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Biodiversity Development Assessment Report

Proposed Residential Subdivision at 523 Raymond Terrace Road (Lot 100 DP847510) Chisholm NSW 2322.

Prepared for: ACG Clovelly Road Pty Ltd

C/ - ADW Johnson

May 2023

AEP Ref: 2713

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Document Name	Biodiversity Development Assessment Report for Proposed Residential Subdivision at 523 Raymond Terrace Road (Lot 100 DP847510) Chisholm NSW 2322.
Project Number	2713
Client Name	ACG Clovelly Road Pty Ltd
Accredited Assessor	Natalie Black (BAAS 19076)
AEP Project Team	Craig Anderson Ian Benson Natalie Black Kelly Drysdale Simon Purcell Bonni Yare Naomi Stackhouse Tim Mouton Alissa Rogers Oscar Anderson Byron De Jager Darcy Kilvert Alana Guest Kieran Giffen Alex McNamara Samuel Rayfield

Revision

Revision	Date	Authors	Reviewed	Approved
01	28/04/2023	Naomi Stackhouse	Kelly Drysdale	Natalie Black
02	19/05/2023	Naomi Stackhouse	Kelly Drysdale	Natalie Black

Distribution

Revision	Date	Name	Organisation
01	28/04/2023	Stephanie Van Dissel and Adrian Galasso	ADW Johnson & ACG Clovelly Road Pty Ltd
02	19/05/2023	Stephanie Van Dissel and Adrian Galasso	ADW Johnson & ACG Clovelly Road Pty Ltd

EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) was commissioned by ADW Johnson on behalf of ACG Clovelly Road Pty Ltd (the proponent) to undertake a Biodiversity Development Assessment Report (BDAR) for a Residential Subdivision over land identified as 523 Raymond Terrace Road (Lot 100 DP847510) Chisholm, NSW 2322, located within the Maitland City Council (LGA) in the Greater Hunter region of New South Wales.

The proposed residential subdivision sits within the southern-central portion of the newest precinct (Chisholm Central) within Stage 2 of the Thornton North Urban Release Area (TNUAR). On completion, the TNURA anticipates accommodating approximately 5,000 residential lots (or 12,500 residents) and is one of the few sites in the Lower Hunter that has potential to provide significant land supply to address housing affordability.

The "Thornton North – Stage 2" rezoning (which the development sits within) occurred on 23rd September, 2011. Stage 2 rezoned approximately 350ha of land from Zone 1(b) Secondary Rural Land to Zone 2(a) Residential (now R2) and Zone 7(c) Environment Protection General (now E2), to facilitate the development of 2,500 dwellings and protection of areas of ecological significance for threatened flora and fauna species.

The Biodiversity Development Assessment Report undertaken applies only to Lot 100 DP847510. This proposed land is zoned R1 General Residential. The development will include one-hundred and eight (108) lots and two part lots in Lot 662 and of which will include internal roads, services and drainage infrastructure and landscaping.

This report has been prepared to meet the requirements of the *Biodiversity Assessment Method 2020* (BAM) established under Section 6.7 of the *Biodiversity Conservation Act 2016* (NSW). This assessment utilises methods detailed within the BAM Order 2020 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values.

The Study Area (Lot 100 DP847510) covers approximately 10.23ha, which is the entire proposed development footprint. Hence, the Subject Site also totals approx. 10.23ha, comprising approx. 2.42ha of native vegetation in varying conditions, and the remaining 7.81ha consisting of exotic / cleared / existing infrastructure. The Subject Site has been subject to under scrubbing, clearing, extensive grazing and undergone pasture improvement in the past, reducing the inherent biodiversity of the site.

The native vegetation within the Subject Site contains three (3) plant community types (PCTs); which are present in varying condition. Four (4) vegetation zones have been assessed within the three (3) PCTs:

- PCT 1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter (moderate condition) approx. 0.18ha. This community is associated and commensurate with the State Listed Endangered Ecological Community (EEC), Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions and Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion;
- PCT 1600 Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub-grass open forest of the lower Hunter (degraded canopy only and moderate condition) approx. 0.87ha & 0.99ha respectively. This community is associated and commensurate with the State Listed EEC, Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions and Central Hunter Ironbark–Spotted Gum–Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions.

  This community was further assessed against the Commonwealth listed EEC *Central Hunter Valley eucalypt forest and woodland*, and determined not to be commensurate with the

Commonwealth Listed TEC. It is noted here that although the State and Commonwealth EECs were considered and assessed, neither EEC were able to be assigned to this PCT within the BAM-C and therefore were not entered as a TEC in the BAM-C.

- PCT 1736 Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower *Hunter* (poor condition) approx. 0.37ha. This community is associated and commensurate with the State Listed EEC, *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*.

The remainder of the Subject Site comprises of 7.81ha of exotic vegetation and cleared / managed lands, including unnamed access tracks, dams and existing infrastructure.

Fauna species recorded were typical of those expected in this locality and in this type of remnant habitat with existing connection to larger patches of habitat offsite.

Only one (1) threatened avifauna species; Grey-Crowned Babbler was observed on site and was recorded on camera. Seven (7) threatened bats were detected via Anabat; Little bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Greater Broad-nosed Bat, Eastern Coastal Free-tailed Bat and Yellow-bellied Sheath-tailed Bat. Grey-headed Flying Fox was also observed within the Subject Site. No listed threatened flora species were identified as present on site.

Myotis Macropus species credits will apply with all other species incorporated as ecosystem credit species.

Avoid and minimise principles were considered through the planning stage of the proposed development as well as the location within TNUAR and the Thornton North – Stage 2 rezoning. The location of the land on the Subject Site within the growing township of Chisholm has been zoned for R1 General Residential development, therefore, the proposal is considered the most appropriate use for the Subject Site. Furthermore, the proposal has been designed to follow the principles of avoid and minimise by utilising lower quality cleared land that has been subject to clearing and management, whilst areas within the broader locality containing higher quality vegetation, such as the BV mapped land in Woodberry Swamp and the C2 zoned lands in the Precinct, will be avoided, illustrating that the development is located within the most suitable, disturbed part of the landscape. A number of development footprint iteration plans were considered with the final design enabling retention of vegetation along Raymond Terrace Road, which protects two habitat trees

Approximately 2.42ha of native and 7.81ha of exotic / cleared / existing infrastructure within the Subject Site will be cleared for the development. However, this is considered to have a low overall impact on species survival and ecosystem connectivity due to the highly fragmented patches of vegetation, overall degraded state of the Subject Site and presence of more suitable habitat in the surrounding landscape. Furthermore, landscaping and construction will contribute to the minimisation of impacts through:

- Environmentally-friendly lighting design that avoids light-spill into surrounding areas of native vegetation;
- Water Sensitive Urban Design (WSUD) and Storm Water Management; and
- Landscaping using vegetation endemic in the area.

Biodiversity values were assessed for the Subject Site, resulting in the calculation of Biodiversity Offsets. The proposal will require the following Ecosystem credits to offset the residual impact of the proposed development:

- **5 x PCT 1598** (moderate);
- **11 x PCT 1600** (degraded – canopy only);
- **26 x PCT 1600** (moderate); and

- **7 x PCT 1736** (poor).

The proposal will require the following Species credits to offset the residual impact of the proposed development for Southern Myotis:

- **42** x Southern Myotis.

Assessment of the proposal under other relevant environmental policy instruments has been undertaken within the Other Legislation Appendices of this document, including;

- Biodiversity and Conservation State Environmental Planning Policy (Koala Habitat Protection) 2021 (BC SEPP);
- Resilience and Hazard State Environmental Planning Policy (Coastal Management) 2021 (HR SEPP);
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), the development only provides potential seasonal foraging habitat for relevant species and no Threatened Ecological Communities were determined to be associated with EPBC listed TECs; and
- The Subject Site is not mapped as Important Areas for Swift Parrot, Regent Honeyeater, Plains-wanderer or Migratory Shorebirds and no Grey-headed Flying-fox roost camp is present within the site.

The proposal, has also been assessed under other relevant environmental policy instruments including;

- *Water Management Act, 2000* (WM Act); and
- *Fisheries Management Act, 1994* (FM Act).

All of which are detailed within the Appendices of this document.

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Study Certification and Licensing

This report was written by Naomi Stackhouse, Kelly Drysdale, Tim Mouton and Bonni Yare, and reviewed by Kelly Drysdale and certified by Natalie Black (BAAS: 19076) of Anderson Environment & Planning.

Staff	Title/Qualification	Tasks
Craig Anderson	Director BAppSc (EAM) BAAS: 18002	Scientific advice
Ian Benson	Principal Ecologist & Business Manager BEng (Civil) GradDipSc (Ecology) BAAS: 18147	Scientific advice, report review, Equipment data review
Natalie Black	Senior Environmental Manager / Works Coordinator BSc (Hons), Master Planning, Cert IV (TA) BAAS: 19076	Report review and certification
Simon Purcell	Senior Ecologist / Works Coordinator BAppSc (Wildlife Science); Cert III Animal Care and Mgt	Report review, Scientific advice
Kelly Drysdale	Ecology Project Manager Ass.Dip. App Sc, Grad Cert BA, TAE	Project management, Habitat assessment, Targeted Flora Transects, BAM plots, Targeted Fauna Surveys, Equipment Deployment, report writing and review
Bonni Yare	Ecologist/Botanist BSc (NRM), Cert 3 Cons&LandMgt	Targeted Flora Transects, BAM plots, Targeted Fauna Surveys, PCT Determination, Equipment Deployment, Habitat Assessment, Contributing PCT report author
Naomi Stackhouse	Ecologist BSc Cons&Ecol (Completion 2023)	Report Author, Targeted Fauna Surveys, Equipment Deployment, Equipment Data review
Alissa Rogers	Ecologist BPrkMgt	BAM plots and Habitat Assessment
Tim Mouton	Senior Ecologist BEncSc; MEnvSc BAAS: 19083	Contributing PCT report author, PCT Determination, GIS Mapping
Oscar Anderson	Ecologist BEnvScMgmt (Completion 2023)	Targeted Flora Transects, BAM plots, Habitat Assessment, Targeted Fauna Surveys
Byron De Jager	Ecologist BSc (SusResMgmt) Cert 3 Cons&LandMgt	Targeted Flora Transects, Habitat Assessment, Targeted Fauna Surveys
Darcy Kilvert	Ecologist BSc Biology	Targeted Flora Transects

Staff	Title/Qualification	Tasks
Alana Guest	Ecologist BSc Animal Biology	Targeted Flora Transects, Equipment Deployment, Contributing Report Author
Kieran Giffen	Ecologist Cert 3 Conserv&Ecosystems	Equipment Deployment
Alex McNamara	Ecologist BEnvScMgmt (Completion 2023)	Equipment Deployment
Samuel Rayfield	Ecologist Dip. Cons&LandMgt	Contributing report author

Research was conducted under the following licences:

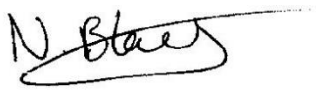
- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW Agriculture; and
- Animal Research Establishment Accreditation Number 53724.

Certification:

As the principal certifier, I, Natalie Black, make the following certification:

- This report has been written to comply with the requirements of the BAM 2020 and obligations outlined within the BAM Assessor Code of Conduct and includes, in the opinion of the writer, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area, and inferences of such for biodiversity credit calculations;
- Anderson Environment and Planning have no actual, potential or perceived conflicts of interest with ADW Johnson. Anderson Environment and Planning has received commercial payment for consulting services and assessment by ADW Johnson for this project.
- BAM Assessment methodology, as well as Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:



Natalie Black

Senior Environmental Manager

Anderson Environment & Planning

BAAS no. 19076

Calculator Ref: 00034989/BAAS19076/22/00034990

19 May 2023

Glossary of Terms

Assessment Area	Land occurring within a 1500m buffer around the Study Area boundary.
BAM	Biodiversity Assessment Method Order (2020) that determines: Methodology applicable to quantifying biodiversity values inherent within a development site; Avoid and minimise efforts required to be employed as part of any development proposal; and Number and class of credits required to offset residual impacts of the proposal upon the biodiversity values therein.
BC Act	Biodiversity Conservation Act 2016
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset the impacts of a development.
BAM Calculator (BAM-C)	The online tool used to interpret site survey data and regional location information to quantify ecosystem and species credits required / generated at a development / stewardship site.
Biodiversity credits	Ecosystem or Species Credits required to offset the loss of biodiversity values on a development site.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats.
BRW	Biodiversity Risk Weighting
CEEC	Critically Endangered Ecological Community
Council	Maitland City Council
DAWE	The former Commonwealth Department of Agricultural, Water and Environment
DCCEEW	The Commonwealth Department of Climate Change, Energy, the Environment and Water
DoEE	The former Commonwealth Department of the Environment and Energy
DPI	The NSW Department of Primary Industries
DPE	The NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning, Industry and Environment
Ecosystem credit	The class of biodiversity credits created or required for the impact on EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a vegetation type.
EEC	Endangered Ecological Community
CEEC	Critically Endangered Ecological Community
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
IBRA	Interim Biogeographic Regionalisation for Australia
OEH	The former NSW Office of Environment and Heritage
PFC	Percentage Foliage Cover
Subject Site	Land upon which the development is proposed, and within which residual impacts upon biodiversity are required to be offset, as shown in **Figure 1**.
Species credit	Class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area based on habitat surrogates.

