October to March

C. tinnula: All months.

The targeted surveys for *L. brevipalmata, L. aurea* and *C. tinnula* were conducted over a total of four nights in March.

Survey Effort:

- Frog Surveys – Active surveys were used to target these species. Four (4) survey nights were undertaken and involved walking slowly along the habitat and spotlighting with head torches to view eyeshine. Frog species recorded include *Limnodynastes peronii, Litoria fallax* and *Litoria peronii* and *Crinia signifera.*

  4th March – 1.5 person hours

  16th March – 1.5 person hours

  17th March – 1.5 person hours

  23rd March – 1.5 person hours

  25th March – 3 person hours

  22 and 23 November – 3 person hours / night

  Total of person hours.

  Results – No targeted frog species were seen despite targeted survey efforts.

- Call Surveys – During and prior to active surveys all frogs calling at the site were listened to identify species present. Frog species recorded include *Limnodynastes peronii*, *Crinia signifera* and *Litoria peronii*.

  Results – No targeted frog species were heard despite targeted survey efforts.

- Review of threatened species database records – a review of the Atlas of NSW Wildlife (BioNet) was undertaken to search for any previous records of *C. tinnula*, *L. brevipalmata and L. aurea n*ear the site.
  Results: There are two records of *L. aurea* from 4.5km to the south-west in the Farley area. These records are from 1999 and 2000.
  There are no records of *L. brevipalmata, C. tinnula & U. mahonyi* or near the site.
- See Figure 2-6 for survey location.

Conclusion

None of the targeted frog species were recorded on site during any of the surveys despite an adequate survey effort. There are no records of *L. brevipalmata, C. tinnula* & *U. mahonyi* in the area and the records of *L.aurea* are not recent and occur a fair distance from site.

These species are not considered to occur within the development site.

2.3.8.2 Targeted survey for *Myotis macropus* (Southern Myotis)

Targeted surveys for *M. macropus* (Southern Myotis) were conducted based on the OEH (2018) *'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method*.

Areas of Potential Habitat in the Site:

Table 2-13 details the areas of potential habitat on the site for *M. macropus* (Southern Myotis).

Table 2-14: Potential Habitat on the Site for *Myotis macropus* (Southern Myotis)

PCT	Vegetation Zone (VZ)	Potential Habitat?
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	YES
	VZ 2: Regenerating	YES
	VZ 3: Derived Grassland	YES
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ 1: Intact	YES

Survey Timing:

The TBCD specifies the appropriate times/months to survey for *M. macropus* (Southern Myotis) is January, February, March, October, November and December.

The targeted surveys for *M. macropus* (Southern Myotis) were conducted over a total of four nights in March (16th to 20th).

Survey Effort:

- Bat call detection surveys – Bat echolocation calls were detected and recorded using an Anabat II Detector and CF ZCAIM, over a total of four nights (16th – 20th March 2021). The Anabat recorder was placed by the edge of the forest overlooking the water way as it represents a potential hunting fly-way for this species. Weather conditions for this survey (heavy rainfall) limited bat activity however 4 bat species were still confidently recorded. Further bat call detection surveys for this species were also undertaken from 1st April 2021 to 3rd April

2021. Analysis of digital ultrasonic bat echolocation calls was undertaken by Amy Rowles of Corymbia Ecology.

- Review of threatened species database records – a review of the Atlas of NSW Wildlife (BioNet) was undertaken to search for any previous evidence of *M. macropus* (Southern Myotis) near the site. There are four records within 10x10 km search area. Records are as recent as 2016 and the nearest occurs Aproximately 1.5km to the east of the subject site.
- See Figure 2-6 for Anabat location.

Results & Conclusion

Analysis of the Anabat recordings detected a possible call that was either *Nyctophilus sp* or *Myotis Macropus*. Amy Rowles stated in her report that "Only a few short passes of only a few pulses. Not clear enough to determine if it was one of these species, may be part of a call from another species". Amy Rowles also confirmed with Firebird ecoSultants that it was only one call at 11:30 pm and that if *Myotis Macropus* was a candidate species within the site she would expect to see multiple clear calls throughout the survey period. Refer to the Bat Call Analysis Reports in Appendix F. See Appendix H for a photo of the Anabat placement within the site.

We have considered *Macropus myotis* unlikely to be present on site.

2.3.8.1 Targeted survey for *Burhinus grallarius* (Bush Stone-curlew)

Areas of Potential Habitat in the Site:

Table 2-14 details the areas of potential habitat on the site for *B. grallarius* (Bush Stone-curlew).

Table 2-15: Potential Habitat on the Site for *Burhinus grallarius* (Bush Stone-curlew)

PCT	Vegetation Zone (VZ)	Potential Habitat?
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	YES
	VZ 2: Regenerating	YES
	VZ 3: Derived Grassland	NO
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ 1: Intact	NO

Survey Timing:

The TSPD specifies the appropriate times/months to survey for breeding *B. grallarius* (Bush Stone-curlew) is any month of the year. The targeted surveys were conducted on the following dates

- Diurnal searches – 4th, 16th, 17th & 23rd March 2021

Survey Methods and Effort:

Survey methods were designed to comply with the survey methods described in the DEC (2006) *Recovery Plan for the Bush Stone-curlew Burhinus grallarius*. The main technique applied here was diurnal bird watching/systematically traversing the site. Calls were also listened for during all nocturnal surveying on site.

- Nocturnal surveys – no calls were heard whilst working on site

  Results: No evidence of presence on the site.

- Diurnal searches – The entire site was systematically traversed, to search for the *B. grallarius* (Bush Stone-curlew). Effort was made to listen for bird calls and to walk through suitable habitat to flush birds.

  Results: No evidence of *B. grallarius* (Bush Stone-curlew) was detected on the site.

- Review of threatened species database records – a review of the Atlas of NSW Wildlife (BioNet) was undertaken to search for any previous evidence of *B. grallarius* (Bush Stone-curlew) near the site.

  Results: There are no records within the search area.

Results

This species was not recorded on site during any of the surveys despite an adequate effort.

This species is not considered to occur within the development site.

Figure 2-6: Targeted Fauna Survey Area

3 STAGE 2 – IMPACT ASSESSMENT

3.1 Avoiding and Minimising Impacts

The following sections 3.1.1 to 3.1.2 describe efforts undertaken to avoid and minimise impacts on biodiversity values in accordance with Chapter 7 of the BAM.

3.1.1 Avoidance of Impacts to the site's biodiversity values

Of the site's two identified PCT's, one is considered to be associated with a threatened ecological community (TEC); PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter is considered to be associated with the BC Act TEC listing of 'Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions'; PCT 1071 within the site is not considered to be threatened. The proposal largely avoids impacts to these two communities by positioning the construction and operational development footprint within a large area of the site that has already been predominantly cleared of native vegetation and now consists of mostly exotic pasture grasses and weeds.

PCT 1604 covers an area of 8.85 ha within the site and it has been separated into three vegetation zones;

- Vegetation zone 1 – Moderate: This vegetation zone occurs in a moderate condition, with an intact canopy stratum, numerous hollow-bearing trees and ground hollows, high density of native ground cover. This area also contains a moderate density of African Olive in the shrub layer and some exotic grasses and forbs in the ground layer.

- Vegetation zone 2 – Regenerating: This vegetation zone is in a state of regeneration, with trees predominately of a young age class and numerous saplings of canopy species occurring. The ground layer is roughly 50% native species to 50% exotic species.

- Vegetation zone 3 – Derived grassland: This vegetation zone is lacking a canopy and shrub layer, but contains many of the native ground species found in vegetation zones 1 and 2. This veg zone acts as an ecotone between PCT 1604 and the exotic pasture grassland within the site.

PCT 1604 will be directly impacted by the proposal by vegetation clearing (5.07 ha) and may be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.81 ha). Most of the direct impacts to this PCT occur within vegetation zones 2 and 3 which are lower

condition than vegetation zone 1; impacts to vegetation zone 1 have largely been avoided by the positioning of the development footprint within the southern portion of the site.

All of the hollow-bearing trees and most of the ground hollows within vegetation zone 1 (PCT 1604) have been avoided. As such, the proposal has avoided significant impacts to nesting habitat for hollow-dependant threatened species.

PCT 1071 will only be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.25 ha); there will be no vegetation removal of PCT 1071. As such, the proposal will avoid significant impacts to any potentially occurring threatened wetland species.

Refer to Table 3-1 for the impact avoidance and minimisation measures. Refer to Figure 3.1 for an overview of direct and indirect impact areas, as well as the area of native vegetation that the proposal has avoided.

Table 3-1 - Impact avoidance and minimisation

Locating a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
Objectives/Requirements	**Compliance**
Project location decisions should be informed by knowledge of biodiversity values. The biodiversity values set out in Stage 1 of the BAM may be used to provide early consideration in planning the route or location of a proposal.	Under the Maitland Local Environment Plan 2011 (the LEP), the Site is zoned R1 General Residential and C3 Environmental Management. The site is predominantly covered in exotic pasture grasses with scattered remnant native trees. Vegetation within the R1 is not identified as high biodiversity value and this is also displayed in in the VIS Score.
Final selection of project location may be an iterative process. Location decisions may need to be revisited when all field surveys have been completed. Direct impacts on clearing of native vegetation and habitat can be avoided and minimised by: (a) locating the development outside of 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	The proposed development has been located in in accordance with the rezoning of land as R1 – General Residential and is part of a wider plan for development of Lochinvar, following on from the *Maitland City Wide Development.* The northern section of the site is zoned as C3 Environmental Management, that will be retained and enhanced in accordance with the Greening Strategy of MCC 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”.

risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or highly cleared PCT. (d) locating the project so its outside of the buffer area around breeding habitat features such as nest trees or caves	a) As reflected in the Biodiversity Values Map, the Subject Land does not contain any areas containing biodiversity values. b) The Subject DA Footprint has been located within the rezoned R1 – General Residential. The majority of the Development Footprint has been located over areas containing both native remnant vegetation and areas of cleared land, with a low VIS Score. c) The Subject DA Footprint will impact upon TEC (PCT 1604). As discussed previously, the vegetation within the site has not been identified as of high conservation value during current detailed surveys and previous surveys that were undertaken as part of the Rezoning. The development footprint has been zoned under the Maitland LEP for Residential development. The direct impacts upon the vegetation that are associated with the proposal is considered to be low due to the already cleared and or disturbed nature of the vegetation due to past and the current use of grazing of cattle and horses. d) All of the hollow-bearing trees and most of the ground hollows have been avoided. As such, the proposal has avoided impacts to nesting habitat for any hollow-dependant species.
Justifications for the decisions in determining the final location must be based on consideration of (a) an analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values (b) an analysis of alternative routes that would avoid or minimise impacts on biodiversity values (c) an analysis of alternative sites that within a property on which the project is proposed that would avoid or minimise impacts on biodiversity values	The removal of vegetation will occur on the southern side of the site in accordance with the LEP being zoned for General Residential.
The proposal may also list and map constraints, such as: (a) Bushfire protection requirements, including clearing for asset protection zones	Bushfire mitigation measures including Asset Protection Zones has been implemented within the proposed lot layout to occur within the R1 zoned land.

(b) Flood planning levels (c) Servicing constraints	
Design the proposal to avoid or minimise direct and indirect impacts on native vegetation, threatened species, threatened ecological communities and their habitat	
Justifications for the decisions in determining the final location must be based on consideration of (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 or entity at risk of SAII) (e) Actions and activities that provide for rehabilitation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation, threatened species, threatened ecological communities and their habitat on the development site	The proposed development will avoid the majority of higher quality habitat within zone 1, This habitat occurs on the northern end of the lot. 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. The retained area of the vegetation within the north section of the site within the C3 zoned land will be rehabilitated a as part of a VMP.
Avoid or Minimise Prescribed Impacts when planning the proposal	
Prescribed impacts may occur on habitat features that are not native vegetation e.g., caves, rocky outcrops and flyways. Because these types of features cannot readily replace or offset, it is important that measures to avoid minimise impacts are undertaken and are clearly documented	No prescribed impacts were identified for the development footprint.
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
*P*rescribed biodiversity impacts can be avoided and minimised by: (a) locating surface works to avoid direct impacts on the habitat features identified in Chapter 6 (b) locating of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features identified in Chapter 6 e.g., locating	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

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 or hydrological processes	structures will be developed that would interfere with migratory birds (wind turbines)
When locating a proposal, the following need to be analysed and justification should be provided for each alternative selected: (a) alternative modes or technologies that would avoid or minimise prescribed impacts (b) alternative routes that would avoid or minimise prescribed impacts (c) alternative locations that would avoid or minimise prescribed impacts (d) alternative sites within a property on which the project is proposed that would avoid or minimise prescribed impacts	The development footprint has not been identified as being of high conservation value and is zoned under the Maitland LEP for Residential. Clearing of this cleared or disturbed remnant patch of vegetation allows for the site to be developed to meet Maitland LEP and avoids other areas that have a higher biodiversity value.
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.	Bushfire mitigation measures including Asset Protection Zones has been implemented within the proposed lot layout to occur within the R1 zoned land.
Design the proposal to avoid or minimise prescribed impacts	
Design measures that can avoid or minimise prescribed impacts include: (a) engineering solutions, such as proven techniques to: i. minimise fracturing of bedrock underlying features of geological significance, or groundwater-dependent communities and their supporting aquifers ii. restore connectivity and movement corridors (b) design elements that minimise interactions with threatened entities, such as: i. designing turbines to dissuade perching and minimise the diameter of the rotor swept area ii.	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.

designing fencing to prevent animal entry to transport corridors iii. providing vegetated buffers rehabilitated with native species (c) maintaining environmental processes that are critical to the formation and persistence of habitat features not associated with native vegetation (d) maintaining hydrological processes that sustain threatened entities (e) controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities.	

3.1.2 Minimisation of Impacts

Mitigation measures are proposed to minimise potential impacts to the site's biodiversity values; these are summarised in Table 3-1. These include measures to be implemented in the pre-construction, construction and post-construction phases. It is considered that these measures would serve to minimise any potential direct or indirect impacts.

Table 3-2: Proposed Mitigation Measures

Action	Responsibility	Timing
Pre-construction Phase Measures		
The area of critically endangered PCT 1604 that occurs within the site but outside of the construction and operational development footprint should be protected in perpetuity through a positive / restrictive covenant, registered on title, under Section 88B or 88E of the *Conveyancing Act 1919*. It is recommended that this should be part of the conditions of consent for the proposal.	Landowner	Covenant commenc clearing w
The proposed APZs are to be managed to the standards of an APZ as defined in *Planning for Bushfire Protection 2019*. No exotic trees or shrubs are to be planted within the proposed APZs. It is recommended that this should be protected in perpetuity through a positive / restrictive covenant, registered on title, under Section 88B or 88E of the Conveyancing Act 1919.	Landowner	Covenant commenc clearing w
The boundaries of the development footprint will be delineated in the field using bunting / flagging tape to ensure inadvertent clearing / disturbance of the adjacent vegetation does not occur.	Project manager.	Prior to c or clearing
Any site workers / contractors are to be inducted on the ecological sensitivities of the site, including, but not limited to, the importance of avoiding disturbance to the vegetation / habitat external to the development footprint.	Project manager in consultation with the project ecologist.	Prior to c or clearing
Erosion and sediment control measures (e.g. silt fences, straw bales wrapped in geotextile etc) must be established before excavation or vegetation clearance begins and are to remain in place until all surfaces have been fully restored and stabilised.	Project manager.	Prior to cc or clearing
A pre-clearing survey will be conducted by a qualified ecologist and will include the following; ➢ Any habitat trees (hollow-bearing trees or nest trees) within the clearing footprint shall be clearly marked (with flagging tape or fluoro spray-paint). Any salvageable habitat features (such as ground timber), identified during the pre-clearing survey, shall be redistributed in the site's retained area of vegetation.	Project Ecologist	Prior to cc or clearing
Construction Phase Management Actions		
During the clearing of native vegetation, and only if habitat trees occur within the development footprint, a suitably qualified and experienced ecologist must: a) Ensure no vegetation clearing occurs outside of the approved clearing footprint. b) Ensure soft felling techniques are utilised for felling of any habitat/hollow-bearing trees. c) Supervise all habitat/hollow-bearing tree removal to capture and/or relocate any dispersed fauna.	Project ecologist	During cle

d) Transport any injured wildlife to appropriate veterinary care or transfer the animal to a local volunteer wildlife carer group. e) Provide post-clearing reporting back to Council should any threatened species be captured or encountered by clearing operations.		
Appropriate weed control measures must be implemented, including for instance: • All weeds removed from the site must be transported in a sealed container or bag and disposed at a waste management facility licenced to accept green waste. • Vehicles, machinery and equipment must be free from weed material (including seeds) before entering the construction corridor.	Project manager.	During exc constructi
Any spoil storage areas or stockpiles will have appropriate erosion control devices installed to control runoff and prevent sedimentation.	Project manager.	During exc constructi
Materials, plant and equipment are not to be stored within the drip-lines of any retained trees at the site or near the site.	Project manager.	During exc constructi
Topsoil is to be removed from newly cleared areas and then stockpiled for later use in the rehabilitation and/or landscaping works.	Project manager.	During exc constructi
Cleared vegetation will be mulched and stockpiled for later use in any vegetation restoration/landscaping activities (provided that it doesn't contain weed material). Where possible, any felled trees may be cut into manageable sections and redistributed in the site.	Project manager.	During exc constructi
Sediment and erosion control devices will be inspected regularly, maintained to ensure effectiveness over the entire duration of the project, and cleaned out before 30% capacity is reached.	Project manager.	During exc constructi
Post-construction Phase Management Actions		
All temporary erosion and sediment control devices such as silt-stop fencing will be removed from the site at the completion of the works, but not until the site is fully revegetated/stabilised.	Project manager.	After cons fully reveg

3.2 Assessment of Direct and Indirect Impacts

The following sections 3.2.1 to 3.2.3 provide an assessment of direct and indirect impacts which were unable to be avoided at the development site in accordance with Section 8 of the BAM.

3.2.1 Direct Impacts

The following describes direct impacts on native vegetation, including impacts on TECs and threatened species through the removal of potential habitat. Direct impacts of the development are detailed in the following Tables 3-2 to 3-3.

Table 3-3: Direct Impacts on Native Vegetation

PCT	BC Act Name / Listing Status	EPBC Act Name / Listing Status	Vegetation Zone (VZ) Name	Direct Impact
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	Central Hunter Valley eucalypt forest and woodland	VZ 1: Moderate	1.99 ha
			VZ 2: Regenerating	1.84 ha
			VZ 3: Derived Grassland	1.24 ha
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	Not a TEC	VZ1: Intact	0 ha

Table 3-4: Change in Vegetation Integrity (VI) Scores

PCT	Vegetation Zone (VZ)	Management Zone / Area Impacted	Current VI Score	Future VI Score	Change in VI Score	Total Change in VI Score
PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	VZ 1: Moderate	To be cleared entirely / 1.14 ha	68.1	0	-68.1	-49.2
		Managed as APZ / 0.54 ha		11.1	-57	
		Indirect Impacts / 0.68		63.3	-4.8	
	VZ 2: Regenerating	To be cleared entirely / 0.81 ha	36.1	0	-36.1	-34.6
		Indirect impacts / 0.09 ha		32.4	-3.7	
	VZ 3: Derived grassland	To be cleared entirely / 1.19 ha	3.6	0	-3.6	-3.4
		Managed as APZ / 0.05 ha		0.1	-3.4	
		Indirect Impacts / 0.07		3.1	-0.5	
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1: Intact	Indirect Impacts / 0.25 ha	52.3	47.5	-4.9	-4.9

3.2.1.1 Assessment of Direct Impacts on the Site's Swamp Sclerophyll Forest TEC

The Central Hunter Grey Box-Ironbark Woodland - Scientific Committee Determination states that the mapped area of the community is approximately 46,920 ha. However, this figure is the pre-European estimated area. The actual mapped area is 14,818 ha (OEH, 2017).

PCT 1604 covers an area of 8.85 ha within the site and it has been separated into three vegetation zones;

- Vegetation zone 1 – Moderate: This vegetation zone occurs in a moderate condition, with an intact canopy stratum, numerous hollow-bearing trees and ground hollows, high density of native ground cover. This area also contains a moderate density of African Olive in the shrub layer and some exotic grasses and forbs in the ground layer.

- Vegetation zone 2 – Regenerating: This vegetation zone is in a state of regeneration, with trees predominately of a young age class and numerous saplings of canopy species occurring. The ground layer is roughly 50% native species to 50% exotic species.

- Vegetation zone 3 – Derived grassland: This vegetation zone is lacking a canopy and shrub layer, but contains many of the native ground species found in vegetation zones 1 and 2. This veg zone acts as an ecotone between PCT 1604 and the exotic pasture grassland within the site.

PCT 1604 will be directly impacted by the proposal by vegetation clearing (5.07 ha) and may be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.81 ha). Most of the direct impacts to this PCT occur within vegetation zones 2 and 3 which are lower condition than vegetation zone 1; impacts to vegetation zone 1 have largely been avoided by the positioning of the development footprint within the southern portion of the site.

All of the hollow-bearing trees and most of the ground hollows within vegetation zone 1 (PCT 1604) have been avoided. As such, the proposal has avoided significant impacts to nesting habitat for hollow-dependant threatened species.

It is recommended that the retained areas of PCT 1604 within the site are protected in perpetuity. See the recommendations in Section 3.1.2 of this BDAR for more information on these mitigation measures. Overall, the recommended mitigation measures would serve to minimise the net area of TEC loss and would ensure that the existing areas of retained TEC are protected.

3.2.1.2 Assessment of Direct Impacts on Confirmed Ecosystem Credit Species

As indicated in previous Table 2-7, several predicted ecosystem credit species have been confirmed for the site. The following provides an assessment of direct impacts on the confirmed ecosystem credit species, which have been grouped into guilds.

Open Forest / Woodland Birds – *Anthochaera phrygia* (Regent Honeyeater (Foraging)), *Callocephalon fimbriatum* (Gang-gang Cockatoo (Foraging)), *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies)), *Chthonicola sagittata* (Speckled Warbler), *Epthianura albifrons* (White-fronted Chat), *Neophema pulchella* (Turquoise Parrot), *Melanodryas cucullata cucullata* (Hooded Robin (south-eastern form)), *Daphoenositta chrysoptera* (Varied Sittella), *Glossopsitta pusilla* (Little Lorikeet), *Lathamus discolor* (Swift Parrot (Foraging)), *Petroica boodang* (Scarlet Robin), *Petroica phoenicea* (Flame Robin), *Ptilinopus magnificus* (Wompoo Fruit-Dove), *Pomatostomus temporalis temporalis* (Grey-crowned Babbler (eastern subspecies)) and *Stagonopleura guttata* (Diamond Firetail).

These are highly mobile species that are able to footage over large ranges. There is potential for any of these species to occur in the site (although some more than others). The area of habitat within the site that these species would most likely prefer is PCT 1604 - vegetation zone 1, which has largely been avoided by the proposal. The total area of PCT 1604 – vegetation zone 1 within the site is 5.45 ha; only 1.99 ha of this vegetation zone would be directly impacted by the proposal, 2.8 ha of vegetation zone 1 would be avoided and it is recommended that the avoided native vegetation within the site be protected in perpetuity.

Overall, it is considered that the avoided habitat described in previous section 3.2.1, as well as the recommended mitigation measures described in previous section 3.1.2 would minimise the impacts on these wide-ranging species.

Birds of Prey – *Lophoictinia isura* (Square-tailed Kite (Foraging)), *Circus assimilis* (Spotted Harrier), *H. morphnoides* (Little Eagle) (Foraging) and *Pandion cristatus* (Eastern Osprey) (Foraging).

P. cristatus (Eastern Osprey) generally hunt over large areas of open water. The study area and nearby surrounding areas do not provide open water for foraging, as such it is considered unlikely that this species would occur within the site. However, the study area may serve as a brief resting area for. *P. cristatus* (Eastern Osprey).

H. morphnoides (Little Eagle), *Lophoictinia isura* (Square-tailed Kite) and *Circus assimilis* (Spotted Harrier) do hunt in terrestrial environments and are more likely to forage within in the site.

These are highly mobile species that are able to footage over large ranges. There is potential for any of these species to occur in the site (although some more than others). The area of habitat within the site that these species would most likely prefer is PCT 1604 - vegetation zone 1, which has largely been avoided by the proposal. The total area of PCT 1604 – vegetation zone 1 within the site is 5.45 ha; only 1.99 ha of this vegetation

zone would be directly impacted by the proposal, 2.8 ha of vegetation zone 1 would be avoided and it is recommended that the avoided native vegetation within the site be protected in perpetuity.