Study Area	Land located at 523 Raymond Terrace Road, Chisholm NSW (Lot DP847510). The Study Area is shown on **Figure 1**.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
VIS	Vegetation Integrity Score

1.0 Stage 1 – Biodiversity Assessment

1.1 Introduction

A residential subdivision is proposed within land known as 523 Raymond Terrace Road, Chisholm NSW (Lot DP847510). At the request of ADW Johnson, on behalf of ACG Clovelly Road Pty Ltd (the Proponent), Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Development Assessment Report (BDAR) addressing the proposed development.

This BDAR undertaken adheres to the approach outlined in the Biodiversity Assessment Methodology (DPIE 2020a) (the BAM) and the BAM Calculator User Guide (DPIE 2020b).

1.1.1 Biodiversity Offset Scheme Threshold Trigger

This BDAR has been triggered as required by Clause 7.1 *Biodiversity Conservation Regulation 2017* by the following threshold:

- 7.2 (1)(a) *the clearing of native vegetation of an area declared by clause 7.2 as exceeding the threshold.*

Therefore, a BDAR is required, an assessment in accordance with Stage 1 and Stage 2 within Biodiversity Assessment Method Order 2020 (BAM Order).

1.1.2 Assessment Scope

The BDAR presented herewith aims to quantify impacts of the proposal upon biodiversity values based upon the methods described within the BAM, including threatened entities listed under the BC Act.

This report includes:

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

1.1.3 The Proposal

ACG Clovelly Road Pty Ltd (the client), is proposing a subdivision for residential lots. The residential development will be situated across 523 Raymond Terrace Road, Chisholm NSW (Lot 100 DP847510), currently zoned for general residential (R1) land use. The development will include one hundred and eight (108) lots in addition to internal roads, services, drainage infrastructure and landscaping incorporated. The proposed will require the removal or modification of approx. 2.42ha of native vegetation.

The proposed development plan is included in **Appendix A**.

1.1.4 General Description of the Subject Site

The Subject Site is located on the eastern outskirts of Chisholm, located in the Maitland City Council Local Government Area (LGA) in the Hunter Region of NSW (**Figure 1**). South of the Study Area is bound by Raymond Terrace Road, with the town of Thornton a further 1km south. The north, east and

west of the Subject Site are bounded by low density residential owned lots with scattered vegetation cover and farm dams. The proposal is approximately 4km Southeast from the town of East Maitland.

The site has been previously cleared for agriculture and predominantly contains sparse native canopy and exotic grassland ground cover, with scattered native vegetation in various conditions throughout. Remnant native woodland borders the Subject Site to the west and connects to patches of under scrubbed native vegetation in the adjacent lots, offering areas of marginally higher biodiversity values habitat. Much of the site has been subject to previous pasture improvement and mowing, reducing the inherent biodiversity of the site. The land has also been managed with activities such as spraying of selective herbicide to remove weed species problematic for primary production grazing.

1.1.5 Site Particulars

Table 1 – Site Particulars

Detail	Comments
Client	ACG Clovelly Rd Pty Ltd
Address	523 Raymond Terrace Road, Chisholm, NSW 2322
Title(s)	Lot 100 DP847510
Study Area	Consists of the entirety of Lot 100 DP847510
Subject Site	The Subject Site is a patchwork of paddocks, including areas of native vegetation and areas of cleared or exotic vegetation, covering approx. 10.23ha
LGA	Maitland City Council
Zoning	Under the *Maitland Local Environmental Plan 2011* the site is zoned as R1 – General residential.
Current Land Use	Unmaintained cleared site with scattered canopy and abandoned buildings, residential dwelling, cars and sheds. Site divided into several paddocks from previous use.
Surrounding Land Use	The entirety of the site is surrounded by land zoned as R1 – General Residential. The north, east and west of the Subject Site are bounded by low density residential owned lots with scattered vegetation cover and farm dams. To the north, west, south, and south east some land is zoned as C3 – Environmental Management. To the south west and south east some land is zoned as RU2 – Rural Landscape.

Figure 1 depicts the extent of the Subject Site and Study Area. **Figure 2** depicts native vegetation occurring within the Assessment Area.

1.1.6 Geology and Soils

Reference to the 1:250,000 Sheet Soil Landscapes (eSpade Soil Tool) of Chisholm suggests that the Beresfield Soil Landscape underlies the site. The Beresfield Soil Landscape is generally undulating low hills and rises on Permian sediments in the East Maitland Hills region. Slope gradients 3–15%, local relief to 50 m, elevation is 20–50 m. The landscape is predominately partially cleared tall open-forest and steeper upper slopes (15–<25%). Soils consist of the following:

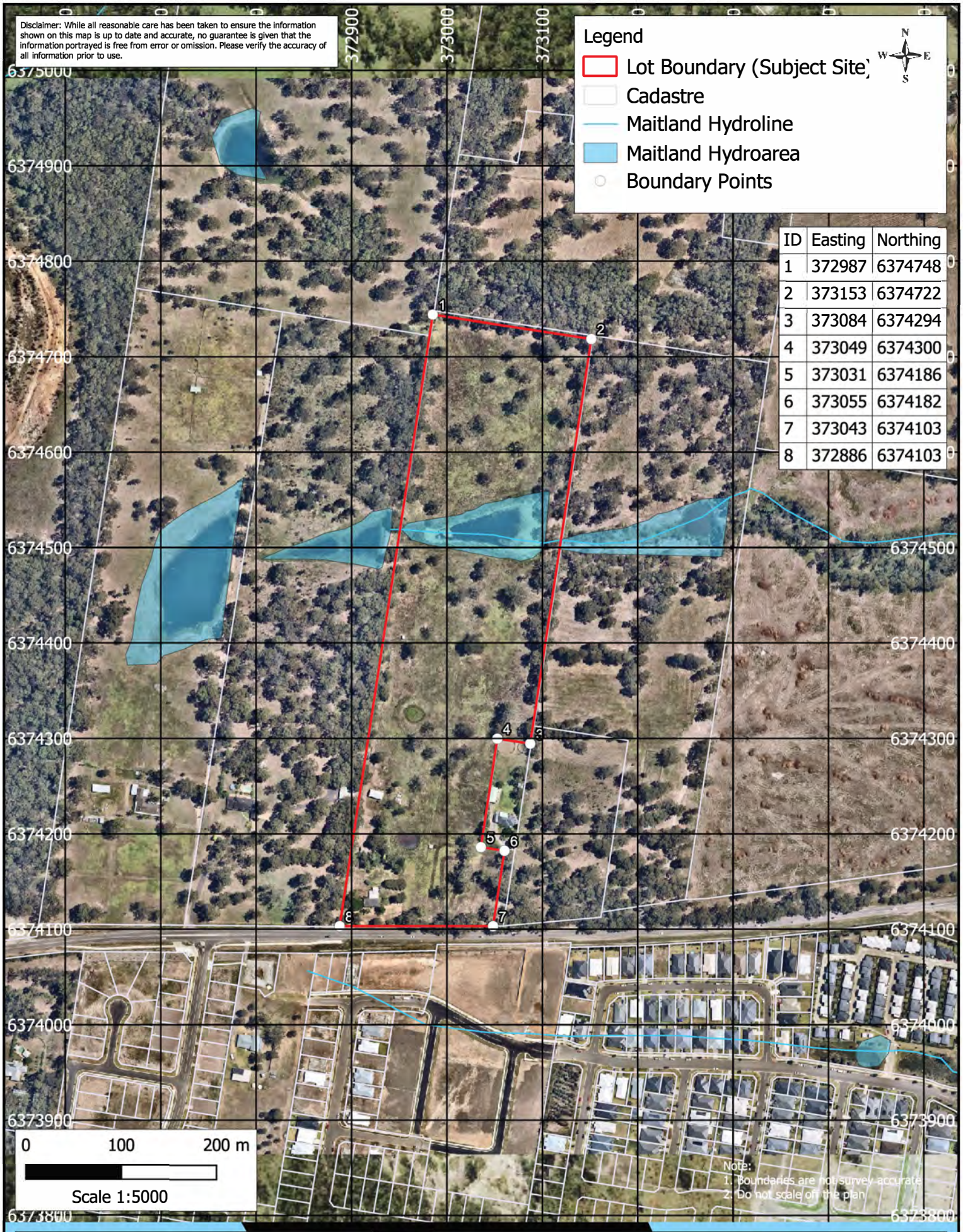
- Moderately deep (<120 cm), moderately well to imperfectly drained Yellow Podzolic Soils, Brown Podzolic Soils, and brown Soloths occur on crests;
- Moderately deep (<120 cm), well-drained Red Podzolic Soils and red Soloths on upper slopes;
- Moderately well to imperfectly drained brown Soloths and yellow Soloths on sideslopes; and
- Deep (>200 cm), imperfectly to poorly drained Yellow Podzolic Soils, yellow Soloths and Gleyed Podzolic Soils on lower slopes.

Qualities and Limitations include high foundation hazard, water erosion hazard, Mine Subsidence District, seasonal waterlogging and high run-on on localised lower slopes, highly acid soils of low fertility.

1.1.7 Information Sources

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

- Field surveys conducted within the site and surrounding areas by AEP (2022 & 2023);
- State survey guidelines (DEC 2004; DECC 2009; OEH 2018, DPIE 2020c; DPE 2022);
- PlantNET NSW (https://plantnet.rbgsyd.nsw.gov.au/);
- Aerial Photograph Interpretation (API) of the site and surrounding locality (Google 2022);
- eSPADE Soil Profiles (NSW Department of Planning and Environment);
- DPE Threatened Biodiversity Profiles (https://www.environment.nsw.gov.au/threatenedSpeciesApp/);
- Search and review of flora and fauna sighting records in the DPE BioNet Atlas within 10km of the site (https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet);
- Protected Matters Search within a 5km radius of the site held by Commonwealth Department of Climate Change, Energy, the Environment and Water (CDCCEEW) summarising Matters of National Environmental Significance that may occur in, or may relate to the Subject Site;
- DPE *BAM – Important Areas Map* to determine whether the site is mapped as *Swift Parrot, Regent Honeyeater, Migratory Shorebird and Plains-wanderer Important Areas;*
- Collective knowledge gained from previous ecological survey and assessment in the Lower Hunter Regional Council area over the past 30 years; and
- Anecdotal records.



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6	373055	6374182
7	373043	6374103
8	372886	6374103

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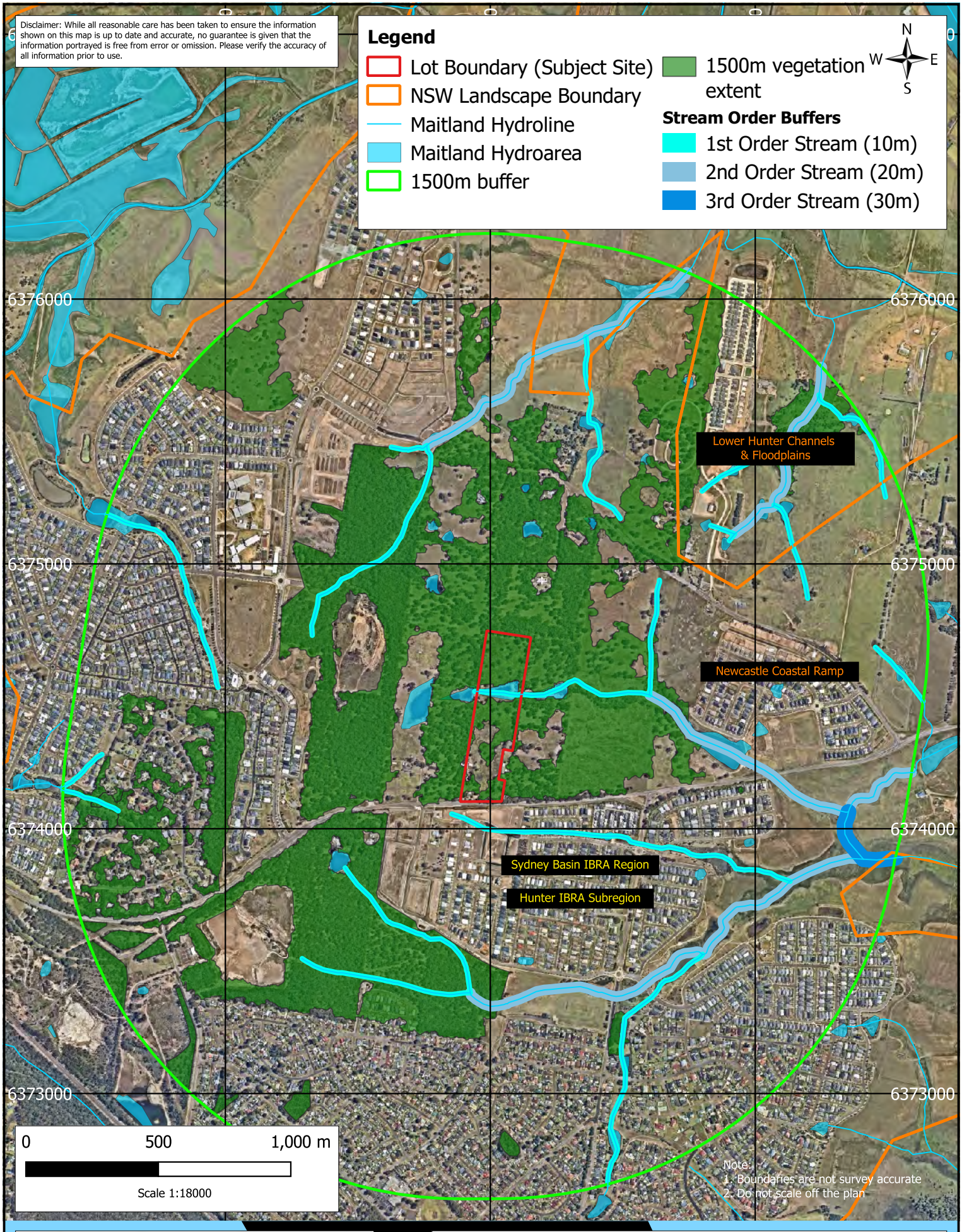
Title: Figure 1 - Site Map

Date: April 2023

Location: 523 Raymond Terrace Rd, Chisholm

AEP ref: 2713

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson



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Title: Figure 2 - Site Location

Date: January 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson AEP ref: 2713

1.2 Landscape Features

1.2.1 Regional Landscapes

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

- IBRA Bioregion: Sydney Basin;
- IBRA Subregion: Hunter; and
- NSW Landscape: Newcastle Coastal Ramp Delineation of NSW Landscape areas are shown in Location Maps (**Figure 2**).