Overall, it is considered that the avoided habitat described in previous section 3.2.1, as well as the recommended mitigation measures described in previous section 3.1.2 would minimise the impacts on these wide-ranging species.

Forest Owls – *Ninox strenua* (Powerful Owl (Foraging)) & *Tyto novaehollandiae* (Masked Owl (Foraging))

These species were not recorded on the site during the targeted surveys undertaken in August 2021. The site contains potential foraging habitat for these owls; although arboreal mammal activity was observed to be low for the site, with low sightings of prey species during spotlighting surveys. Nevertheless, it must be assumed that prey species may nest and forage within the site.

These are highly mobile species that are able to footage over large ranges. There is potential for any of these species to occur in the site (although some more than others). The area of habitat within the site that these species would most likely prefer is PCT 1604 - vegetation zone 1, which has largely been avoided by the proposal. The total area of PCT 1604 – vegetation zone 1 within the site is 5.45 ha; only 1.99 ha of this vegetation zone would be directly impacted by the proposal, 2.8 ha of vegetation zone 1 would be avoided and it is recommended that the avoided native vegetation within the site be protected in perpetuity.

All of the hollow-bearing trees and most of the ground hollows within vegetation zone 1 (PCT 1604) have been avoided. As such, the proposal has avoided significant impacts to nesting habitat for hollow-dependant prey species.

Overall, it is considered that the avoided habitat described in previous section 3.2.1, as well as the recommended mitigation measures described in previous section 3.1.2 would minimise the impacts on these wide-ranging species.

Microbats – *Micronomus norfolkensis* (Eastern Coastal Freetail-bat), *Miniopterus australis* (Little Bentwing-bat) (Foraging) & *Miniopterus orianae oceanensis* (Large Bentwing-bat) (Foraging)

These species are highly mobile and are known to travel large distances to forage. They generally forage in structurally open and associated edge habitat and roost in trees containing hollows, or (in the case of *Miniopterus australis* (Little Bentwing-bat) and *Miniopterus orianae oceanensis* (Large Bentwing-bat), caves or similar structures). *Miniopterus australis* (Little Bentwing-bat) and *Micronomus norfolkensis* (Eastern Coastal Freetail-bat) were recorded within the site as a 'definite' species using an Anabat echolocation recording device during the targeted survey effort (refer to Appendix F for the Bat Call Report). The development footprint contains roosting habitat for hollow dependant species (in the form of hollow-bearing trees in PCT 1604 - vegetation zone 1)

and potential foraging habitat, however the majority of PCT 1604 – vegetation zone 1 within the site will be retained. Large areas of suitable habitat for these species also occurs within the wider Lochinvar locality, ensuring that any local scale impacts from vegetation removal would be unlikely to impact on populations of these wide-ranging species.

All of the hollow-bearing trees and most of the ground hollows within vegetation zone 1 (PCT 1604) have been avoided. As such, the proposal has avoided significant impacts to nesting habitat for these hollow-dependant species.

Overall, it is considered that the avoided habitat described in previous section 3.2.1, as well as the recommended mitigation measures described in previous section 3.1.2 would minimise the impacts on these wide-ranging species.

***Dasyurus maculatus* (Spotted-tailed Quoll)**

D. maculatus (Spotted-tailed Quoll) is known to favour extensive tracts of undisturbed bushland away from human development, the chances of it occurring within the site is very small. Nevertheless, its presence must be assumed.

Overall, it is considered that the recommended mitigation measures would minimise the direct impacts and allow the directly impacted areas of the site to retain some of its habitat values for these species.

***Phascolarctos cinereus* (Koala) (Foraging)**

As discussed in previous section 2.3.4.1, Firebird ecoSultants conducted a survey for core koala habitat and prepared a Koala Assessment Report. It was found that the site does not contain core koala habitat, no further provisions of the Koala Habitat Protection SEPP 2021 apply. Refer to Appendix G.

Targeted field surveys (which included scat searches, area searches and searching for scratch marks on trees) found no evidence of *P. cinereus* (Koala) occurring in the site. It is concluded that the site would not constitute 'Core Koala Habitat' as defined by SEPP.

Overall, it is considered that the recommended mitigation measures would minimise the direct impacts and allow the directly impacted areas of the site to retain some of its habitat values for these species.

Megabats - *Pteropus poliocephalus* (Grey-headed Flying-fox) (Foraging)

These species were not recorded within the site during any of the spotlighting surveys undertaken in March 2021.

These species are highly mobile and are known to travel large distances to forage. The development footprint potential foraging habitat, however the majority of native vegetation within the site will be retained. Large areas of suitable habitat for these species also occurs within the wider Maitland locality, ensuring that any local scale impacts from vegetation removal would be unlikely to impact on populations of these wide-ranging species.

Overall, it is considered that the recommended mitigation measures would minimise the direct impacts and allow the directly impacted areas of the site to retain some of its habitat values for these species.

Wetland Birds - *Anseranas semipalmata* (Magpie Goose), *Oxyura australis* (Blue-billed Duck), *Rostratula australis* (Australian Painted Snipe), *Stictonetta naevosa* (Freckled Duck), *Botaurus poiciloptilus* (Australasian Bittern),

These species were not recorded within the site. The site's PCT 1071 only occurs as a small artificial farm in an otherwise rural / pastural landscape. As such, PCT 1071 within the site would likely only provide low quality marginal habitat for these species. In any case, PCT 1071 will only be indirectly impacted by changes in edge effects, noise, light pollution and dust from construction phase activities and post-development activities (0.25 ha); there will be no vegetation removal of PCT 1071. As such, the proposal will avoid significant impacts to any potentially occurring threatened wetland species.

Overall, it is considered that the recommended mitigation measures would minimise the direct impacts and allow the directly impacted areas of the site to retain some of its habitat values for these species.

Threatened Fauna

***Callocephalon fimbriatum* (Gang-gang Cockatoo), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Cercartetus nanus* (Eastern Pygmy-possum), *Delma impar* (Striped Legless Lizard), *Hoplocephalus bitorquatus* (Pale-headed Snake), *Ninox strenua* (Powerful Owl), *Phascogale tapoatafa* (Brush-tailed Phascogale), *Planigale maculata* (Common Planigale) & *Tyto novaehollandiae* (Masked Owl)**

These species were not recorded within the site.The most likely habitat for these species within the site is PCT 1604 – vegetation zone 1. Direct impacts to PCT 1604 – vegetation zone 1 have been largely avoided by locating much of the development footprint in the southern and middle portions of the site. All hollow-bearing trees within the site have been avoided by the proposal. Some ground hollows occur within the development footprint; it is recommended that all ground hollows that occur within the development footprint be relocated to the conservation area of the site (the area of PCT 1604 within the site that occurs outside the development footprint). As such, potential impacts to these potentially occurring species and their associated habitat have largely been avoided and mitigated.

3.2.2 Indirect Impacts

The indirect impacts of the development have been identified and are outlined in Table 3-8. A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures have been applied. Likelihood criteria, consequence criteria and risk matrix are provided in Table 3-5, Table 3-6 and Table 3-7.

Table 3-5: Likelihood Criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 3-6: Consequence Criteria

Consequence category	Description
Critical (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible (Minimal impact or no lasting effect)	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 3-7: Risk Matrix

Consequence	Likelihood				
	Almost certain	**Likely**	**Possible**	**Unlikely**	**Remote**
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 3-8: Risk Assessment for all Identified Potential Indirect Impacts

Indirect Impact	Development Phase	Risk (pre-mitigation)	Risk (post-mitigation)	Nature	Extent	Frequency	Duration	Timing
Inadvertent impacts on adjacent habitat or vegetation	Construction and operation	Medium	Low	Potential damage to adjacent habitat or vegetation	Adjacent vegetation	Daily, during construction	During construction	Potentially long-term impacts
Sedimentation and contaminated and/or nutrient rich run-off	Construction and operation	Medium	Low	Potential runoff during construction works	Into downstream areas	During heavy rainfall or storm events	During rainfall events	Potentially long-term impacts
Noise, dust or light spill	Construction and operation	Medium	Low	Noise and dust created from machinery during construction. No night works during construction. Minor noise and light during operation from residents	Adjacent vegetation	Daily during construction and sporadically during operation	Daily during construction and sporadically during operation	Short-term impacts during construction phase, long-term impacts during operation
Transport of weeds and pathogens from the site to adjacent vegetation	Construction and operation	Medium	Low	Potential spread of weed and pathogens from incoming machinery and equipment, as well as from gardens established in new lots	Potential to spread into nearby habitat	During construction and operation	Ongoing for the life of the development	Potentially long-term impacts
Rubbish dumping	Construction and operation	Low	Low	Potential rubbish dumped by workers and/or residents	Potential for rubbish to spread into areas outside the development footprint	Anytime during construction and operation	Ongoing for the life of the development	Ongoing for the life of the development

Wood collection	Construction and operation	Low	Low	Potential removal of habitat by workers and/or residents	Potential habitat to be removed from areas outside the development footprint	Anytime during construction and operation	Ongoing for the life of the development	Ongoing for the life of the development
Bush rock removal and disturbance	Construction and operation	Low	Low	Potential removal of habitat by workers and/or residents	Potential habitat to be removed from areas outside the development footprint	Anytime during construction and operation	Ongoing for the life of the development	Ongoing for the life of the development
Vehicle strike	Construction and operation	Low	Very Low	Potential for native fauna to be struck by working machinery and moving vehicles	Within access roads and within development footprint	Daily, during construction and operational phases	Ongoing for the life of the development	Potential long-term impacts.
Increased risk of fire	Construction and operation	Medium	Low	Potential for fire to spark during construction and operation from any machinery or electrical works	Adjacent vegetation	Anytime during construction and operation	Anytime during construction and operation	Anytime during construction and operation

3.2.3 Potential Prescribed Biodiversity Impacts

No prescribed biodiversity impacts are anticipated from the proposed development. The site does not contain any habitat features identified in s.8.2.1.2 of the BAM. The proposal would not severe or significantly interfere with a habitat corridor.

3.3 Impact Summary

3.3.1 Serious and Irreversible Impacts

The OEH (2017) *Guidance to Assist a Decision-maker to Determine a Serious and Irreversible Impact* lists the ecological communities and species that are 'potential serious and irreversible impact (SAII) entities'. There are no series and irreversible impact (SAII) entities relevant to this assessment.

3.3.2 Impacts Which Require an Offset

As per Section 10.2 of the BAM, the removal of native vegetation within the site requires offsetting to achieve the 'no net loss standard'. To calculate the required offsets in the form of ecosystem credits, the BAM Calculator has taken into consideration the impact area along with the loss in VIS and the biodiversity risk weighting of the PCTs. Table 3-8 Details the Credits required

Table 3-2 Ecosystem Credits required

Vegetation Zone (PCT)	Impact Area (ha)	Future VIS	Vegetation Integrity Score Loss	Biodiversity Risk Weighting	Credit Requirements
1604_Moderate	2.7	0	-49.2	2	65
1604_Regenerating	1.9	0	_34.6	2	33
1604_DGrassland	1.5	0	-3.1	2	0
Total Credits for 1604					98
1071_VZ1	0.25	0	-4.9	2	1

3.3.3 Impacts Not Requiring an Offset

Zone 1604 Derived Grassland.