1.2.2 Identified Landscape Features

The BAM Calculator identifies nine (9) landscape features that require assessment for their relevance to the Subject Site. These features are outlined in **Table 2**.

Table 2 – Landscape Feature Assessment

Landscape Feature	Assessment
Rivers and Streams	Three (3) farm dams are recorded within the Subject Site, with one (1) unnamed first order watercourse mapped across the central portion of the site leading from the largest of the farm dams. A preliminary inspection of aquatic features within the Subject Site, was undertaken during a field survey, which it was noted that there was a lack of watercourse features reflecting a continuous stream, as indicated by the regional mapping. Further assessment and consultation with Department of Planning Industry and Environment (Water) (DPIE -Water) is required to determine if *Section 91* of the *Water Management Act, 2000 (*WM Act*)* is triggered but it is likely that a Controlled Activities Approval (CAA) is required.
Wetlands	No mapped wetlands (SEPP Resilience and Hazards 2021 or otherwise) occur within the site. Three (3) artificial dams were recorded within the Subject Site.
Native Vegetation Extent	Approximately 2.42ha of native vegetation occurs within the Subject Site. PCTs occurring within the Subject Site are as follows: • PCT 1598 *Forest Red Gum grassy open forest on floodplains of the lower Hunter* (moderate condition) (0.18ha); • PCT 1600 *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* (canopy only degraded, and moderate condition) (0.87ha & 0.99ha); and • PCT 1736 *Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter* (poor condition) (0.37ha). PCT 1600 is likely commensurate with the listed *BC Act,* Endangered: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (Equivalent) largely equivalent to; Listed *BC Act,* E: Central Hunter Ironbark–Spotted Gum–Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions, however, it does not qualify as the Commonwealth listed *EPBC* Central Hunter Valley eucalypt forest and woodland. It is noted here that although the State and Commonwealth EECs were considered and assessed, neither EEC's were able to be assigned to this PCT within the BAM-C and therefore were not entered as a TEC in the BAM-C. PCT 1598 is likely commensurate with the listed *BC Act,* Endangered: Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions (Equivalent) largely equivalent to; Listed BC Act, E: Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion. PCT 1736 is likely commensurate with listed *BC Act*, E: Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions. Further assessment of federal level associations are provided in **Appendix G**.
Connectivity Features	The Subject Site lies within a moderately fragmented landscape with cleared paddocks and residential lots surrounding the township of Chisholm. The north and

Landscape Feature	Assessment
	eastern portions of the site are bounded by dense native canopy but moderately cleared lower strata. These surrounding lots provide higher habitat and biodiversity values than offered by the Subject Site, which does not function as a part of a corridor. The most significant native remnant corridors close to the Subject Site are the mosaic of native patches running parallel to the site approx. 300m northwest zoned C2.
Karst, Caves, Crevices, Cliffs, Rock and other Geological Features of Significance	There are no identified karst, caves, crevices, cliffs, rock and other geological features of significance within the Subject Site.
NSW Landscape	The Subject Site occurs within the Newcastle Coastal Ramp.
Soil hazard features	None known on site.
Features identified by the Secretary's Environmental Assessment Requirements (SEARs)	No SEARs apply to this proposal.
Areas of Outstanding Biodiversity Value (AOBV) under the BC Act:	No areas of AOBV are present on the Subject Site or the adjacent lands.

1.3 Site Context Components

1.3.1 Method

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

1.3.2 Landscape Native Vegetation Cover

The Assessment Area, consisting of a 1500m buffer placed around the Subject Site, covers approximately 958.47ha. Approximately 242.07ha comprises native vegetation as per Section 4.3.2 of the BAM. This equates to approximately 25.25% native vegetation cover and was entered as such within the BAM Calculator.

1.4 Native Vegetation

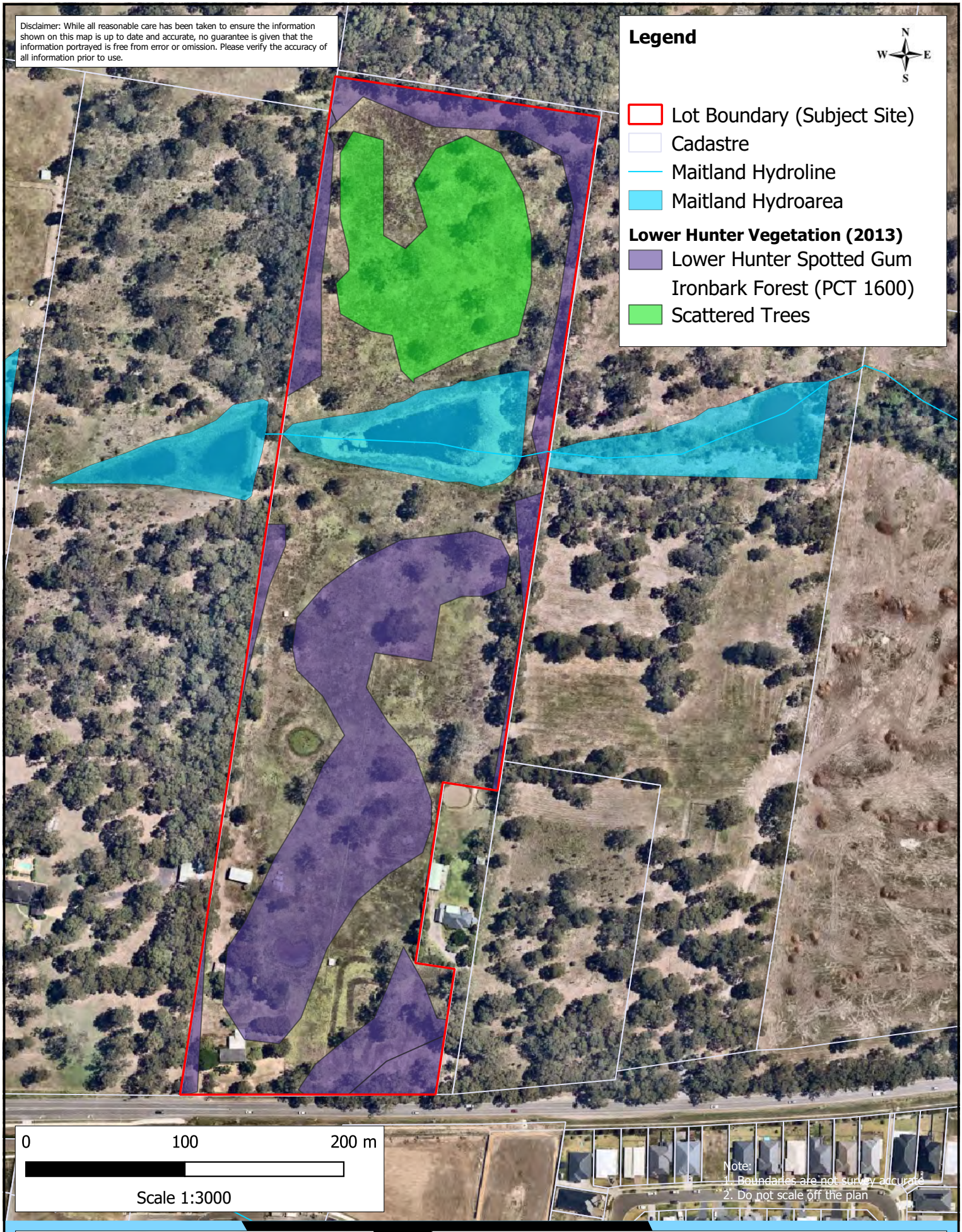
1.4.1 Regional Mapping

Regional vegetation mapping utilised for the site was Lower Hunter Regional Vegetation (Parsons Brinkerhoff, 2013). The vegetation communities mapped within the area, and their extent, are provided in **Table 3** and **Figure 3.**

Regional vegetation mapping served as a basis for preliminary site assessment. Ground-truthing of vegetation by AEP (2022) was the prime source of data to inform Plant Community Type determination in the present assessment.

Table 3 - Regional Vegetation Mapping Results

PCT ID	PCT Name	Area (ha)
1600	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	3.52
0	Scattered Trees	1.33
0	Unmapped	5.32
	Total	**10.17**



AEP

Title: Figure 3 - Regional Vegetation Mapping Date: April 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson AEP ref: 2713

1.4.2 Plot Based Floristics Surveys

Flora surveys were undertaken by AEP in September 2022 and October 2022 to produce a flora species list for the Subject Site, to search specifically for threatened flora and fauna species known to occur within the wider area, and to gather data necessary to both derive vegetation community type(s) and to meet relevant survey guidelines. Such works included:

- Ground-truthing of vegetation mapping to identify all vegetation communities present onsite as well as segregate vegetation zones according to condition and current management practices;
- Systematic coverage of the site using the Random Meander Technique (Cropper 1993); and
- A total of seven (7) BAM plots were undertaken by AEP within the remnant native and other vegetation present within the Subject Site. Plots were located randomly within each vegetation zone. Minor modifications to plot locations were made on site due to factors such as ecotones and proximity to disturbed edges.

A summary of the plot data and field sheets are provided in **Appendix D**. The location of BAM Plots are depicted in **Figure 4**.

1.4.2.1 Plant Community Types (PCTs) and Vegetation Zones

The Subject Site contains a number of fenced paddocks in various conditions, including pasture improved areas, degraded exotic grassland featuring scattered canopy trees, and remnant exotic planted vegetation. Degraded paddocks with native canopy are the most dominant throughout the site, with smaller areas along the eastern and western boundaries containing stands of high-quality vegetation.

A mapped Hydroline crosses the site, forming a stagnant water body that contains some wetland-associated vegetation in poor condition. There are also two small farm dams in the Southwestern portion of the site. The site also contains other features, such tracks, piles of discarded waste, abandoned infrastructure and internal fencing. Two BAM plots were undertaken within exotic and planted vegetation on site, which returned no PCT matches due to low native cover of less than 15% NVE ground cover and did not qualify as native. The remaining five (5) plots, were undertaken in native vegetation in various conditions.

Where the scattered grassland and remnant canopy occurs, three (3) Plant Community Types (PCTs) were identified:

- **PCT 1598** *Forest Red Gum grassy open forest on floodplains of the lower Hunter* (moderate condition);
- **PCT 1600** *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* (canopy only degraded and moderate condition); and
- **PCT 1736** *Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter* (poor condition).

The remainder of the project area consists of cleared/weeds and/or overgrown planted exotic vegetation. Areas that were cleared or dominant with weeds and/or non-native pasture were grouped and validated as not being assigned to a PCT. Many of these areas lacked structural diversity and were dominated by one (1) or two (2) weed species, most notably *Ehrharta erecta* (Panic Veldtgrass) and *Lantana camara* (Lantana).

An abundance of high threat weeds are present throughout the site including *Ehrharta erecta* (Panic Veldtgrass), *Lantana camara* (Lantana), *Phoenix canariensis* (Canary Island Date Palm), *Asparagus plumosus* (Climbing Asparagus Fern), *Cinnamomum camphora* (Camphor Laurel), *Ligustrum lucidum*

(Large-leaved Privet), *Pinus spp., Bidens pilosa* (Cobbler's Pegs), *Olea europaea subsp. cuspidata* (African Olive), *Cenchrus clandestinum* (Kikuyu), *Chlorophytum comosum* (Spider Plant), *Senecio madagascariensis* (Fireweed), *Asparagus aethiopicus* (Asparagus Fern), *Ochna serrulata* (Mickey Mouse Plant), *Bryophyllum delagoense* (Mother of Millions), *Eragrostis curvula* (African Lovegrass), *Pistia stratiotes* (Water Lettuce) and *Axonopus fissifolius* (Narrow-leaved Carpet Grass).