3.3.4 Identification of Areas Not Requiring Assessment

N/A

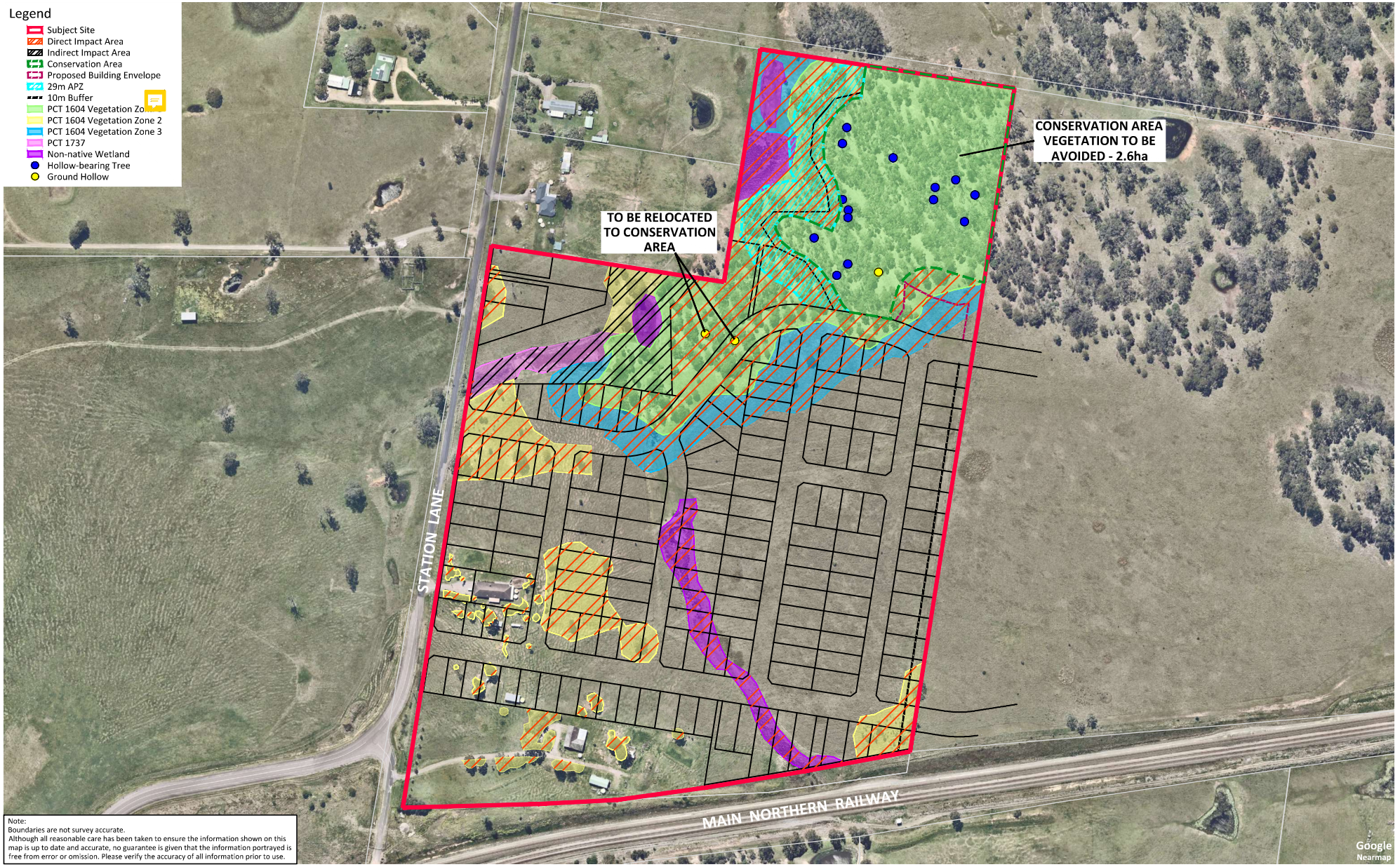

FIGURE 3-1: DIRECT/INDIRECT IMPACTS & AVOIDANCE

Ref No 2813 H

CLIENT Client
SITE DETAILS Lots 1307 & 1308 DP 1141533 Lochinvar
DATE 21 July 2022

NORTH

0 50 100 150
SCALE 3000 @ A3

PIXELDRAFTING

Firebird ecoSultants Pty Ltd
ABN - 16 105 985 993
Level 1, 146 Hunter Street, Newcastle NSW 2300
P O Box 354 Newcastle NSW 2300

4 BIODIVERSITY CREDIT REPORT

The Biodiversity Credit Report is provided in the following pages.

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APPENDIX A SITE PLANS

APPENDIX B PLOT FLORISTIC SURVEY DATA

BAM PLOT DATA SHEET

26/02/2021 Nick W, Andrew C

Copy these 2 rows into BAM Calc	plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	Shrub	strucGrass	strucForbs
	T1		1737	100	Intact	56				0	0	3	2	0	0	0.0	0.0	85.2	15.2

Species List

Enter first 4 letters of genus and first 4 letters of species here

OR type/paste Scientific Name here

Abreviation	Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	GrowthForm	N or E	HTE	Cover	Abundance
Lobe Purp	Plantae	Flora	Campanulaceae	Lobelia purpurascens	whiteroot	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Cype Grac	Plantae	Flora	Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Tolf Sepa	Plantae	Flora	Zygophyllaceae (Tribuloideae)	Tribulus cistoides	Caltrop	Not Listed	Not Listed		Introduced	NO	0.1	1
Ludw Pepl	Plantae	Flora	Onagraceae	Ludwigia peploides	Floating primrose-Willow	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		15	15
Cyno Dact	Plantae	Flora	Poaceae	Cynodon dactylon	Common Couch	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.2	2
Pasp Dila	Plantae	Flora	Poaceae	Paspalum dilatatum	Paspalum	Not Listed	Not Listed		Introduced	YES	0.1	1
Tagh Orie	Plantae	Flora	Fabaceae	Taghis orientalis	Broad-leaved Cumburgi	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		30	1
Verb Bona	Plantae	Flora	Verbenaceae	Verbena bonariensis	Purpletop	Not Listed	Not Listed		Introduced	NO	0.1	1
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								
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				Not Found								

Tree Count	Absent=0,Present =1
80cm +	
50-79 cm	
30-49 cm	
20-29 cm	
10-19 cm	
5-9 cm	
<5 cm	

Logs: sum of longs on ground >10cm

Hollows: Number of hollow bearing trees

1 x 1 m Plots	Subplot	Average
Leaf Litter		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0
Bare Ground		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0
Cryptogram		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0
Rock Cover		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0

BAM PLOT DATA SHEET

26/02/2021 Nick W, Andrew C

Copy these 2 rows into BAM Calc	plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	Shrub	strucGrass	strucForbs
	T1		1804	100	Derived Grassland	55				0	0	9	4	0	0	0.0	0.0	32.4	0.4

Species List

Enter first 4 letters of genus and first 4 letters of species here

OR type/paste Scientific Name here

Abreviation	Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	GrowthForm	N or E	HTE	Cover	Abundance
Bide Pilo	Plantae	Flora	Asteraceae	Bidens pilosa	Cobbler's Pegs	Not Listed	Not Listed		Introduced	YES	0.1	1
Cony Bona	Plantae	Flora	Asteraceae	Conyza bonariensis	Flaxleaf Fleabane	Not Listed	Not Listed		Introduced	NO	0.1	1
Senе Mada	Plantae	Flora	Asteraceae	Senecio madagascariensis	Fireweed	Not Listed	Not Listed		Introduced	YES	0.1	10
Prat Purp	Plantae	Flora	Campanulaceae	Wahlenbergia gracilis	Whiteroot	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Cype Grac	Plantae	Flora	Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Glyc Clan	Plantae	Flora	Fabaceae (Faboideae)	Glycine clandestina species complex	Twining Glycine	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	10
Loma Fili	Plantae	Flora	Lomandraceae	Lomandra filiformis	Wattle Mat Rush	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Loma Mult	Plantae	Flora	Lomandraceae	Lomandra multiflora	Many-flowered Mat-rush	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Sida Rhom	Plantae	Flora	Malvaceae	Sida rhombifolia	Paddy's Lucerne	Not Listed	Not Listed		Introduced	NO	0.1	1
Dian Revo	Plantae	Flora	Phormiaceae	Dianella revoluta	Blueberry Lily	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	10
Plan Lanc	Plantae	Flora	Plantaginaceae	Plantago lanceolata	Lamb's Tongues	Not Listed	Not Listed		Introduced	NO	0.1	1
Aris Ramo	Plantae	Flora	Poaceae	Aristida ramosa	Purple Wiregrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	1
Aris Vaga	Plantae	Flora	Poaceae	Aristida vagans	Threeawn Speargrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Axon Fis	Plantae	Flora	Poaceae	Axonopus fissifolius	Narrow-leafed Carpet Grass	Not Listed	Not Listed		Introduced	YES	0.1	1
Chlo Trun	Plantae	Flora	Poaceae	Chloris truncata	Windmill Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Cymb Refr	Plantae	Flora	Poaceae	Cymbopogon refractus	Barbed Wire Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	1
Micr Stip	Plantae	Flora	Poaceae	Microlaena stipoides	Weeping Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Pasp Dist	Plantae	Flora	Poaceae	Paspalidium distans	Shotgrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Pasp Dila	Plantae	Flora	Poaceae	Paspalum dilatatum	Paspalum	Not Listed	Not Listed		Introduced	YES	5	1
Rytl Cass	Plantae	Flora	Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		2	1
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								

Tree Count	Absent=0,Present =1
80cm +	0
50-79 cm	0
30-49 cm	0
20-29 cm	0
10-19 cm	0
5-9 cm	0
<5 cm	0

Logs: 0 sum of longs on ground >10cm

Hollows: 0 Number of hollow bearing trees

1 x 1 m Plots	Subplot	Average
Leaf Litter		
	5	20
	15	5
	25	5	2.0
	35	1
	45	1
Bare Ground		
	5	20
	15	10
	25	5	12.0
	35	5
	45	15
Cryptogram		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0
Rock Cover		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0

BAM PLOT DATA SHEET

26/02/2021 Nick W, Andrew C

Copy these 2 rows into BAM Calc	plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	Shrub	strucGrass	strucForbs
	T1		1604	100	Regenerating	56				3	0	9	3	0	0	35.0	0.0	37.5	0.3

Species List

Enter first 4 letters of genus and first 4 letters of species here

OR type/paste Scientific Name here

Abreviation	Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	GrowthForm	N or E	HTE	Cover	Abundance
Bide Pilo	Plantae	Flora	Asteraceae	Bidens pilosa	Cobbler's Pegs	Not Listed	Not Listed		Introduced	YES	0.1	1
Senе Mada	Plantae	Flora	Asteraceae	Senecio madagascariensis	Fireweed	Not Listed	Not Listed		Introduced	YES	0.2	20
Prat Purp	Plantae	Flora	Campanulaceae	Prata purpurascens	Whiteroot	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Dich Repe	Plantae	Flora	Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Cype Grac	Plantae	Flora	Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Loma Fil	Plantae	Flora	Lomandraceae	Lomandra filiformis	Many-flowered Mat-rush	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Euca Creb	Plantae	Flora	Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark	Not Listed	Not Listed	Tree (TG)	Alive in NSW, Native		30	10
Aris Ramo	Plantae	Flora	Poaceae	Aristida ramosa	Purple Wiregrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Aris Vaga	Plantae	Flora	Poaceae	Aristida vagans	Threeawn Speargrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Cymb Refr	Plantae	Flora	Poaceae	Cymbopogon refractus	Barbed Wire Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		20	10
Cyno Dact	Plantae	Flora	Poaceae	Cynodon dactylon	Common Couch	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	10
Mel Repe	Plantae	Flora	Poaceae	Melinis repens	Red Natal Grass	Not Listed	Not Listed		Introduced	NO	0.1	1
Micr Stip	Plantae	Flora	Poaceae	Microlaena stipoides	Weeping Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Pani Effu	Plantae	Flora	Poaceae	Panicum effusum	Hairy Panic	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Pasp Dila	Plantae	Flora	Poaceae	Paspalum dilatatum	Paspalum				Introduced	YES	5	1
Rytl Cass	Plantae	Flora	Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native	YES	0.1	1
Them Rufi	Plantae	Flora	Poaceae	Themeda australis	Kangaroo Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Verb Rig	Plantae	Flora	Verbenaceae	Verbena rigida	Veined Verbena	Not Listed	Not Listed		Introduced		0.1	1
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								

Tree Count	Absent=0,Present =1
80cm +	
50-79 cm	
30-49 cm	1
20-29 cm	1
10-19 cm	1
5-9 cm	1
<5 cm	1

Logs: 1 sum of longs on ground >10cm

Hollows: 0 Number of hollow bearing trees

1 x 1 m Plots	Subplot	Average
Leaf Litter		
	5	20
	15	10
	25	2	7.8
	35	0
	45	10
Bare Ground		
	5	10
	15	10
	25	5	9.6
	35	10
	45	20
Cryptogram		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0
Rock Cover		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0

BAM PLOT DATA SHEET

Copy these 2 rows into BAM Calc	plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	Shrub	strucGrass	strucForbs
	T1		1604	100	Moderate	56	-32.715647	151.4588820		1	1	19	19	1	2	50.0	0.5	44.5	3.1