Fieldwork identified four (4) vegetation zones within the Subject Site which are described in **Section 1.4.3**. Ground-truthed PCT and vegetation zone mapping for the Subject Site is shown in **Figure 4**. BAM plot photographs are included in the body of the report and additional site photographs are provided in **Appendix F**.

1.4.3 PCT Selection Justification

The BAM's assessment module requires the identification of the PCT or the most likely PCTs, and all TECs, on the Subject Land. The identification must be in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification system. The identification of TECs must be consistent with the NSW Threatened Species Scientific Committee Final Determination for the TEC.

Diagnostic species recorded on site during fieldwork that support the determination of PCTs are shown in **Tables 4** and **5** below.

Table 4 – Species Data for Potential PCT Determination

Plot ID	Dominant Native Species	Diagnostic species present	Potential PCTs
1	*Corymbia maculata, Eucalyptus fibrosa, Lobelia purpurascens, Glochidion ferdinandi*	*Corymbia maculata, Eucalyptus fibrosa, Lobelia purpurascens*	1600
2	*Lobelia purpurascens, Oxalis perennans*	*Lobelia purpurascens*	Nil – degraded, not enough data to support a PCT
3	*Eucalyptus amplifolia, E. tereticornis, Corymbia maculata, Dichondra repens, Eucalyptus globoidea, Lobelia purpurascens, Oplismenus aemulus, Hardenbergia violaceae, Cymbopogon refractus, Imperata cylindrica*	*Eucalyptus amplifolia, E. tereticornis, Corymbia maculata, Dichondra repens, Lobelia purpurascens, Oplismenus aemulus, Hardenbergia violaceae, Cymbopogon refractus, Imperata cylindrica*	1598, 1600
4	*Eleocharis sphacelata, Cynodon dactylon, Juncus usitatus, Marsilea mutica, Centella asiatica, Ludwigia peploides subsp. montevidensis, Persicaria decipiens, Ranunculus inundatus, Spirodela punctata, Myriophyllum latifolium*	*Eleocharis sphacelata, Cynodon dactylon, Juncus usitatus, Ludwigia peploides subsp. montevidensis, Persicaria decipiens,*	1736
5	*Corymbia maculata, Eucalyptus paniculata, Cynodon dactylon, Microlaena stipoides, E. globoidea, Paspalidium distans, Dichondra repens, Lobelia purpurascens, Hardenbergia violaceae, Breynia oblongifolia, Dendrophtoe vittalina, Entolasia stricta, Dichelachne micrantha*	*Corymbia maculata, Microlaena stipoides, Dichondra repens, Lobelia purpurascens, Hardenbergia violaceae, Breynia oblongifolia, Entolasia stricta,*	1600
6	*Eucalyptus robusta, Melaleuca brateata, Hymenosporum flavum, Hibiscus heterophyllus, Corymbia eximia, Acmena smithii, Syzygium luemanii, Casuarina glauca, Callistemon viminalis*	*Nil – the following assemblage of species does not correlate with a PCT*	Nil – planted native

Plot ID	Dominant Native Species	Diagnostic species present	Potential PCTs
7	*Corymbia maculata, Cynodon dactylon, Lobelia purpurascens, Dichondra repens, Juncus usitatus, Glycine clandestina*	*Corymbia maculata, Lobelia purpurascens, Dichondra repens, Glycine clandestina*	1600

Review of floristic data concluded that plots and PCTs were associated as follows. Further justification is provided in **Tables 5** to **13**.

- PCT 1600: BAM plots 1, 5 & 7 in two conditions;
- PCT 1598: BAM plot 3;
- PCT 1736: BAM plot 4;
- Planted Native: BAM plot 6; and
- Exotic/Severely disturbed: BAM plot 2.

Table 5 – Decision making Key Planted Native (Appendix D, BAM 2020)

Item	Standard for Assessment	Options	AEP Assessment
1	Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?	**Yes** - The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied. **No** - Go to 2.	No – the native vegetation within the planted areas is not endemic to the area. Native canopy species include *Eucalyptus robusta* which typically occurs in coastal areas and *Corymbia eximia* which is usually found at higher elevations, these two trees would not typically co-occur. Other rainforest trees such as *Acmena smithii* and *Ficus rubiginosa* do not fit the area, with no remnant rainforest communities nearby. Native species within the mid-stratum are not locally endemic species, such as *Hymenosporum flavum* (Native Frangipani), *Hibiscus heterophylla* (Native Rosella) and *Melaleuca bracteata* (Black Tea Tree). The understorey contains <5% cover of locally endemic forbs and vines which could be reasonably assigned a PCT, however given the low cover score and proximity to native vegetation, these species have likely colonised from the adjacent bushland. Further to this, many of the planted species are common nursery plants that can be readily acquired. This assisted with determining that the vegetation was planted. It was also evident that the plants had been planted in stands (trees were of similar size and were planted in rows) to provide shade within a paddock and in association within the curtilage of house on site. **NO**
2	Is the planted native vegetation: a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat	**Yes** - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM. **No** - Go to 3.	a. The plants within the Subject Site were not planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9 (2.); and b. The primary objective was not to replace or regenerate a Plant Community Type or a threatened plant species population or its habitat, but to utilise native species for cover around horse paddocks and the curtilage of houses. **NO**
3	Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:	**Yes** - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM. **No** - Go to 4.	Refer Below
3	Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing		

Item	Standard for Assessment	Options	AEP Assessment
	threatened species habitat under one of the following:		
3a	A species recovery project		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of a species recovery project. **NO**
3b	Saving our Species project		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Saving our Species project. **NO**
3c	Other types of government funded restoration project.		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of other types of government funded restoration project **NO**
3d	Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat **NO**
3e	Legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g., Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act)		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g., Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act). **NO**
3f	Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan.		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan. **NO**
3g	Approved vegetation management plan (e.g., as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000).		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of an approved vegetation management plan (e.g., as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000). **NO**
4	Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or	**Yes** - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).	The planted vegetation within the Subject Site have not been planted / translocated for the purpose of a voluntarily revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation. **NO**

Item	Standard for Assessment	Options	AEP Assessment
	provide for management of the native vegetation?	**No** - Go to 5.	
5	Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or tea tree farms?	**Yes** - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). **No** - Go to 6.	The planted vegetation within the Subject Site was not planted / translocated for the functional, aesthetic, horticultural or plantation forestry purposes. **NO**
6	Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)?	**Yes** - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). **No** - There may be other types of occurrences of planted native vegetation that do not easily fit into the decision-making key above. Assessors should contact the BAM Support mailbox at bam.support@environment.nsw.gov.au for further advice on using the BAM to assess other types of occurrences of planted native vegetation.	The planted vegetation within the Subject Site is not planted native vegetation identified as being widely cultivated on a list approved by the Secretary of the Department (or an officer authorised by the Secretary. **NO**
Evidence demonstrating the application of the decision-making key to the areas of planted native vegetation must be provided in the BDAR or BCAR.			AEP Contacted BAM Support to assist with determining the appropriate assessment process with other projects to which the native planted principals apply. Following provision of information from BAM support, the planted native vegetation was assessed against the information provided and it was determined that the planted native vegetation module could be applied to some part of the vegetation across the site. Where applicable vegetation that could be assigned a PCT was assessed within the BAM-C.

It has been concluded that a portion of vegetation (0.23ha) within the proposed development could be assessed in accordance with **Appendix D.2** of the BAM 2020. **Appendix D.2** requires the assessor to

assess the planted native vegetation for the suitability for use by threatened species, recording results. It is noted that if the surveys show suitable habitat or record sighting of threatened species the assessor must apply **Section 8.4** of the BAM to mitigate and manage impacts as credits are not applied the offset the proposed impacts. The assessor must assess the suitability of the planted native vegetation for use by threatened species and record any incidental sightings or evidence (e.g., scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation.

The Subject Site area (0.23ha) that are classified as Planted Native Vegetation; as per BAM 2020, require no assessment for the percentage native vegetation cover when using the planted assessment method, therefore no Vegetation Integrity Score was required to be determined.

BAM Plot 6 Planted native & exotic

Table 6 – Determination of PCT 1600

Potential PCTs	1590	1593	1600	1601
Regional Vegetation	No	No	Yes – mapped within the site	No
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter	Hunter	Hunter
NSW Landscape	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp
LGA	Maitland	Maitland	Maitland	Maitland
Listed Key Diagnostic Species (VIS)	**Canopy Species:** *Corymbia maculata; Eucalyptus umbra; Eucalyptus fibrosa;* **Mid Stratum:** *Allocasuarina torulosa; Pultenaea villosa; Persoonia linearis; Breynia oblongifolia; Bursaria spinosa; Leucopogon juniperinus; Daviesia ulicifolia; Pandorea pandorana;* **Ground Stratum:** *Microlaena stipoides; Themeda australis; Imperata cylindrica; Cymbopogon refractus; Aristida vagans; Pratia purpurascens; Vernonia cinerea; Dianella caerulea; Lomandra multiflora; Lepidosperma laterale; Cheilanthes sieberi;*	**Canopy Species:** *Eucalyptus fibrosa; Corymbia maculata;* **Mid Stratum**: *Melaleuca nodosa; Bursaria spinosa; Melaleuca decora; Pultenaea spinosa; Acacia parvipinnula; Correa reflexa; Maytenus silvestris; Macrozamia flexuosa; Ozothamnus diosmifolius; Persoonia linearis; Myrsine variabilis;* **Ground Stratum:** *Aristida vagans; Entolasia stricta; Microlaena stipoides; Lepidosperma laterale; Dianella revoluta; Pomax umbellata; Goodenia rotundifolia; Cheilanthes sieberi;*	**Canopy Species:** *Corymbia maculata; Eucalyptus fibrosa; Eucalyptus crebra; Eucalyptus moluccana;* **Mid Stratum:** *Bursaria spinosa; Daviesia ulicifolia; Acacia parvipinnula; Breynia oblongifolia; Leucopogon juniperinus;* **Ground Stratum:** *Aristida vagans; Themeda australis; Lomandra confertifolia; Lomandra filiformis; Vernonia cinerea; Brunoniella australis; Pratia purpurascens; Cheilanthes sieberi;*	**Canopy Species:** *Corymbia maculata; Eucalyptus crebra; Eucalyptus fibrosa;* **Mid Stratum:** *Daviesia ulicifolia; Lissanthe strigosa; Bursaria spinosa; Acacia parvipinnula;* **Ground Stratum:** *Cymbopogon refractus; Aristida vagans; Aristida ramosa; Microlaena stipoides; Cheilanthes sieberi; Lomandra multiflora; Dianella revoluta; Pratia purpurascens; Brunoniella australis; Laxmannia gracilis;*
Present Key Diagnostic Species within Study Area	**Canopy Species:** *Corymbia maculata; Eucalyptus fibrosa;* **Mid Stratum:** *Allocasuarina torulosa;(outside plot) Breynia oblongifolia; Bursaria spinosa; Leucopogon juniperinus; Daviesia ulicifolia; Pandorea pandorana;* **Ground Stratum:** *Microlaena stipoides; Themeda australis; Imperata cylindrica; Cymbopogon refractus; Aristida vagans; Pratia purpurascens; Dianella caerulea; Lomandra multiflora;*	**Canopy Species:** *Eucalyptus fibrosa; Corymbia maculata;* **Mid Stratum**: *Bursaria spinosa; Acacia parvipinnula; Ozothamnus diosmifolius;* **Ground Stratum:** *Aristida vagans; Entolasia stricta; Microlaena stipoides;*	**Canopy Species:** *Corymbia maculata; Eucalyptus fibrosa; Eucalyptus moluccana;* **Mid Stratum:** *Bursaria spinosa; Daviesia ulicifolia; Acacia parvipinnula; Breynia oblongifolia; Leucopogon juniperinus;* **Ground Stratum:** *Aristida vagans; Themeda australis; Lomandra filiformis; Pratia purpurascens;*	**Canopy Species:** *Corymbia maculata; Eucalyptus fibrosa;* **Mid Stratum:** *Daviesia ulicifolia; Bursaria spinosa; Acacia parvipinnula;* **Ground Stratum:** *Cymbopogon refractus; Aristida ramosa; Aristida vagans; Microlaena stipoides; Cheilanthes sieberi; Lomandra multiflora; Pratia purpurascens;*
Absence of Key Diagnostic Species within the Study Area	**Canopy Species:** *Eucalyptus umbra;* **Mid Stratum:** *Pultenaea villosa; Persoonia linearis;* **Ground Stratum:** *Vernonia cinerea; Lepidosperma laterale;*	**Canopy Species:** **Mid Stratum**: *Melaleuca nodosa; Melaleuca decora; Pultenaea spinosa; Correa reflexa; Maytenus silvestris; Macrozamia flexuosa; Persoonia linearis; Myrsine variabilis;* **Ground Stratum:** *Lepidosperma laterale; Dianella revoluta; Pomax umbellata; Goodenia rotundifolia;*	**Canopy Species:** *Eucalyptus crebra;* **Mid Stratum:** Nil **Ground Stratum:** *Lomandra confertifolia; Vernonia cinerea; Brunoniella australis;*	**Canopy Species:** *Eucalyptus crebra;* **Mid Stratum:** *Lissanthe strigosa;* **Ground Stratum:** *Dianella revoluta; Brunoniella australis; Laxmannia gracilis;*
PCT Description	Open forests with a canopy dominated by Corymbia maculata. The mid-storey consists of a diverse open shrub layer along with various small climbers. The ground layer in characteristically grassy with a mix of forbs; small ferns and other graminoids.	Open forests with a canopy dominated by Eucalyptus fibrosa. The mid-storey consists of a diverse open shrub layer. The ground layer is typically dominated by grasses with forbs and small ferns.	Open forests with a canopy dominated by Corymbia maculata. The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.	Open forests with a canopy dominated by Corymbia maculata and Eucalyptus crebra. The mid-storey consists of a sparse shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.
Vegetation Formation	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);
Vegetation Class	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;
Geographical Restrictions	Flats; low rises (hillslopes); Low ranges of the lower Hunter Valley and Central Coast at lower elevations	Flats; low rises; Restricted to the lower Hunter Valley.	Hillslopes; low rises; Restricted to the lower Hunter Valley.	Flats, Central and Lower Hunter Valley.
Elevation	Information not available	Information not available	Information not available	Information not available

Potential PCTs	1590	1593	1600	1601
Soil Profiles	Sandstone, Conglomerate	Information not available	Siltstone, Conglomerate	Conglomerate, Sandstone
Habitat Restrictions	PCT 1590 occurs on low ranges of the lower Hunter Valley and Central Coast at lower elevations (Hunter Project). site data confirm its presence in Hunter, Karuah Manning, Upper Hunter, and Wyong SRs. It may also extend into Pittwater SR.	PCT 1593 occurs is restricted to the lower Hunter Valley (Hunter Project). Site/map data confine this PCT to Hunter and Wyong SRs, but it is likely to extend into Karuah Manning SR, and may be represented in lower parts of Upper Hunter and Yengo SRs.	PCT 1600 is restricted to the lower Hunter Valley, and occurs in Hunter, Karuah Manning, Upper Hunter, Wyong, and Yengo SRs (Hunter Project).	PCT 1601 occurs in central and lower Hunter Valley (Hunter Project). Site data associated this PCT with Hunter SR while map data extends it into Karuah Manning, Upper Hunter, Wyong, and Yengo SRs. It may also extend into Ellerston, Kerrabee, Mummel Escarpment, and Tomalla SRs.
PCT Determination	This community had a high match for diagnostic species, however due to the presence of canopy species present that were not described by this community, PCT 1600 was considered a better fit and was also regionally mapped within the site.	This community fit reasonably well for the site, however other communities contained a higher number of diagnostic species and were considered a better match. Therefore, this PCT was discounted.	The vegetation community is regionally mapped as occurring within the site, it contained one of the highest matches for diagnostic species and contained a higher number of canopy trees than similar PCTs and is considered the best fit for the site.	This PCT fits the site reasonably well with a good number of diagnostic species present, however other communities had a higher number of diagnostic species present and were considered a better fit. Therefore, this PCT was discounted.
Result	**PCT 1600**			
BAM Plots	1, 5 & 7			
Estimate cleared value of PCT (%)	71			
EEC	Listed BC Act, Endangered: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions. This PCT is considered to be commensurate with the state listed TEC.			
Vegetation Zones				
Vegetation Zones of PCT 1600 within Subject Site	Moderate Degraded condition			

Table 7 – PCT 1600 - Moderate

Category	Description
Description of Vegetation Zone	This vegetation zone occurs on the boundaries of the site and contained a greater diversity that within the rest of the site. These areas are moderately disturbed, natural regeneration is present and residual species persist within the mid and ground stratums. **Canopy Stratum:** The canopy is dominated by *Corymbia maculata* which co-occurs with a number of other Eucalypt species including ironbarks; *Eucalyptus fibrosa, E. siderophloa* and *E. paniculata*, stringybark; *E. globoidea,* and occasional *E. moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. acmenoides* (White Mahogany). **Mid-Stratum:** The midstory is generally sparse with occasional individuals of *Ozothamnus diomifolius, Acacia parvipinnula, Acacia falcata, Leucopogon juniperinus, Daviesia ulicifolia, Notelaea ovata, Breynia oblongifolia* and *Exocarpus cupressiformis.* **Ground-Stratum:** The ground stratum possesses a mix of native and exotic species, containing native grasses; *Entolasia stricta, Dichelachne crinita, Aristida vagans, Microlaena stipoides* and *Themeda triandra*. Common forbs include; *Dichondra repens, Lobelia purpurascens* and *Dianella longifolia*. Climbers such as *Hardenbergia violaceae* and *Glycine clandestina* were common, and the sedge, *Lomandra multiflora*. **Common weeds:** Exotic species are prominent throughout this zone and included exotic grasses and other common pasture weeds such as, *Sida rhombifolia*, *Lolium perrenne* (Perennial Ryegrass), *Hypochaeris radicata* (Catsear), *Trifolium repens* (White Clover). High threat exotic species include, *Cenchrus clandestinum* (Kikuyu), *Ehrharta erecta* (Panic Veldtgrass), *Bidens pilosa* (Farmers Friends) and *Senecio madagascariensis* (Fireweed).
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.99ha of the Subject Site.
Plot	5

PCT 1600 Moderate Condition BAM Plot 5

Table 8 – PCT 1600 – Degraded Condition

Category	Description
Description of Vegetation Zone	This vegetation zone consists of scattered trees and saplings with a low abundance of native groundcovers and occurs throughout the site. These areas contain a high cover of exotic grasses along with native forbs and grasses. This vegetation zone has been highly degraded by livestock in the past but has been left for some time, which is evident by the presence of regenerative canopy species. **Canopy Stratum:** *Corymbia maculata, Eucalyptus fibrosa*, *E. paniculata, E. moluccana, E. tereticornis* and *E. siderophloa.* **Mid-Stratum:** mostly absent. **Ground-Stratum:** The ground stratum possesses a low number of native species, consisting of mostly forbs, *Dichondra repens* and *Lobelia purpursascens*, climber, *Glycine clandestina* and native grass, *Dichelachne crinita*. **Common weeds:** Exotic species are prominent throughout this zone and included exotic grasses and other common pasture weeds such as, *Sida rhombifolia*, *Plantago lanceolata* (Lambs tongue), *Briza spp*, *Hypochaeris radicata* (Catsear), *Trifolium repens* (White Clover) High threat exotic species include, *Cenchrus clandestinum* (Kikuyu), *Ehrharta erecta* (Panic Veldtgrass), *Bidens pilosa* (Farmers Friends) and *Senecio madagascariensis* (Fireweed).
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.87ha of the Subject Site.
Plots	1 & 7

PCT 1600 Degraded Condition BAM Plot 1

PCT 1600 Degraded Condition BAM Plot 7

Table 9 – Determination of PCT 1598

Potential PCTs	1594	1598	1726
Regional Vegetation	No	No – mapped nearby	No
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter	Hunter
NSW Landscape	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp
LGA	Maitland	Maitland	Maitland
Listed Key Diagnostic Species (VIS)	**Canopy Species**: *Eucalyptus amplifolia; Angophora floribunda; Eucalyptus tereticornis;* **Mid Stratum**: *Acacia parvipinnula; Cassinia uncata; Duboisia myoporoides; Hakea sericea;* **Ground Stratum:** *Paspalidium distans; Cynodon dactylon; Panicum simile; Lomandra confertifolia; Dianella revoluta; Oxalis perennans; Veronica plebeia;*	**Canopy Species:** *Eucalyptus tereticornis; Eucalyptus punctata; Angophora floribunda;* **Mid Stratum:** *Breynia oblongifolia; Leucopogon juniperinus; Daviesia ulicifolia; Persoonia linearis; Jacksonia scoparia;* **Ground Stratum:** *Microlaena stipoides; Cymbopogon refractus; Imperata cylindrica; Pratia purpurascens; Cheilanthes sieberi; Lomandra multiflora; Pomax umbellata;*	**Canopy Species**: *Eucalyptus amplifolia;* **Mid Stratum:** *Melaleuca linariifolia; Melaleuca ericifolia;* **Ground Stratum:** *Carex appressa; Juncus usitatus; Echinopogon ovatus; Alternanthera denticulata; Entolasia marginata; Cynodon dactylon;*
Present Key Diagnostic Species within Study Area	**Canopy Species**: *Eucalyptus amplifolia; Eucalyptus tereticornis;* **Mid Stratum**: *Acacia parvipinnula;* **Ground Stratum:** *Paspalidium distans; Cynodon dactylon; Oxalis perennans; Veronica plebeia;*	**Canopy Species:** *Eucalyptus tereticornis;* **Mid Stratum:** *Breynia oblongifolia; Leucopogon juniperinus; Daviesia ulicifolia;* **Ground Stratum:** *Microlaena stipoides; Cymbopogon refractus; Imperata cylindrica; Pratia purpurascens; Cheilanthes sieberi; Lomandra multiflora;*	**Canopy Species**: *Eucalyptus amplifolia;* **Mid Stratum:** **Ground Stratum:** *Juncus usitatus; Cynodon dactylon;*
Absence of Key Diagnostic Species within the Study Area	**Canopy Species**: *Angophora floribunda;* **Mid Stratum**: *Cassinia uncata; Duboisia myoporoides; Hakea sericea;* **Ground Stratum:** *Panicum simile; Lomandra confertifolia; Dianella revoluta;*	**Canopy Species:** *Eucalyptus punctata; Angophora floribunda;* **Mid Stratum:** *Persoonia linearis; Jacksonia scoparia;* **Ground Stratum:** *Pomax umbellata;*	**Canopy Species**: **Mid Stratum:** *Melaleuca linariifolia; Melaleuca ericifolia;* **Ground Stratum:** *Carex appressa; Echinopogon ovatus; Alternanthera denticulata; Entolasia marginata;*
PCT Description	Open forests with a canopy dominated by Eucalyptus amplifolia. The mid-storey consists of an open shrub layer and the ground layer is typically grassy.	Open forests with a canopy dominated by Eucalyptus tereticornis. The mid-storey consists of an open shrub layer. The ground layer is dominated by grasses with sparse graminoids and forbs	Myrtaceous Tall Shrublands with occasional emergent Eucalypts. The ground stratum is characterised by sedges and related species with some grasses favouring wet conditions.
Vegetation Formation	Forested Wetlands;	Forested Wetlands;	Forested Wetlands;
Vegetation Class	Coastal Floodplain Wetlands;	Coastal Floodplain Wetlands;	Coastal Swamp Forests;
Geographical Restrictions	PCT 1594 occurs on floodplains of the Lower Hunter Valley (Hunter Project). Thus, likely to be confined to Hunter SR, extending into Karuah Manning SR to the north as evidenced by site data, and possibly Wyong SR to the south. Site association with Ellerston and Mummel Escarpment SRs is not likely to be correct for this Lower Hunter PCT.	Floodplain; Open forests with a canopy dominated by Eucalyptus tereticornis. The mid-storey consists of an open shrub layer. The ground layer is dominated by grasses with sparse graminoids and forbs. There are no site data or descriptive distributional data for PCT 1598, however given its title it is likely to occur in Hunter SR, and extend into Karuah Manning and Pittwater SRs.	PCT 1726 is found in poorly drained sites and on some waterways on the lower Central Coast and hinterlands, at elevations of 5 to 200 m (Hunter Project). site data associate this PCT with Wyong and Yengo SRs. It may also occur in Pittwater SR.
Elevation	Information not available	Information not available	5-200m
Soil Profiles	Sandstone	Information not available	Sandstone
Habitat Restrictions	Flats; Occurs of floodplains of the Lower Hunter Valley.	Floodplain; Open forests with a canopy dominated by *Eucalyptus tereticornis*. The mid-storey consists of an open shrub layer. The ground layer is dominated by grasses with sparse graminoids and forbs.	Swamps; valley floors; This community is found in poorly drained sites and on some waterways on the lower Central Coast and hinterlands. Elevations range from 5 to 200m.
PCT Determination	While this community contains *E. amplifolia* as a dominant canopy species in conjunction with *E. tereticornis* which is generally present with the community on site, PCT 1598 is mapped nearby and contains a greater	The vegetation on site contained the highest floristic match with this PCT, this community is also mapped within the area. While canopy tree, *Eucalyptus amplifolia* is prominent within the site and is not considered a diagnostic species of	No melaleucas were present within the site which is inconsistent with the description of this PCT, despite a number of diagnostic species present, the assemblage of species and structure of the community present on site is

Potential PCTs	1594	1598	1726
	number of diagnostic species, therefore PCT 1598 is considered to be the best fit.	this PCT, in vegetation descriptions of this community such as LHCCREMS 2000 (MU 19 - Hunter Lowlands Redgum Forest) this community is generally found to intergrade with spotted gum ironbark communities and may contain E. amplifolia, which is resonate with the communities present within the site. As such, this community was determined to be the best fit.	generally inconsistent with this PCT, as such other communities were considered a better fit.
Result	**PCT 1598**		
BAM Plots	3		
Estimate cleared value of PCT (%)	0		
EEC	Listed *BC Act*, Endangered: Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions and Listed BC Act, Endangered: Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion. This PCT is considered to be commensurate with the state listed TEC.		
Vegetation Zones			
Vegetation Zones of this PCT within Subject Site	Moderate Condition		