Species List

Enter first 4 letters of genus and first 4 letters of species here

OR type/paste Scientific Name here

Abreviation	Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	GrowthForm	N or E	HTE	Cover	Abundance
Pseu Vari	Plantae	Flora	Acanthaceae	Pseuderanthemum variabile	Pastel Flower	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	200
Arth Mill	Plantae	Flora	Anthericaceae	Arthropodium milleflorum	Pale Vanilla-lily	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	50
Cent Asia	Plantae	Flora	Apiaceae	Centella asiatica	Indian Pennywort	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	5
Chry Apoc	Plantae	Flora	Asteraceae	Chrysocephalum apiculatum	Common Everlasting	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	20
Cony Bona	Plantae	Flora	Asteraceae	Conyza bonariensis	Flaxleaf Fleabane				Introduced	NO	0.1	1
Foch Spha	Plantae	Flora	Asteraceae	Fachion sphaenos	Star Cudweed	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	20
Hypo Radi	Plantae	Flora	Asteraceae	Hypochaeris radicata	Catsear	Not Listed	Not Listed		Introduced	NO	0.1	1
Sene Mada	Plantae	Flora	Asteraceae	Senecio madagascariensis	Fireweed	Not Listed	Not Listed	Forb (FG)	Introduced	YES	0.1	1
Vern Dine	Plantae	Flora	Asteraceae	Vernonia dinerea	Ironbush	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	30
Prat Purp	Plantae	Flora	Campanulaceae	Prata purpurascens	Whiteroot	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.5	11
Wahl grac	Plantae	Flora	Campanulaceae	Wahlenbergia gracilis	Sprawling Bluebell	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Comm Cyan	Plantae	Flora	Commelinaceae	Commelina cyanea	Native Wandering Jew	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	10
Dich Repe	Plantae	Flora	Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.5	500
Poly Cely	Plantae	Flora	Convolvulaceae	Polymeria calycina	Slender Birdseed	Not Listed	Not Listed	Other (OG)	Alive in NSW, Native		0.1	1
Cype Grac	Plantae	Flora	Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Fimb	Plantae	Flora	Cyperaceae	Fimbristylis spp.		Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	10
Sde Mads	Plantae	Flora	Cyperaceae	Schoenus maschinus	Tufted Bog-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.5	200
Desm Vari	Plantae	Flora	Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil	Not Listed	Not Listed	Other (OG)	Alive in NSW, Native		0.2	200
Glyc Clan	Plantae	Flora	Fabaceae (Faboideae)	Glycine clandestina	Twining Glycine	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	50
Zorn Dyct	Plantae	Flora	Fabaceae (Faboideae)	Zornia dyctiocarpa	Zornia	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	5
Loma Fil	Plantae	Flora	Lomandraceae	Lomandra filiformis	Wattle Mat-rush	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	5
Loma Mult	Plantae	Flora	Lomandraceae	Lomandra multiflora	Many-flowered Mat-rush	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	20
Sida rhom	Plantae	Flora	Malvaceae	Sida rhombifolia	Paddy's Lucerne	Not Listed	Not Listed		Introduced	NO	0.1	1
Erem Debi	Plantae	Flora	Myoporaceae	Eremophila debilis	Amulla	Not Listed	Not Listed	Shrub (SG)	Alive in NSW, Native		0.5	200
Euca Moluc	Plantae	Flora	Myrtaceae	Eucalyptus moluccana	Grey Box	Not Listed	Not Listed	Tree (TG)	Alive in NSW, Native		90	24
Olea Euro	Plantae	Flora	Oleaceae	Olea europaea	Common Olive	Not Listed	Not Listed		Introduced	YES	70	13
Quer Tere	Plantae	Flora	Quercaceae	Quercus tereticornis	Native Oaks	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Dian Revo	Plantae	Flora	Phormiaceae	Dianella revoluta	Blueberry Lily	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	25
Phyl Virg	Plantae	Flora	Phyllanthaceae	Phyllanthus virgatus complex	Seed-under-Leaf	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	30
Plan Lanc	Plantae	Flora	Plantaginaceae	Plantago lanceolata	Lamb's Tongues	Not Listed	Not Listed		Introduced	NO	0.1	1
Aris Ramo	Plantae	Flora	Poaceae	Aristida ramosa	Purple Wiregrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	1000
Aris Vaga	Plantae	Flora	Poaceae	Aristida vagans	Threeawn Speargrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	10
Axon Como	Plantae	Flora	Poaceae	Axonopus compressus	Broad-leaved Carpet Grass	Not Listed	Not Listed		Introduced	NO	0.1	1
Both	Plantae	Flora	Poaceae	Bothriochloa spp.	Tedgrass, Bluegrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	200
Broc	Plantae	Flora	Poaceae	Bromus spp.		Not Listed	Not Listed		Introduced	NO	0.1	1
Chlo Trun	Plantae	Flora	Poaceae	Chloris truncata	Windmill Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	30
Cymb Refr	Plantae	Flora	Poaceae	Cymbopogon refractus	Barbed Wire Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	1000
Dich Seri	Plantae	Flora	Poaceae	Dichanthium sericeum	Queensland Bluegrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	10
Digi Dida	Plantae	Flora	Poaceae	Digitaria didactyla	Queensland Blue Couch	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	300
Erag pect	Plantae	Flora	Poaceae	Eragrostis tenuifolia	Paddock Lovegrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	20
Micr Stip	Plantae	Flora	Poaceae	Microlaena stipoides	Weeping Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	1
Pani Effu	Plantae	Flora	Poaceae	Panicum effusum	Hairy Panic	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Pasp Dist	Plantae	Flora	Poaceae	Paspalidium distans	Shotgrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		8	400
Pasp Dila	Plantae	Flora	Poaceae	Paspalum dilatatum	Paspalum				Introduced	YES	0.1	10
Rytl Cass	Plantae	Flora	Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		1	200
Rytl Race	Plantae	Flora	Poaceae	Rytidosperma racemosum	Wallaby Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	1
Them Aust	Plantae	Flora	Poaceae	Themeda australis	Kangaroo Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		70	700
Chei Sieb	Plantae	Flora	Pteridaceae	Cheilanthes sieberi	Rock Fern	Not Listed	Not Listed	Fern (FG)	Alive in NSW, Native		0.1	1
Acae Sp20	Plantae	Flora	Rubiaceae	Asperula sp20	Prickly Woodruff	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	10
Rich Stel	Plantae	Flora	Rubiaceae	Richardia stellaris	Field Madder	Not Listed	Not Listed		Introduced	NO	0.1	10
Scia Prin	Plantae	Flora	Solanaceae	Solanum prinophyllum	Forest Nightshade	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	1
Stac Muri	Plantae	Flora	Stackhousiaceae	Stackhousia muricata	Stackhousia	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	200
Rich Bras	Plantae	Flora	Rubiaceae	Richardia brasiliensis	Mexican Clover	Not Listed	Not Listed		Introduced	NO	0.1	5
				Not Found								

Tree Count	Absent=0,Present =1
80cm +	
50-79 cm	
30-49 cm	
20-29 cm	
10-19 cm	
5-9 cm	
<5 cm	

Logs: 13 sum of longs on ground >10cm

Hollows: 1 Number of hollow bearing trees

1 x 1 m Plots	Subplot	Average
Leaf Litter		
	5	60
	15	40
	25	40	64.0
	35	30
	45	80
Bare Ground		
	5	60
	15	30
	25	20	18.0
	35	30
	45	0
Cryptogram		
	5	0
	15	0
	25	0	1.0
	35	5
	45	0
Rock Cover		
	5	0
	15	0
	25	0	0.0
	35	0
	45	0

BAM PLOT DATA SHEET

Copy these 2 rows into BAM Calc	plot	pct	area	gotoblaze	conditioncloss	zone	easting	northing	bearing	compTree	compShrub	compGross	compForbs	compFerns	compOther	structTree	Shrub	structGross	structForbs
	TT									1		0	11	5	0	0	50.0	0.0	42.5	1.3

Species List

Enter first 4 letters of genus and first 4 letters of species here

OR type/paste Scientific Name here

Abbreviation	Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	GrowthForm	N or E	HTE	Cover	Abundance
Hypo Radi	Plantae	Flora	Asteraceae	Hypochaeris radicata	Catsear	Not Listed	Not Listed		Introduced	NO	0.1	4
Sene Mada	Plantae	Flora	Asteraceae	Senecio madagascariensis	Fireweed	Not Listed	Not Listed		Introduced	YES	0.1	5
Trac Purp	Plantae	Flora	Campanulaceae	Theilis purpurascens	Whiteroot	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.5	20
Dich Repe	Plantae	Flora	Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.5	400
Cype Grac	Plantae	Flora	Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	6
Glyc Clan	Plantae	Flora	Fabaceae (Faboideae)	Glycine clandestina species complex	Twining Glycine	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	50
Loma Fili	Plantae	Flora	Lomandraceae	Lomandra filiformis	Wattle Mat-rush	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	6
Loma Mult	Plantae	Flora	Lomandraceae	Lomandra multiflora	Many-flowered Mat-rush	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	20
Euca Malu	Plantae	Flora	Myrtaceae	Eucalyptus melliodora	Grey Box	Not Listed	Not Listed	Tree (TG)	Alive in NSW, Native		50	10
Olea Euro	Plantae	Flora	Oleaceae	Olea europaea	Common Olive	Not Listed	Not Listed		Introduced	YES	15	16
Dian Revo	Plantae	Flora	Phormiaceae	Dianella revoluta	Blueberry Lily	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native	YES	0.1	30
Plan Lanc	Plantae	Flora	Plantaginaceae	Plantago lanceolata	Lamb's Tongues	Not Listed	Not Listed		Introduced	NO	0.1	1
Aris Ramo	Plantae	Flora	Poaceae	Aristida ramosa	Purple Wiregrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	0
Aris Vaga	Plantae	Flora	Poaceae	Aristida vagans	Threeawn Speargrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	0
Chlo Trun	Plantae	Flora	Poaceae	Chloris truncata	Windmill Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		0.1	5
Cymb Refl	Plantae	Flora	Poaceae	Cymbopogon refractus	Barbed Wire Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	0
Mic Stip	Plantae	Flora	Poaceae	Microlaena stipoides	Weeping Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		8	0
Pasp Dist	Plantae	Flora	Poaceae	Paspalidium distans	Shotgrass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		5	0
Tari Tict	Plantae	Flora	Poaceae	Tetrarrhena juncifolium	Rednecked Wallaby Grass; Silvertop Wallaby Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		20	0
Them Aust	Plantae	Flora	Poaceae	Themeda australis	Kangaroo Grass	Not Listed	Not Listed	Grass & grasslike (GG)	Alive in NSW, Native		10	0
Sola Pinn	Plantae	Flora	Solanaceae	Solanum pinnatifidum	Forest Nightshade	Not Listed	Not Listed	Forb (FG)	Alive in NSW, Native		0.1	10
				Not Found								
				Not Found								
				Not Found								
				Not Found								
				Not Found								

Tree Count	Absent=0,Present =1
80cm +	
50-79 cm	
30-49 cm	
20-29 cm	
10-19 cm	
5-9 cm	
<5 cm	

Logs	=sum of longs on ground >10cm
20	
Hollows	=Number of hollow bearing trees
2	

1 x 1 m Plots	Subplot	Average
	Leaf Litter	
5	10	
15	35	
25	10	15.6
35	15	
45	8	
	Bare Ground	
5	3	
15	60	
25	7	13.8
35	2	
45	3	
	Cryptogram	
5	0	
15	0	
25	0	0.0
35	0	
45	0	
	Rock Cover	
5	0	
15	0	
25	0	0.0
35	0	
45	0	