Table 10 – PCT 1598 - Moderate Condition

Category	Description
Description of Vegetation Zone	This vegetation zone is located along the dammed hyrdoline in the north of the site. The vegetation contains a dense stand of predominantly *Eucalyptus amplifolia*, in conjunction with various other eucalypt species such as *E. tereticornis, E. globoidea, E. acmenoides, E. moluccana* and *Corymbia maculata*. The shrub layer contains a sparse native cover with thickets of Lantana, the understorey is diverse, though moderately disturbed. There is some overlap in assemblage with PCT 1600, however due to the presence of the drainage line and prominence of *E. amplifolia,* this PCT was included. **Canopy Stratum:** The canopy is dominated by *E. amplifolia* and to a lesser extent *E. tereticornis* and *Corymbia maculata.* **Mid-Stratum:** The midstratum was generally sparse and contained a number of native species including, *Ozothamnus diomifolius, Leucopogon juniperinus, Breynia oblongifolia, Notelaea ovata, Indigophora australis* and *Exocarpus cupressiformis*. **Ground-Stratum:** The groundcover was diverse containing grasses, *Paspalidium distans, Aristida vagans, Cymbopogon refractus, Sporobolus creber, Imperata cylindrica, Oplismenus aemulus and Entolasia stricta,* prominent forb species included *Dichondra repens, Lobelia purpurascens, Brachyscome multifida, Dianella longifolia, Poranthera microphylla, Wahlenbergia gracilis* and fern *Cheilanthes sieberi.* **Common weeds:** *Plantago lanceolata* (Lambs Tongue) and *Sida rhombifolia* were prominent within the groundcovers. High threat exotics include; *Lantana camara* (Lantana) which formed thickets within the midstratum, *Ehharta erecta* (Panic Veldtgrass) was prominent in the groundcover and to a lesser extent *Cenchrus clandestinum* (Kikuyu) and *Senecio madagascariensis* (Fireweed).
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.18ha of the Subject Site.
Plots	3

PCT 1598 Moderate Condition BAM Plot 3

Table 11 – Determination of PCT 1736

Potential PCTs	1736	1737	1740
Regional Vegetation	No – mapped nearby	No	No
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter	Hunter
NSW Landscape	Information not provided	Information not provided	Information not provided
LGA	Information not provided	Information not provided	Information not provided
Listed Key Diagnostic Species (VIS)	**Canopy Species**: **Mid Stratum**: *Melaleuca linariifolia; Melaleuca styphelioides;* **Ground Stratum:** *Paspalum distichum; Eleocharis sphacelata; Juncus usitatus; Ludwigia peploides; Epaltes australis; Persicaria decipiens; Persicaria hydropiper; Cynodon dactylon;*	**Canopy Species:** *Melaleuca quinquinervia* **Mid Stratum:** **Ground Stratum:** *Typha orientalis; Persicaria strigosa; Cladium procerum; Cynodon dactylon;*	**Canopy Species**: **Mid Stratum:** **Ground Stratum:** *Eleocharis sphacelata; Philydrum lanuginosum; Ludwigia peploides;*
Present Key Diagnostic Species within Study Area	**Canopy Species**: **Mid Stratum**: **Ground Stratum:** *Eleocharis sphacelata; Juncus usitatus; Ludwigia peploides; Persicaria decipiens; Cynodon dactylon;*	**Canopy Species:** **Mid Stratum:** **Ground Stratum:** *Typha orientalis; Cynodon dactylon;*	**Canopy Species**: **Mid Stratum:** **Ground Stratum:** *Eleocharis sphacelata; Ludwigia peploides;*
Absence of Key Diagnostic Species within the Study Area	**Canopy Species**: **Mid Stratum**: *Melaleuca linariifolia; Melaleuca styphelioides;* **Ground Stratum:** *Paspalum distichum; Epaltes australis; Persicaria hydropiper;*	**Canopy Species:** *Melaleuca quinquinervia* **Mid Stratum:** **Ground Stratum:**	**Canopy Species**: **Mid Stratum:** **Ground Stratum:** *Philydrum lanuginosum;*
PCT Description	Freshwater wetlands containing areas of open water. The community is generally dominated by spike rushes; grasses or semi-aquatic species depending on the local level and duration of inundation. Myrtaceous shrubs may be present as emergent.	Tall Rushlands dominated by Typha| Melaleuca may occur as isolated emergent.	Freshwater Wetlands dominated by spike rushes. All three listed species may be common depending on local site conditions.
Vegetation Formation	Freshwater Wetlands;	Freshwater Wetlands;	Freshwater Wetlands;
Vegetation Class	Coastal Freshwater Lagoons;	Coastal Freshwater Lagoons;	Coastal Freshwater Lagoons;
Geographical Restrictions	PCT 1736 occurs on poorly drained sites on the coastal lowlands from Paxton to just north of Raymond Terrace (Hunter Project). Probably confined to the Hunter and Karuah Manning SRs, but may extend into the Upper Hunter, Wyong, and Yengo SRs.	This community typically occurs at the margins of standing fresh water along the coast from about Woy Woy to Hexham| there is one isolated occurrence in the Goulburn River NP. Substrates are generally sands and muds.	PCT 1740 occurs at elevations below 30 m, from Wyong to Failford on coastal alluvial sands and muds (Hunter Project). Occurs in the Hunter, Karuah Manning, and Wyong SRs, possibly extending into Pittwater SR.
Elevation	1-120m	<50m, up to 367m further inland	<30m
Soil Profiles	Information not available	Sandstone	Information not available
Habitat Restrictions	Flats; open water edges; This community occurs on poorly drained sites on the coastal lowlands from Paxton to just north of Raymond Terrace. Substrates are unconsolidated sediments and elevation ranges from 1 to 120m.	Flats; local ponding	Closed depressions;
PCT Determination	This PCT had the best diagnostic fit for the site, containing rushes, grasses and semi-aquatic species. Based on distribution, this PCT was also a better fit than other similar communities.	Typha dominates in degraded farm dams on the site, however in the larger water body, PCT 1736 had a higher floristic match.	This PCT was a reasonable fit for the community on site, however PCT 1736 had a higher diagnostic fit.
Result	**PCT 1736**		

Potential PCTs	1736	1737	1740
BAM Plots	4		
Estimate cleared value of PCT (%)	0.8		
EEC	Listed BC Act, Endangered: Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This PCT is considered to be commensurate with the state listed TEC.		
Vegetation Zones			
Vegetation Zones of this PCT within Subject Site	Poor Condition		

Table 12 – PCT 1736 - Poor Condition

Category	Description
Description of Vegetation Zone	This vegetation zone is located along the edge of the dammed hyrdoline in the north of the site. The vegetation contains a combination of freshwater plants including a small portion of free-floating vegetation; *Spirodela punctata* (Duckweed) and exotic, *Pistia stratiotes* (Water Lettuce). This zone is dominated by *Eleocharis sphacelata* (Tall Spike-rush) with a greater diversity of vegetation occurring on the waters edges and banks, including fern, *Marsilea mutica*, forbs, *Ludwigia peploides* (Water Primrose), *Persicaria decipiens* (Slender Knotweed), *Ranunculus inundatus* (River Buttercup), common rush, *Juncus usitatus* and grass, *Cynodon sp.* (Common Couch). **Canopy Stratum:** Absent. **Mid-Stratum:** Absent. **Ground-Stratum:** The vegetation contains a combination of freshwater plants including a small portion of free-floating vegetation; *Spirodela punctata* (Duckweed) and exotic, *Pistia stratiotes* (Water Lettuce). This zone is dominated by *Eleocharis sphacelata* (Tall Spike-rush) with a greater diversity of vegetation occurring on the waters edges and banks, including fern, *Marsilea mutica*, forbs, *Ludwigia peploides* (Water Primrose), *Persicaria decipiens* (Slender Knotweed), *Ranunculus inundatus* (River Buttercup), common rush, *Juncus usitatus* and grass, *Cynodon sp.* (Common Couch). **Common weeds:** *Pistia stratiotes* (Water Lettuce) was observed in low abundance and is considered a High Threat Exotic (HTE)
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.37ha of the Subject Site.
Plots	4

PCT 1736 Poor Condition BAM Plot 4

1.4.4 Non-native / Cleared / Existing Infrastructure

A large portion of the Subject Site of 7.19ha has been identified as mostly exotic vegetation on cleared land that has been pasture improved and degraded by cattle. However, the land has been vacant for a period of time and natural regeneration is present on the edges of the lot, adjacent to higher quality vegetation. The dominant exotic species that occurred throughout this area included predominantly pasture weeds and grasses, *Cenchrus clandestinum* (Kikuyu), *Axonopus fissifolius* (Narrow-leaved Carpet Grass), *Senecio madagascariensis* (Fireweed), *Verbena spp* (Purpletop) *and Plantago lanceolata* (Ribwort). Anthropogenic species *Cynodon sp.* (Common Couch) was prevalent; common native forbs included: *Lobelia purpurascens* (White Root) *and Centella asiatica* (Swamp Pennywort). Although some native species were present, these areas were not included in the PCT determination as they contained primarily exotic species and no community could be associated (VIS score of <5) **refer BAM plot 2** below.

Also included with this calculation is 0.30ha of land that has been identified as water bodies in the form of farm dams. An area of planted vegetation of 0.23ha was present north of the house, which contained a mix of exotic and native species, no PCT was able to be assigned as discussed in the planted native section. Current infrastructure existing as a previously utilised residential dwelling with associated farming and garden sheds covered an area of 0.08ha, with the total area not assigned to a PCT of 7.81ha.

High threat exotic weeds present include: *Cenchrus clandestinum* (Kikuyu), *Axonopus fissifolius* (Narrow-leaved Carpet Grass), *Senecio madagascariensis* (Fireweed), *Bidens pilosa* (Cobbler's Pegs*), Ehrharta erecta* (Panic Veldtgrass), *Lantana camara* (Lantana), *Bryophyllum delagoense* (Mother of Millions*), Eragrostis curvula* (African Lovegrass), *Pistia stratiotes* (Water Lettuce) and *Eichornia crassipes* (Water Hyacinth).

Non-native / Cleared

BAM Plot 2 Exotic

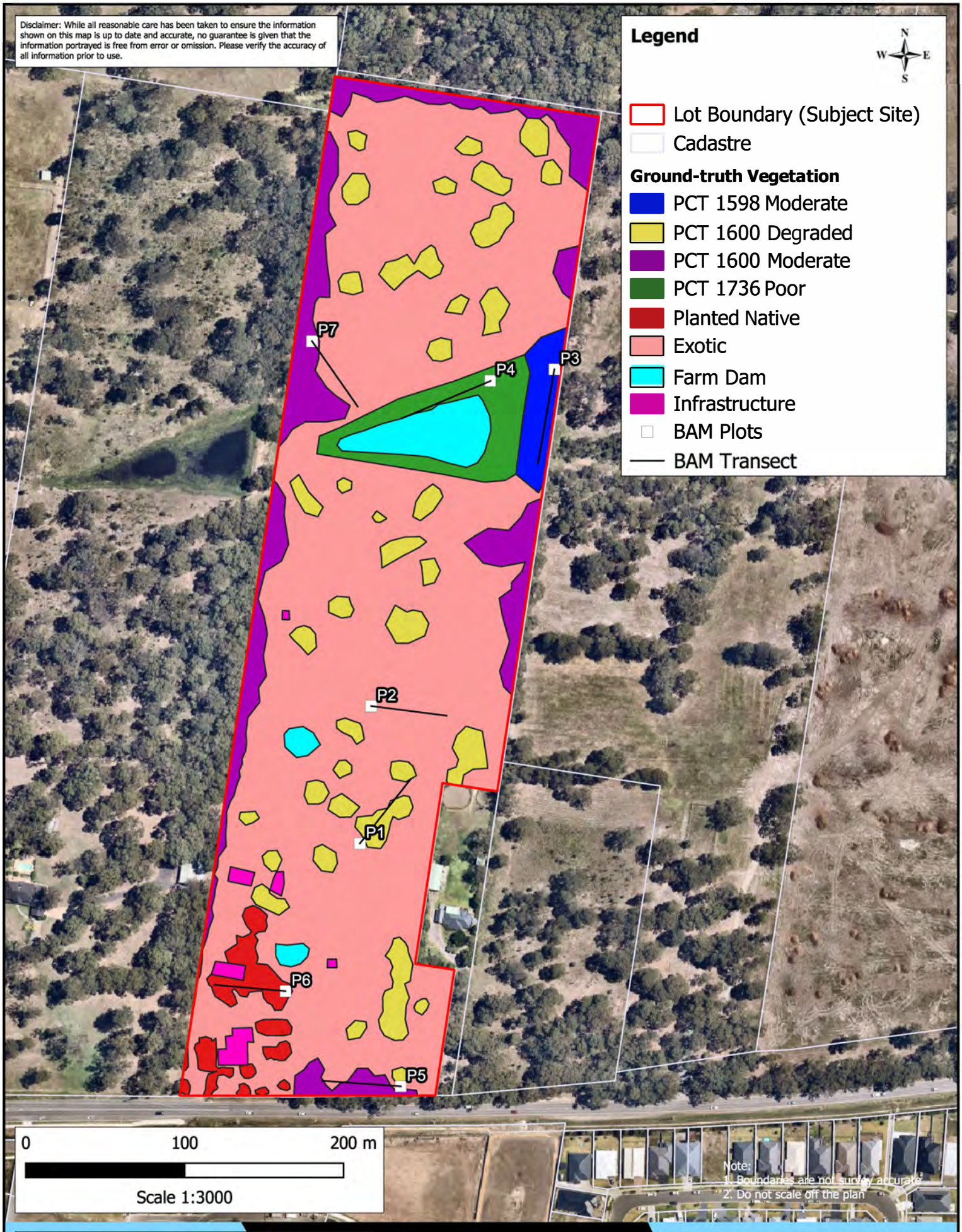
Additional site photographs are included in **Appendix F**.

Table 13 provides a summary of the vegetation within the Site.

Table 13 – Summary of Vegetation Zones Areas

Zone	Vegetation Community	Condition	Total Subject Site / Area of Removal (ha)
1	PCT 1600	Moderate	0.99
2	PCT 1600	Degraded	0.87
3	PCT 1598	Moderate	0.18
4	PCT 1736	Poor	0.37
Total Native Vegetation (ha)			**2.42**
Non-remnant / cleared areas / rural / exotic / planted native/ farm dams/infrastructure			7.81
Total (ha)			**10.23**

Discrepancies in numbers are due to rounding.



AEP

Title: Figure 4 - Ground-truthed Vegetation Map Date: April 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson AEP ref: 2713

1.4.5 Vegetation Integrity Assessment

1.4.5.1 Patch Size

The native vegetation that exists within the Subject Site is connected to vegetation to the north, south, east and west that, as defined by the BAM, extends as a patch of more than 100ha. The maximum patch size of '≥100ha' is therefore appropriate for each vegetation zone and was entered as such within the Calculator.

1.4.6 Vegetation Integrity Score

Plot data was used to determine the composition, structure and function condition score the vegetation zones within the Subject Site, which informed the vegetation integrity score. Plot data has been tabulated (refer **Tables 14 & 15**) and includes corresponding condition scores along with the overall vegetation integrity score. Vegetation Condition Class has been rated using the following percentage bands associated with the Vegetation Integrity Scores:

- 70 - 100 Good;
- 50 - 69 Moderate;
- 35 - 49 Poor;
- 25 - 34 Degraded;
- 16 - 24 Highly Degraded; and
- <15 Severely Degraded.

Table 14 – Vegetation Integrity Score for PCT 1600 – Canopy only degraded and Moderate condition

Site Attribute	PCT 1600 – Degraded Condition - Canopy only		PCT 1600 – Moderate Condition
Plot #	1	7	5
Location	373001E 6374262N	372971E 6374578N	373030E 6374169N
Bearing	30	136	257
Tree	3	1	5
Shrub	0	0	1
Grass & Grass-like	1	3	7
Forb	3	3	3
Fern	0	0	0
Other	0	2	3
Composition Condition Score	**11.2**		**42.9**
Tree	40.1	25	59.3
Shrub	0	0	1
Grass & Grass-like	0.2	2	10.9
Forb	1.1	9.3	4.5
Fern	0	0	0
Other	0	1	2.2
Structure Condition Score	**28.4**		**39.8**
Regenerating Stems (<5cm DBH)	Present	Present	Present
Stem Classes (cm DBH)	30-49, 50-79	5-9, 50-79	5-9, 10-19, 20-29, 30-49, 50-79
# Large Trees	2	3	3
Hollow-bearing Trees	1	1	1
Litter Cover (%)	16	22	31
Coarse Woody Debris (m)	14	9	20
High Threat Weed Cover	47	19.4	32.5
Function Condition Score	**57.1**		**82.9**
Current Vegetation Integrity Score	**26.3**		**52.1**

Table 15 - Vegetation Integrity Score for PCT 1598 and PCT 1736 – Moderate Condition and Poor Condition

Site Attribute	PCT 1598 – Moderate Condition	PCT 1736 – Poor Condition
Plot #	3	4
Location	373009E 6374348N	373107E 6374554N
Bearing	92	337
Tree	4	0
Shrub	6	0
Grass & Grass-like	10	2
Forb	11	6
Fern	0	0
Other	4	0
Composition Condition Score	**92.2**	**62.8**
Tree	43	0
Shrub	2	0
Grass & Grass-like	6.2	33
Forb	8.3	1.5
Fern	0	0
Other	2.3	0
Structure Condition Score	**22.5**	**27.2**
Regenerating Stems (<5cm DBH)	Present	-
Stem Classes (cm DBH)	5-9, 10-19, 20-29, 30-49	-
# Large Trees	1	-
Hollow-bearing Trees	0	-
Litter Cover (%)	33	-
Coarse Woody Debris (m)	11.5	-
High Threat Weed Cover	24.3	6
Function Condition Score	**99.3**	**-**
Current Vegetation Integrity Score	**59.1**	**36.9**

1.4.7 Assessment of State Listed Threatened Ecological Communities

The communities present within the Subject Site are associated with state listed Threatened Ecological Communities. **Tables 16** to **18** assess the vegetation communities within the Subject Site to determine if the communities present meet the State criteria for the listed communities.

Table 16 – Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions

Characteristics	Assessment of Vegetation Community – Subject Site
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures	The Beresfield Soil Landscape is generally undulating low hills and rises on Permian sediments in the East Maitland Hills region.
The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath. These substrates are said to produce 'moderately fertile' soils	Moderately deep (<120 cm), moderately well to imperfectly drained Yellow Podzolic Soils, Brown Podzolic Soils, and brown Soloths occur on crests. Highly acid soils of low fertility.
Lower Hunter Spotted Gum – Ironbark Forest is dominated by *Corymbia maculata*, (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), while *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark) occur occasionally.	**Upper stratum** present; *Corymbia maculata, Eucalyptus fibrosa,* (*Eucalyptus crebra* and *Eucalyptus punctata* outside BAM plots) in the upper stratum.
The understorey is marked by the tall shrub, *Acacia parvipinnula,* and by the prickly shrubs, *Daviesia ulicifolia, Bursaria spinosa, Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis, Maytenus silvestris* and *Breynia oblongifolia*.	**Mid stratum** present; *Daviesia ulicifolia, Bursaria spinosa Acacia parvipinnula* (outside); *Breynia oblongifolia.*
The ground layer is diverse; frequent species include *Cheilanthes sieberi, Cymbopogon refractus, Dianella revoluta, Entolasia stricta, Glycine clandestina, Lepidosperma laterale, Lomandra multiflora, Microlaena stipoides, Pomax umbellata, Pratia purpurascens, Themeda australis* and *Phyllanthus hirtellus.*	**Ground stratum** present; *Themeda australis, Pratia purpurascens.* Outside of plots; *Entolasia stricta, Glycine clandestine* and *Microlaena stipoides*
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley.	The Subject Site is 35kms from Cessnock in the Lower Hunter region.
Eucalyptus fibrosa, Acaci a parvipinnula and prickly shrub species occur more frequently or in greater abundance in Lower Hunter Spotted Gum – Ironbark Forest than in any of the other communities mentioned above.	The Subject Site within this PCT is dominated by *Corymbia Maculata* with *Eucalyptus fibrosa* 15% coverage in one of three BAM plots. *Acacia parvipinnula* was noted as an incidental outside of the BAM plots.

Characteristics	Assessment of Vegetation Community – Subject Site
Result: Although not a definitive list, due to the nature of the Scientific Committee determination, enough attributes are evident to conclude that PCT 1600 in moderate condition 0.99ha is potentially commensurate with the Listed BC Act, E: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (Equivalent) largely equivalent to. It also has association with Listed BC Act: Central Hunter Ironbark Spotted Gum "Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions (Part) which in turn is associated with the EPBC Federally listed; • Central Hunter Valley eucalypt forest and woodland Refer **Appendix G** Other legislation where it was further assessed and is not considered to be commensurate. It is further noted that within the BAM-C there is no Associated TEC and no EPBC Act listed, however the precautionary principal was applied and the criteria was reviewed as it is still listed within the VIS.	

Table 17 – Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions

Characteristics	Assessment of Vegetation Community – Subject Site
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is the name given to the ecological community found on gentle slopes arising from depressions and drainage flats on permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions (sensu Thackway and Cresswell 1995) and characterised by the following assemblage of species: • *Angophora costata* • *Austrodanthonia monticola* • *Billardiera scandens* • *Breynia oblongifolia* • *Brunoniella australis* • *Cheilanthes sieberi subsp. sieberi* • *Corymbia maculata* • *Cyanthillium cinereum* • *Cymbopogon refractus* • *Daviesia ulicifolia* • *Desmodium varians* • *Dichondra repens* • *Digitaria parviflora* • *Echinopogon caespitosus var. caespitosus* • *Entolasia stricta* • *Eragrostis brownii* • *Eragrostis leptostachya* • *Eucalyptus crebra* • *Eucalyptus moluccana* • *Eucalyptus punctata* • *Eucalyptus tereticornis* • *Glycine clandestina* • *Imperata cylindrica var. major*	The Beresfield Soil Landscape is generally undulating low hills and rises on Permian sediments in the East Maitland Hills region. PCT 1598 association (highlighted in bold in left hand column); **Upper stratum** present; *Eucalyptus tereticornis,* however outside of plot and within Subject site*; Corymbia maculata, Eucalyptus crebra* and *Eucalyptus punctata* **Mid stratum** present; *Breynia oblongifolia* Outside of plot; *Daviesia ulicifolia, oblongifolia.* ***Ground stratum*** *present; Entolasia stricta, Cymbopogon refractus, Dichondra repens, Lobelia purpurascens, Eragrostis leptostachya Imperata cylindrica, Leucopogon juniperinus, Lomandra multiflora subsp. multiflora, Paspalidium distans* and *Solanum prinophyllum* **Outside of plot;** *Themeda australis, Glycine clandestine, Microlaena stipoides.*

Characteristics	Assessment of Vegetation Community – Subject Site
• *Jacksonia scoparia* • *Lagenifera stipitata* • *Leucopogon juniperinus* • *Lomandra longifolia* • *Lomandra multiflora subsp. multiflora* • *Microlaena stipoides var. stipoides* • *Panicum simile* • *Paspalidium distans* • *Persoonia linearis* • *Pomax umbellata* • *Pratia purpurascens/Lobelia purpurascens* • *Solanum prinophyllum* • *Themeda australis.*	
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions. Currently only a small area (less than 2% of total) of Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is included in National Parks and Wildlife Service estate in the Lower Hunter (Wereketa) National Park. The majority of the remainder of the community is not on public land.	Subject Site within the Sydney Basin bioregion and within the Maitland LGA.
Result: Although not a definitive list, due to the nature of the Scientific Committee determination, enough attributes are evident to conclude that PCT 1598 in moderate condition 0.18ha is commensurate with the Listed BC Act: Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions (Equivalent). As such it was noted as such within the BAM-C. There is no EPBC Act listed and no further assessment was required.	

Table 18 – Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

Characteristics	Assessment of Vegetation Community – Subject Site
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an	Semi-permanent inundation by freshwater overbank stream flow. Freshwater Wetlands on Coastal Floodplains generally occur below 20 m Sydney Basin and South East Corner bioregions and Subject Site is at 18m elevation.

Characteristics	Assessment of Vegetation Community – Subject Site
average recurrence interval of 100 years or less Freshwater Wetlands on Coastal Floodplains generally occur below 20 m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from sedgelands and reedlands to herbfields, and woody species of plants are generally scarce. Typically these wetlands form mosaics with other floodplain communities, and often they include or are associated with ephemeral or semi-permanent standing water.	
The composition of Freshwater Wetlands on Coastal Floodplains is primarily determined by the frequency, duration and depth of waterlogging and may be influenced by the level of nutrients and salinity in the water and substrate. The community is characterised by the following assemblage of species: • *Alisma plantago-aquatica* • *Azolla filiculoides var. rubra* • *Azolla pinnata* • *Baumea articulata* • *Baumea rubiginosa* • *Bolboschoenus caldwellii* • *Bolboschoenus fluviatilis* • *Brasenia schreiberi* • *Carex appressa* • *Centipeda minima* • *Ceratophyllum demersum* • *Cyperus lucidus* • *Eclipta platyglossa* • *Eclipta prostrata* • *Eleocharis acuta* • *Eleocharis equisetina* • *Eleocharis minuta* • *Eleocharis sphacelata* • *Fimbristylis dichotoma* • *Gratiola pedunculata* • *Hemarthria uncinate* • *Hydrilla verticillata* • *Hydrocharis dubia* • *Juncus polyanthemos* • *Juncus usitatus* • *Leersia hexandra* • *Lemna spp.* • *Lepironia articulata* • *Ludwigia peploides subsp. montevidensis* • *Marsilea mutica* • *Maundia triglochinoides* • *Myriophyllum crispatum*	PCT 1736 association (highlighted in bold in left hand column); Ground stratum present within BAM plot: *Juncus usitatus, Eleocharis sphacelate, Myriophyllum latifolium, Spirodela punctata, Marsilea mutica, Ludwigia peploides subsp. montevidensis, Persicaria decipiens and Ranunculus inundates.* Outside of plot; *Typha orientalis*,

Characteristics	Assessment of Vegetation Community – Subject Site
• *Myriophyllum latifolium* • *Myriophyllum propinquum* • *Myriophyllum variifolium* • *Najas marina* • *Najas tenuifolia* • *Nymphaea gigantea* • *Nymphoides geminate* • *Nymphoides indica* • *Ottelia ovalifolia* • *Panicum obseptum* • *Panicum vaginatum* • *Paspalum distichum* • *Persicaria attenuate* • *Persicaria decipiens* • *Persicaria hydropiper* • *Persicaria lapathifolia* • *Persicaria strigose* • *Philydrum lanuginosum* • *Phragmites australis* • *Potamogeton crispus* • *Potamogeton ochreatus* • *Potamogeton perfoliatus* • *Potamogeton tricarinatus* • *Pseudoraphis spinescens* • *Ranunculus inundates* • *Schoenoplectus litoralis* • *Schoenoplectus mucronatus* • *Schoenoplectus validus* • *Spirodella spp.* • *Triglochin procera sensu lato* • *Typha orientalis* • *Utricularia australis* • *Vallisneria spp.* • *Wolffia spp.*	
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Penrith, Fairfield, Liverpool, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions.	Subject Site is located within the Sydney Basin bioregion and within the Maitland LGA.