APPENDIX C RECORDED SPECIES LIST

Family	Scientific Name	Common Name	BC Act	EPBC Act
Fauna				
Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	Not Listed	Not Listed
Hylidae	*Litoria peronii*	Peron's Tree Frog	Not Listed	Not Listed
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	Not Listed	Not Listed
Myobatrachidae	*Limnodynastes peronii*	Brown-striped Frog	Not Listed	Not Listed
Artamidae	*Cracticus tibicen*	Australian Magpie	Not Listed	Not Listed
Artamidae	*Cracticus torquatus*	Grey Butcherbird	Not Listed	Not Listed
Meliphagidae	*Manorina melanocephala*	Noisy Miner	Not Listed	Not Listed
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	Vulnerable	Not Listed
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	Not Listed	Not Listed
Bovidae	*Bos taurus*	European cattle	Not Listed	Not Listed
Equidae	*Equus caballus*	Horse	Not Listed	Not Listed
Flora				
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	Not Listed	Not Listed
Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla-lily	Not Listed	Not Listed
Apiaceae	*Centella asiatica*	Indian Pennywort	Not Listed	Not Listed
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	Not Listed	Not Listed
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	Not Listed	Not Listed
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	Not Listed	Not Listed
Asteraceae	*Euchiton sphaericus*	Star Cudweed	Not Listed	Not Listed
Asteraceae	*Hypochoeris radicata*	Catsear	Not Listed	Not Listed
Asteraceae	*Senecio madagascariensis*	Fireweed	Not Listed	Not Listed
Asteraceae	*Vernonia cinerea*		Not Listed	Not Listed
Campanulaceae	*Lobelia purpurascens*	whiteroot	Not Listed	Not Listed
Campanulaceae	*Pratia purpurascens*	Whiteroot	Not Listed	Not Listed
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	Not Listed	Not Listed
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Not Listed	Not Listed
Convolvulaceae	*Dichondra repens*	Kidney Weed	Not Listed	Not Listed
Convolvulaceae	*Polymeria calycina*		Not Listed	Not Listed
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	Not Listed	Not Listed
Cyperaceae	*Fimbristylis spp.*		Not Listed	Not Listed
Cyperaceae	*Scleria mackaviensis*		Not Listed	Not Listed
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	Not Listed	Not Listed
Fabaceae (Faboideae)	*Glycine clandestina species complex*		Not Listed	Not Listed
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	Not Listed	Not Listed
Fabaceae (Faboideae)	*Zornia dyctiocarpa*		Not Listed	Not Listed

Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	Not Listed	Not Listed
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Not Listed	Not Listed
Myoporaceae	*Eremophila debilis*	Amulla	Not Listed	Not Listed
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	Not Listed	Not Listed
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Not Listed	Not Listed
Oleaceae	*Olea europaea*	Common Olive	Not Listed	Not Listed
Onagraceae	*Ludwigia peploides*		Not Listed	Not Listed
Oxalidaceae	*Oxalis perennans*		Not Listed	Not Listed
Phormiaceae	*Dianella revoluta*	Blueberry Lily	Not Listed	Not Listed
Phyllanthaceae	*Phyllanthus virgatus complex*		Not Listed	Not Listed
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	Not Listed	Not Listed
Poaceae	*Aristida ramosa*	Purple Wiregrass	Not Listed	Not Listed
Poaceae	*Axonopus compressus*	Broad-leaved Carpet Grass	Not Listed	Not Listed
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	Not Listed	Not Listed
Poaceae	*Bothriochloa spp.*	Redgrass, Bluegrass	Not Listed	Not Listed
Poaceae	*Brachypodium spp.*		Not Listed	Not Listed
Poaceae	*Chloris truncata*	Windmill Grass	Not Listed	Not Listed
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	Not Listed	Not Listed
Poaceae	*Cynodon dactylon*	Common Couch	Not Listed	Not Listed
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass	Not Listed	Not Listed
Poaceae	*Digitaria didactyla*	Queensland Blue Couch	Not Listed	Not Listed
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Not Listed	Not Listed
Poaceae	*Melinus repens*	Red Natal Grass	Not Listed	Not Listed
Poaceae	*Microlaena stipoides*	Weeping Grass	Not Listed	Not Listed
Poaceae	*Panicum effusum*	Hairy Panic	Not Listed	Not Listed
Poaceae	*Paspalidium distans*		Not Listed	Not Listed
Poaceae	*Paspalum dilatatum*	Paspalum	Not Listed	Not Listed
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass	Not Listed	Not Listed
Poaceae	*Rytidosperma pallidum*	Redanther Wallaby Grass; Silvertop Wallaby Grass	Not Listed	Not Listed
Poaceae	*Rytidosperma racemosum*	Wallaby Grass	Not Listed	Not Listed
Poaceae	*Themeda australis*	Kangaroo Grass	Not Listed	Not Listed
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	Not Listed	Not Listed
Rubiaceae	*Asperula scoparia*	Prickly Woodruff	Not Listed	Not Listed
Rubiaceae	*Richardia brasiliensis*	Mexican Clover	Not Listed	Not Listed
Rubiaceae	*Richardia stellaris*		Not Listed	Not Listed
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	Not Listed	Not Listed
Stackhousiaceae	*Stackhousia muricata*	Stackhousia	Not Listed	Not Listed
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	Not Listed	Not Listed
Verbenaceae	*Verbena bonariensis*	Purpletop	Not Listed	Not Listed
Verbenaceae	*Verbena rigida*	Veined Verbena	Not Listed	Not Listed

APPENDIX D QUALIFICATIONS, LICENSING AND CERTIFICATION

Qualifications

Fieldwork for this project was undertaken by Sarah Jones, Andrew Carty, Tahlia Thompson, Matthew Cook, and Thomas Stephens. Report writing for this project was undertaken by Ryan Herbert with editing and review by Sarah Jones. Qualifications are provided in the table below.

Ryan Herbert	***Ecologist / Bushfire Planning Consultant*** B.Env.Sc&Mgt. Undertaken Accredited Assessor course. Accredited Assessor application in progress. Member of the Ecological Consultants Association of NSW
Andrew Carty	***Botanist***
Sarah Jones	***Ecologist / Bushfire Planning Consultant*** B.Env.Sc., G.DIP.DBPA (Design for Bushfire Prone Areas) *BAAS 18020 Accredited Assessor, as required by the Biodiversity Conservation Regulation 2017 and accredited to apply the BAM* Member of the Ecological Consultants Association of NSW
Nick Weigner	***Ecologist*** B.Sc. (Zoology & Ecology) (Hons)

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL100533;
- Animal Research Authority (Trim File No: TRIM 11/5655) issued by NSW Department of Primary Industries; and
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: TRIM 11/5655) issued by Department of Primary Industries.

Certification

As the project certifier, I, Sarah Jones make the following certification:

- This Biodiversity Development Assessment Report has been prepared in accordance with the Biodiversity Assessment Method established under the NSW Biodiversity Conservation Act 2016.
- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;
- Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, or where the survey work has been undertaken with specified departures from industry standard guidelines, details of which are discussed and justified in Section 2;
- 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*.

Signature of Certifier:

Sarah Jones
B.Env.Sc., G.DIP.DBPA (Design for Bushfire Prone Areas)
Ecologist / Bushfire Planner

BAAS 18020 Accredited Assessor

APPENDIX E BAM SUMMARY REPORTS

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00034593/BAAS18020/22/00034594

Proposal Name
Lochinvar Subdivision

BAM data last updated *
16/06/2022

Assessor Name
Sarah Elizabeth Jones

Assessor Number
BAAS18020

BAM Data version *
54

Proponent Names

Report Created
10/08/2022

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
To be finalised

BOS entry trigger
BOS Threshold: Area clearing threshold

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater

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	HBT Cr	No HBT Cr	Total credits to be retired
1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	6.1	65	33	98
1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	0.3	0	1	1

1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Freshwater Lagoons This includes PCT's: 781, 783, 1071, 1290, 1735, 1736, 1737, 1740, 1741, 1742	Coastal Freshwater Lagoons >=70% and <90%	1071_VZ1	No	1	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.
1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_Moderate	Yes	65	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.

Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_Regenerating	No	33	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.
Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_DGrassland	No	0	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.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00034593/BAAS18020/22/00034594

Proposal Name
Lochinvar Subdivision

BAM data last updated *
16/06/2022

Assessor Name
Sarah Elizabeth Jones

Assessor Number
BAAS18020

BAM Data version *
54

Proponent Names

Report Created
10/08/2022

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
To be finalised

BOS entry trigger
BOS Threshold: Area clearing threshold

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater

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	HBT Cr	No HBT Cr	Total credits to be retired
1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	6.1	65	33	98
1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	0.3	0	1	1

1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Freshwater Lagoons This includes PCT's: 781, 783, 1071, 1290, 1735, 1736, 1737, 1740, 1741, 1742	Coastal Freshwater Lagoons >=70% and <90%	1071_VZ1	No	1	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.
1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_Moderate	Yes	65	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.

Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_Regenerating	No	33	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.
Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1600, 1601, 1604	-	1604_DGrassland	No	0	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.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Candidate Species Report

Proposal Details

Assessment Id 00034593/BAAS18020/22/00034594	Proposal Name Lochinvar Subdivision	BAM data last updated * 16/06/2022
Assessor Name Sarah Elizabeth Jones	Report Created 10/08/2022	BAM Data version * 54
Assessor Number BAAS18020	Assessment Type Part 4 Developments (General)	BAM Case Status Open
Assessment Revision 0	Date Finalised To be finalised	BOS entry trigger BOS Threshold: Area clearing threshold

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

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia bynoeana Bynoe's Wattle	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Asperula asthenes Trailing Woodruff	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Burhinus grallarius Bush Stone-curlew	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Callistemon linearifolius Netted Bottle Brush	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Callocephalon fimbriatum Gang-gang Cockatoo	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	☑ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Crinia tinnula Wallum Froglet	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cryptostylis hunteriana Leafless Tongue Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?

Cynanchum elegans White-flowered Wax Plant	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Delma impar Striped Legless Lizard	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Diuris tricolor Pine Donkey Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus castrensis Singleton Mallee	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus glaucina Slaty Red Gum	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus parramattensis subsp. decadens Eucalyptus parramattensis subsp. decadens	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Eucalyptus pumila Pokolbin Mallee	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Grevillea parviflora subsp. parviflora Small-flower Grevillea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hoplocephalus bitorquatus Pale-headed Snake	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria brevipalmata Green-thighed Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Maundia triglochinoides Maundia triglochinoides	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?

Melaleuca biconvexa Biconvex Paperbark	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Monotaxis macrophylla Large-leafed Monotaxis	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox connivens Barking Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox strenua Powerful Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ozothamnus tesselatus Ozothamnus tesselatus	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Persicaria elatior Tall Knotweed	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascogale tapoatafa Brush-tailed Phascogale	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Planigale maculata Common Planigale	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Prostanthera cineolifera Singleton Mint Bush	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Pterostylis chaetophora Pterostylis chaetophora	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Rutidosis heterogama Heath Wrinklewort	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Thesium australe Austral Toadflax	No (surveyed) *Survey months are outside of the months specified in Bionet.	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Tyto novaehollandiae Masked Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Uperoleia mahonyi Mahony's Toadlet	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Black-tailed Godwit	Limosa limosa	Refer to BAR
Broad-billed Sandpiper	Limicola falcinellus	Refer to BAR
Curlew Sandpiper	Calidris ferruginea	Refer to BAR
Eastern Osprey	Pandion cristatus	Habitat constraints
Great Knot	Calidris tenuirostris	Refer to BAR
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Koala	Phascolarctos cinereus	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints

Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat constraints
North Rothbury Persoonia	Persoonia pauciflora	Refer to BAR
Pink-tailed Legless Lizard	Aprasia parapulchella	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints
Tarengo Leek Orchid	Prasophyllum petilum	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints
Zannichellia palustris	Zannichellia palustris	Habitat constraints

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034593/BAAS18020/22/00034594	Lochinvar Subdivision	16/06/2022
Assessor Name	Report Created	BAM Data version *
Sarah Elizabeth Jones	10/08/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS18020	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter												
1	1604_Moderate	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	68.1	49.2	2.6	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		65
2	1604_Regenerating	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	36.1	34.6	1.9	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		33

3	1604_DGrassland	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	3.6	3.1	1.5	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		0
											Subtotal	**98**
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion												
4	1071_VZ1	Not a TEC	52.3	4.9	0.25	PCT Cleared - 75%	High Sensitivity to Gain			2.00		1
											Subtotal	**1**
											Total	**99**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034593/BAAS18020/22/00034594	Lochinvar Subdivision	16/06/2022
Assessor Name	Report Created	BAM Data version *
Sarah Elizabeth Jones	10/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS18020	Part 4 Developments (General)	Open
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Area clearing threshold	To be finalised

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Australian Painted Snipe	Rostratula australis	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Barking Owl	Ninox connivens	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Black Bittern	Ixobrychus flavicollis	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Black Falcon	Falco subniger	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Black-necked Stork	Ephippiorhynchus asiaticus	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Black-tailed Godwit	Limosa limosa	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Blue-billed Duck	Oxyura australis	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Broad-billed Sandpiper	Limicola falcinellus	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter

Comb-crested Jacana	Irediparra gallinacea	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Curlew Sandpiper	Calidris ferruginea	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Diamond Firetail	Stagonopleura guttata	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Eastern Osprey	Pandion cristatus	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Flame Robin	Petroica phoenicea	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Freckled Duck	Stictonetta naevosa	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Gang-gang Cockatoo	Callocephalon fimbriatum	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Great Knot	Calidris tenuirostris	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Grey-headed Flying-fox	Pteropus poliocephalus	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Large Bent-winged Bat	Miniopterus orianae oceanensis	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Little Bent-winged Bat	Miniopterus australis	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Little Eagle	Hieraaetus morphnoides	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter

Little Eagle	Hieraaetus morphnoides	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Little Lorikeet	Glossopsitta pusilla	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Magpie Goose	Anseranas semipalmata	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Masked Owl	Tyto novaehollandiae	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Powerful Owl	Ninox strenua	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Regent Honeyeater	Anthochaera phrygia	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Scarlet Robin	Petroica boodang	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Speckled Warbler	Chthonicola sagittata	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Spotted Harrier	Circus assimilis	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Square-tailed Kite	Lophoictinia isura	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
Swift Parrot	Lathamus discolor	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Turquoise Parrot	Neophema pulchella	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Varied Sittella	Daphoenositta chrysoptera	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
White-bellied Sea-Eagle	Haliaeetus leucogaster	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
White-fronted Chat	Epthianura albifrons	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
White-throated Needletail	Hirundapus caudacutus	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
		1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion

Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Glossy Black-Cockatoo	Calyptorhynchus lathami	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter
Painted Honeyeater	Grantiella picta	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints
Painted Honeyeater	Grantiella picta	Habitat constraints

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00034593/BAAS18020/22/00034594	Lochinvar Subdivision	16/06/2022
Assessor Name	**Report Created**	**BAM Data version ***
Sarah Elizabeth Jones	10/08/2022	54
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18020	Part 4 Developments (General)	Open
Assessment Revision	**Date Finalised**	**BOS entry trigger**
0	To be finalised	BOS Threshold: Area clearing threshold

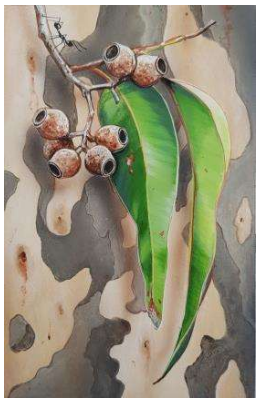
* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones

1	1604_Moderate	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Moderate	2.65	2	Clear (1.2 ha) APZ (0.8 ha) Indirect (0.65 ha)
2	1604_Regenerating	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Regenerating	1.93	1	Clear (1.84 ha) Indirect (0.09 ha)
3	1604_DGrassland	1604-Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	DGrassland	1.47	1	Clear (1.26 ha) APZ (0.13 ha) Indirect (0.08 ha)
4	1071_VZ1	1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	VZ1	0.25	1	

APPENDIX F BAT CALL REPORTS



CORYMBIA ECOLOGY

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BAT CALL ANALYSIS RESULTS

Firebird – Lochinvar- 16-20/03/2021

1121 files (1064 noise) – low activity level likely due to heavy rainfall during survey period.

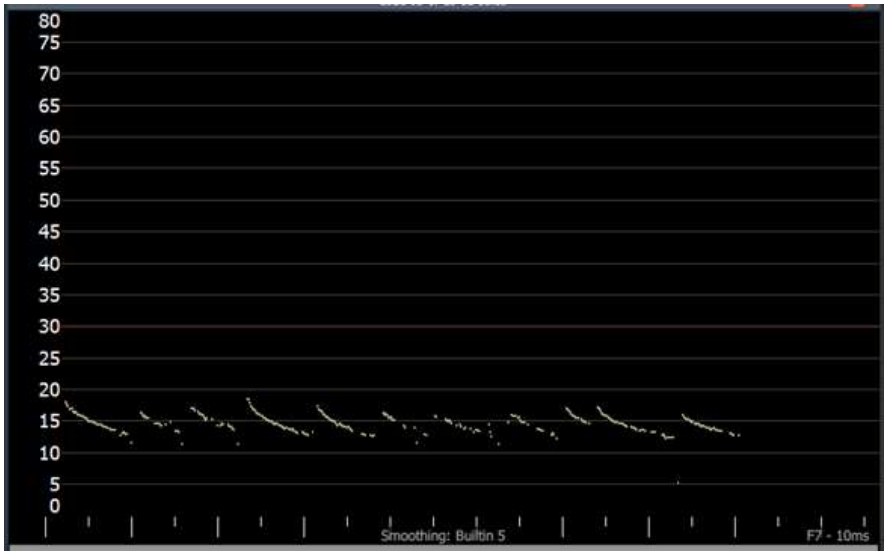
Species	ID Confidence	Notes
Austronomus australis	D	
Micronomus norfolkensis	D	
Mormopterus (Ozimops) planiceps (previously species 4)	Pr	
Chalinolobus gouldii	D	
Miniopterus australis	Pr	

Note: only calls identified a definite should be entered in Bionet

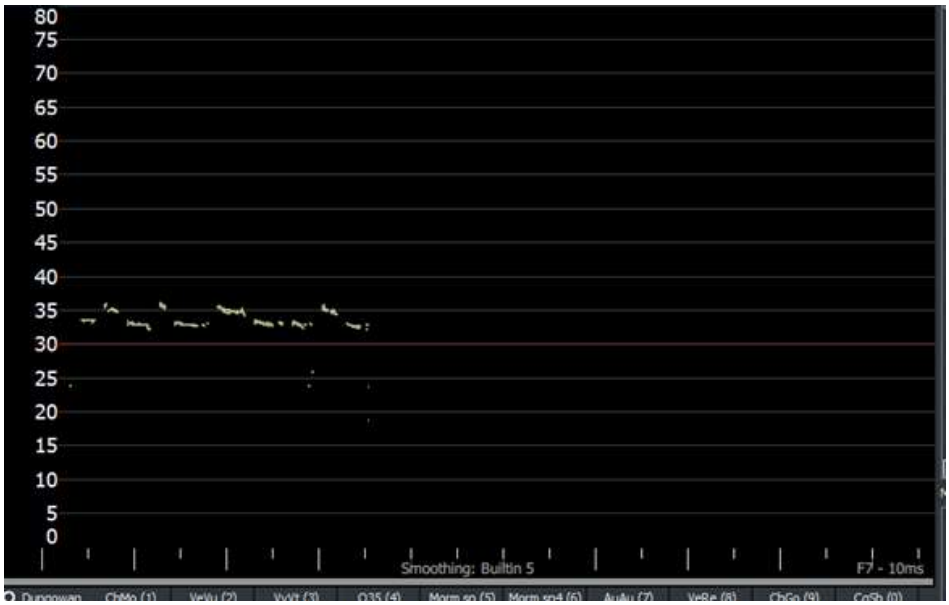
- D – definite; Pr – probable; Po – possible; E-either.
- Calls were analysed using Anabat Insight.
- Example calls presented below are displayed in this report at F7.
- Analysis was completed on the 8 April 2021.
- The following resources were consulted during analysis:
  - Pennay M., Law B., and Reinhold L. (2004) Bat Calls of NSW. DEC of NSW.
  - Corben C. (2009) Anabat Techniques Workshop, Titley Scientific.
  - Personal experience analysing calls and collection of reference calls in NSW
  - Anabat Insight Workshop (2019), Titley Scientific and Balance Environmental.

Examples of calls for definite and probable identified species

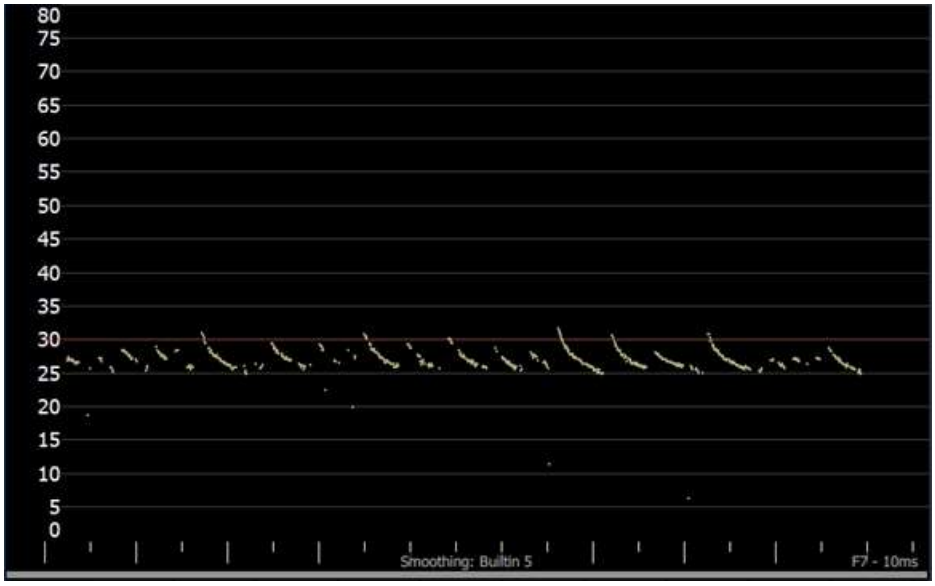
Austronomus australis



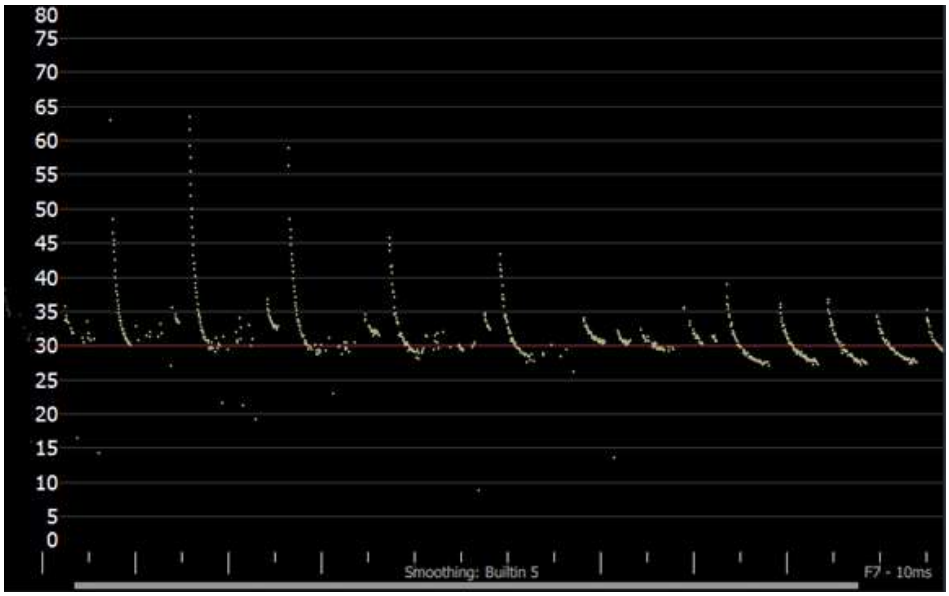
Micronomus norfolkensis



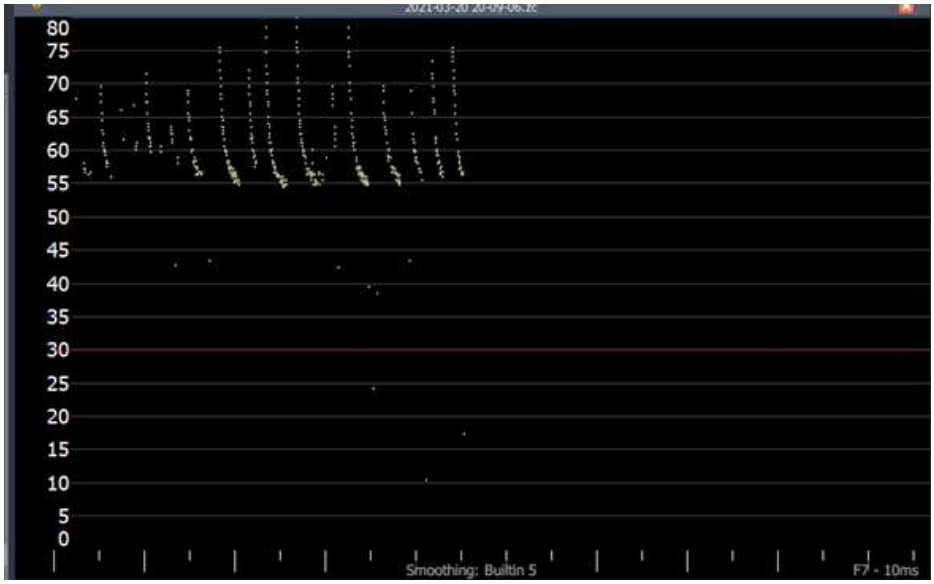
Mormopterus (Ozimops) planiceps (probable)

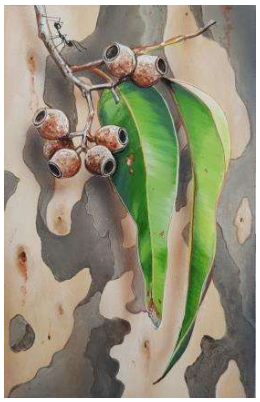


Chalinolobus gouldii



Miniopterus australis (probable)


80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Smoothing: Builtin 5
F7 - 10ms



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BAT CALL ANALYSIS RESULTS

Firebird – Lochinvar- 1-3/04/2021

Species	ID Confidence	Notes
Austronomus australis	D	
Micronomus norfolkensis	D	
Mormopterus (Ozimops) ridei	Po	This species may occur, however overlap with other species and only a few short passes, a higher rating cannot be provided.
Mormopterus (Ozimops) planiceps (previously species 4)	Pr	Highly likely to be this species, but some potential overlap with other species and only a few short passes, a higher rating cannot be provided.
Chalinolobus gouldii	D	
Calinolobus gouldi / Scotorepens balstoni	E	When pulses are not alternating calls are difficult to distinguish between these two species. Although *S. balstoni* is primarily a western species, it is known to occur further east in the Hunter Valley area.
Scotorepenes orion	Po	One pass at 35Khz was recorded. This pass is most likely from *Scotorepens orion,* however the calls of this species significantly overlap with *Scoteanax rueppellii* and *Falsistrellus tasmaniensis,* however the latter is less likely to occur due to the habitat present. Several other species also do uncharacteristic calls within the parameters of this sequence.
Vespadelus vulturnus	Pr	Only one clear call characteristic of this species. There is overlap in call characteristics with *V. troughtoni* and the occurrence of this species cannot be discounted therefore a higher rating could not be given to *V. vulturnus.*
Nyctophilus sp / Myotis macropus	E-Po	Only a few short passes of only a few pulses. Not clear enough to determine if it was one of these species, may be part of a call from another species.
Miniopterus australis	D	

Note: only calls identified a definite should be entered in Bionet

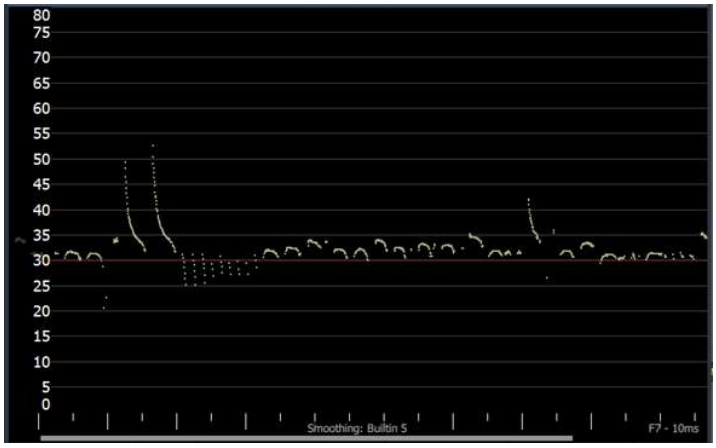
- D – definite; Pr – probable; Po – possible; E-either.
- Calls were analysed using Anabat Insight.
- Example calls presented below are displayed in this report at F7.
- Analysis was completed on the 21 April 2021.
- The following resources were consulted during analysis:
  - Pennay M., Law B., and Reinhold L. (2004) Bat Calls of NSW. DEC of NSW.
  - Corben C. (2009) Anabat Techniques Workshop, Titley Scientific.

- Personal experience analysing calls and collection of reference calls in NSW
- Anabat Insight Workshop (2019), Titley Scientific and Balance Environmental.

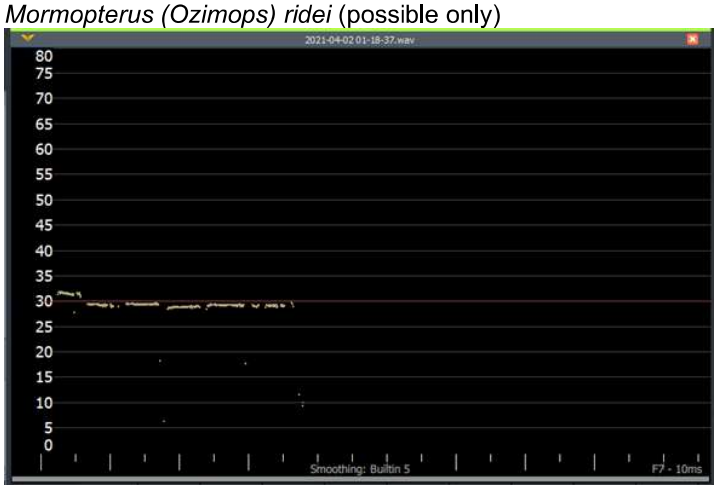
Examples of calls for definite and probable identified species

Austronomus australis

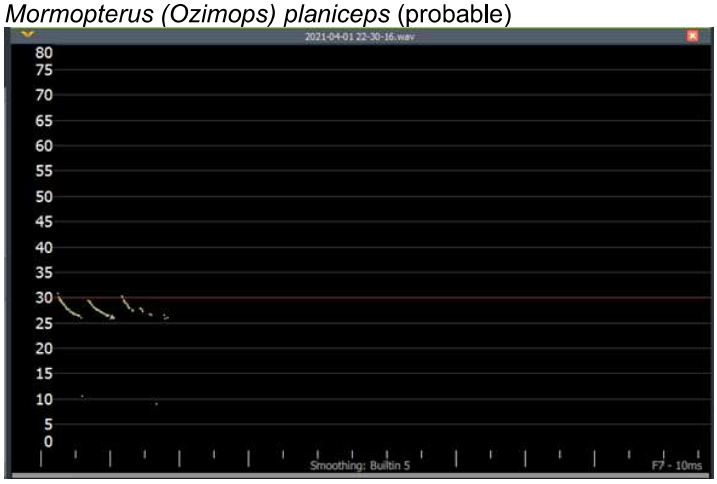
Micronomus norfolkensis



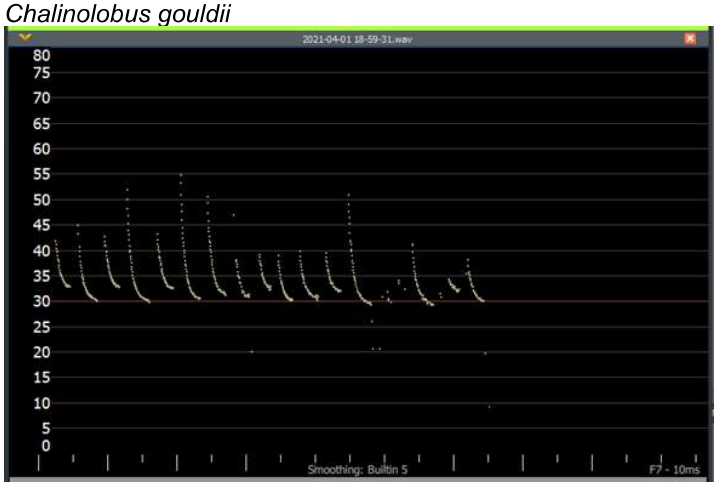
Mormopterus (Ozimops) ridei (possible only)



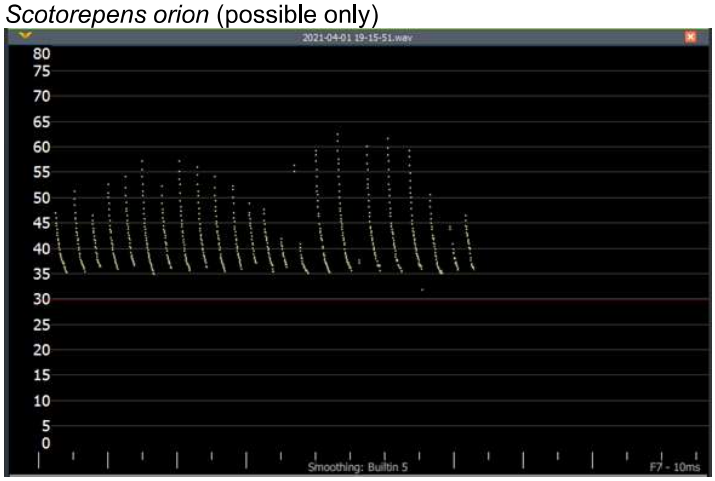
Mormopterus (Ozimops) planiceps (probable)



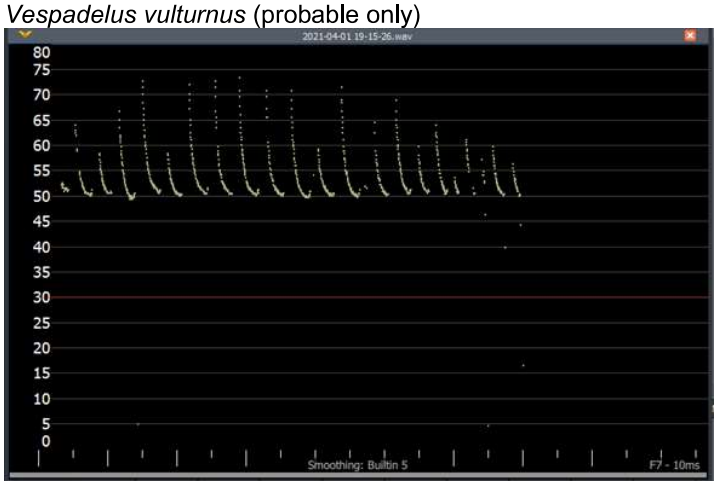
Chalinolobus gouldii



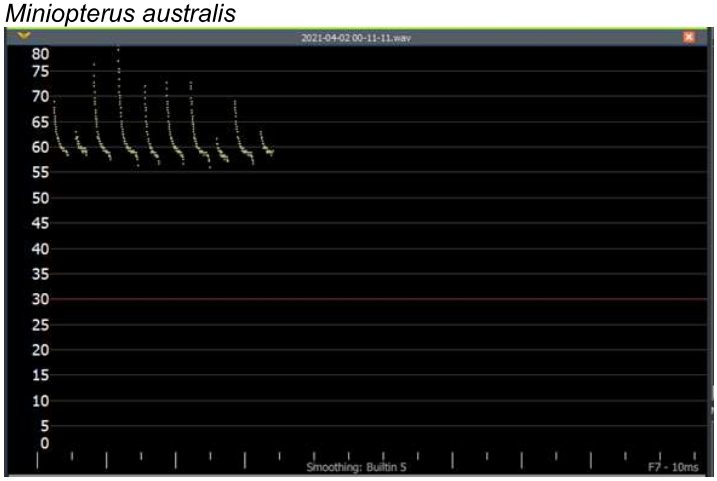
Scotorepens orion (possible only)



Vespadelus vulturnus (probable only)



Miniopterus australis



APPENDIX G INTERIM GRASSLANDS AND OTHER GROUNDCOVER ASSESSMENT METHOD REPORT

APPENDIX H PHOTOS

T2 (Transect 2) of PCT 1604 (Moderate) – Vegetation Zone 1. Photo taken on 1 April 2021

T1 (Transect 1) of PCT 1604 (Regenerating) – Vegetation Zone 2. Photo taken on 1 April 2021

T1 (Transect 1) of PCT 1604 – Vegetation Zone 3 (Derived grassland). Photo taken on 1 April 2021

T1 (Transect 1) of PCT 1071. Photo taken on 1 April 2021

Hollow-bearing tree within PCT 1604 – Vegetation Zone 1. Photo taken on 1 August 2021

Ground hollow within PCT 1604 – Vegetation Zone 1. Photo taken on 1 April 2021

Anabat Echolocation Recording Device placed within PCT 1604 – Vegetation Zone 1. Photo taken on 1 April 2021