Characteristics	Assessment of Vegetation Community – Subject Site
Land clearing continues to threaten Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and are further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, filling associated with urban and industrial development, pollution and eutrophication from urban and agricultural runoff, weed invasion, overgrazing, trampling by livestock	The Subject Site is located is located on previously utilised agricultural land or in close proximity to rural centres.
Very few examples of Freshwater Wetlands on Coastal Floodplains remain unaffected by weeds.	The second most prolific species in this plot was the weed species *Cynodon*
Result: Although not a definitive list, due to the nature of the Scientific Committee determination, enough attributes are evident to conclude that PCT 1736 in poor condition 0.37ha is commensurate with the Listed BC Act: Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. As such it was noted as such within the BAM-C. There is no EPBC Act listed and no further assessment was required.	

1.5 Threatened Species

Under the BAM, threatened species are classified into two types: 'Ecosystem Credit' and 'Species Credit' type species, as detailed within the BioNet Atlas Threatened Species Profile Database (DPE).

A predicted Ecosystem Credit Species assessment is presented in **Table 19**, and a Species Credit Species assessment is presented in **Table 20**.

Field surveys were undertaken on site from August 2022 to January 2023 by AEP. A summary of survey effort within the Subject Site is included in **Section 1.4** and **Table 22**, and species listed are presented in **Appendix B** and **Appendix C.**

Figure 5 shows the location of NSW BioNet Atlas records of threatened species in the locality.

1.5.1 Ecosystem Credit Species

Ecosystem Credit species are associated with PCTs and other habitat surrogates that are used to predict their occurrence on a particular site.

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

Those Ecosystem Credit Species predicted to occur within the site are provided in **Table 19**.

Table 19 – Predicted Ecosystem Credit Species

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas) Y/N	Recorded by AEP within site or nearby surrounds Y/N
Botaurus poiciloptilus	Australasian Bittern	Moderate	Y	N
Rostratula australis	Australian Painted Snipe	Moderate	Y	N
Ninox connivens	Barking Owl (Foraging)	High	N	N
Ixobrychus flavicollis	Black Bittern	Moderate	N	N
Falco subniger	Black Falcon	Moderate	Y	N
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Moderate	Y	N
Ephippiorhynchus asiaticus	Black-necked Stork	Moderate	Y	N
Limosa limosa	Black-tailed Godwit	High	Y	N
Oxyura australis	Blue-billed Duck	Moderate	N	N
Limicola falcinellus	Broad-billed Sandpiper	High	N	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High	N	N
Irediparra gallinacea	Comb-crested Jacana	Moderate	Y	N
Calidris ferruginea	Curlew Sandpiper (Foraging)	High	Y	N
Stagonopleura guttata	Diamond Firetail	Moderate	N	N
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	High	Y	Y
Falsistrellus tasmaniensis	Eastern False Pipistrelle	High	Y	N
Tyto longimembris	Eastern Grass Owl	Moderate	N	N
Pandion cristatus	Eastern Osprey (Foraging)	Moderate	Y	N
Stictonetta naevosa	Freckled Duck	Moderate	Y	N
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	Moderate	Y	N
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	High	N	N
Calidris tenuirostris	Great Knot (Foraging)	High	N	N
Scoteanax rueppellii	Greater Broad-nosed Bat	High	Y	Y
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Moderate	Y	Y

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas) Y/N	Recorded by AEP within site or nearby surrounds Y/N
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	High	Y	Y
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form) (Foraging)	Moderate	N	N
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)	High	Y	Y
Miniopterus australis	Little Bent-winged Bat (Foraging)	High	Y	Y
Hieraaetus morphnoides	Little Eagle (Foraging)	Moderate	Y	N
Glossopsitta pusilla	Little Lorikeet	High	Y	N
Anseranas semipalmata	Magpie Goose	Moderate	Y	N
Tyto novaehollandiae	Masked Owl (Foraging)	High	Y	N
Grantiella picta	Painted Honeyeater (Foraging)	Moderate	N	N
Ninox strenua	Powerful Owl (Foraging)	High	Y	N
Anthochaera phrygia	Regent Honeyeater (Foraging)	High	Y	N
Petroica boodang	Scarlet Robin	Moderate	N	N
Chthonicola sagittata	Speckled Warbler	High	N	N
Circus assimilis	Spotted Harrier	Moderate	Y	N
Dasyurus maculatus	Spotted-tailed Quoll	High	N	N
Lophoictinia isura	Square-tailed Kite (Foraging)	Moderate	Y	N
Lathamus discolor	Swift Parrot (Foraging)	Moderate	Y	N
Xenus cinereus	Terek Sandpiper (Foraging)	High	N	N
Neophema pulchella	Turquoise Parrot	High	Y	N
Daphoenositta chrysoptera	Varied Sittella	Moderate	Y	N
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	High	Y	N
Epthianura albifrons	White-fronted Chat	Moderate	N	N
Hirundapus caudacutus	White-throated Needletail	High	Y	N
Petaurus australis	Yellow-bellied Glider	High	N	N

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas) Y/N	Recorded by AEP within site or nearby surrounds Y/N
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	High	Y	Y

1.5.2 Species Credit Species

Additional threatened fauna species determined by the BAM calculator that have the potential to use the Subject Site as suitable habitat are identified in **Table 20**.

The flora and fauna species lists for the site are included in **Appendix B** and **Appendix C.**

Table 20 – Potential Species Credit Species

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Flora					
Thesium australe Austral Toadflax	1.5	N	0	N/A	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).
Melaleuca biconvexa Biconvex Paperbark	2	N	0	N/A	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.
Acacia bynoeana Bynoe's Wattle	2	N	0	N/A	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains.
Eucalyptus parramattensis subsp. decadens Eucalyptus parramattensis decadens	2	N	0	N/A	This species is associated with low moist areas alongside drainage lines and adjacent to wetlands. It is often found in woodland on sandy soils. The endangered population occurs on sandy alluvium within a floodplain community which also supports *Eucalyptus robusta* (Swamp mahogany), *E. tereticornis* (Forest Red Gum), *E. gummifera* (Sydney Bloodwood) as well as *Melaleuca* (Paperbark) species.
Rutidosis heterogama Heath Wrinklewort	2	N	0	N/A	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides. Recorded from near Cessnock to Kurri Kurri, with an outlying occurrence at Howes Valley.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Monotaxis macrophylla Large-leafed Monotaxis	2	N	0	N/A	Large-leafed Monotaxis is recorded from several highly disjunct populations in NSW: eastern edge of Deua NP (west of Moruya), Bemboka portion of South East Forests National Park, Cobar area (Hermitage Plains), the Tenterfield area, and Woodenbong (near the Queensland border). It is also in Queensland. A recent record from the eastern spur of the Nandewar Range is in the Namoi catchment. There is a great diversity in the associated vegetation within NSW (less though in Queensland), encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude. Grows on rocky ridges and hillsides.
Cryptostylis hunteriana Leafless Tongue Orchid	1.5	N	0	N/A	A leafless orchid only undetectable when flowering. Does not appear to have well defined habitat preferences, known from a range of communities including swamp-heath and woodland. Associated with *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera and Allocasuarina littoralis*. Often occurs in association with more common C. subulata and C. erecta which can signify suitable niche habitat within a locale.
Maundia triglochinoides Maundia triglochinoides	2	N	0	N/A	Occurs in permanent swamps and wetlands (30-60cm deep) on the central and north coasts of New South Wales; although locally common at individual sites the number of known locations is small and these are highly scattered.
Callistemon linearifolius Netted Bottle Brush	1.5	N	0	N/A	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers Spring to Summer
Ozothamnus tesselatus Ozothamnus tesselatus	1.5	N	0	N/A	Grows in eucalypt woodland, restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth.
Diuris tricolor Pine Donkey Orchid	1.5	N	0	N/A	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris spp*.). It is found in sandy soils, either on flats or small rises. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
					Associated species include *Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta,* Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species.
Eucalyptus pumila Pokolbin Mallee	3	Y	0	N/A	Currently known only from a single population west of Pokolbin in the Hunter Valley. Historical records also exist for Wyong and Sandy Hollow, however, has not been recorded recently in these areas. The single known population occupies north-west-facing slopes derived from sandstone. Present as a mid-canopy species to a height of 6 m within dry sclerophyll woodland which has a canopy comprising *Eucalyptus fibrosa, Callitris endlicheri* and, to a lesser extent, *Corymbia maculata.* Very little is known about the biology or ecology of this species. It is thought to flower in April-May, but like many eucalypts does not flower every year. Individual plants are understood to regrow by sprouting from a basal lignotuber and therefore can persist following fires. However, such vegetative reproduction may suppress the production of fruits/seeds, necessary for the recruitment of new individuals to a population, and the time between such disturbance and the onset of sexual reproduction is not known.
Pterostylis chaetophora Taree Rustyhood	2	N	0	N/A	The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Flowers from September to November. Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually. Fails to flower in dry seasons.
Pomaderris queenslandica Scant Pomaderris	2	N	0	N/A	Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolata. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks
Eucalyptus castrensis Singleton Mallee	3	Y	0	N/A	Known only from a single dense stand near Singleton in the lower Hunter Valley. Here it is locally dominant stand over about ten hectares with a number of smaller outlying stands over a 2.5 km range. Very restricted in range, but locally dominant, occurring as a dense mallee stand over about three hectares, on a low broad ridgetop on loam over sandstone.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
					Occurs on a low broad ridgetop on loam over sandstone. The understorey consists of grasses and scattered shrubs, with bare ground and litter. *Eucalyptus fibrosa* and *Corymbia maculata* grow adjacent to, but not within, the stand.
Prostanthera cineolifera Singleton Mint Bush	2	N	0	N/A	Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands. Fire response is unknown, but other Prostanthera species are fire sensitive, with recruitment occurring from the soil seed bank following a fire. Life span is unknown but is expected to be in the vicinity of 10-20 years while the estimated minimum time to produce seed is approximately 3-4 years. Restricted to only a few localities near Scone, Cessnock and St Albans.
Eucalyptus glaucina Slaty Red Gum	2	N	0	N/A	Grows in grassy woodland and dry eucalypt forest, on deep, moderately fertile and well-watered soils. Found in separate districts along the eastern seaboard of NSW, from near Casino, to Taree, south to Broke, and recently discovered on the eastern side of the Blue Mountains National Park near Warragamba Dam.
Grevillea parviflora subsp. parviflora Small-flower Grevillea	2	N	0	N/A	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities are occupied in other locations where the species can be found.
Persicaria elatior Tall Knotweed	2	N	0	N/A	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Sometimes this species dies off above ground off in winter, but in other situations can persist through winter. It can be identified from its leaves without flowers.
Asperula asthenes Trailing Woodruff	2	N	0	N/A	Occurs in damp sites, often along river banks. This small herb occurs only in NSW. It is found in scattered locations from the Central Coast (Mandalong area) north to near Kempsey, with several records from the Port Stephens / Karuah / Wallis Lakes area / Forster (including Myall Lakes NP, New England NP, Wallingat NP and Darawnk NR).
Cynanchum elegans	2	N	0	N/A	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp.*

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
White-flowered Wax Plant					*integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Plants are capable of suckering from rootstock in response to occasional slashing or grazing. The fire response of the species is unknown although it has been known to reshoot following fire. Annual burning at one site has been shown to result in population decline. Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley.
Zannichellia palustris Zannichellia palustris	2	N	0	N/A	In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.
Fauna					
Barking Owl *Ninox connivens*	2	Y	0	N/A	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Roosts in shaded portions of tree canopies. Requires large old trees with hollows for nesting. Barking Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit.
Brush-tailed Phascogale *Phascogale tapoatafa*	2	N	3	There are only 3 nearby records recorded in Bionet, with the closest approx. 800m south in 2018.	The species preferred habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. The species prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf-litter; however, they can also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. They feed mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of up to 40 ha, while males have overlapping territories often greater than 100 ha. They nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and can use many different hollows over a short time span. Mating occurs May – July.
Bush Stone-curlew	2	N	0	N/A	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Burhinus grallarius					northern Australia is it still common however and, in the south-east, it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Habitat constraints include fallen/standing dead timber including logs.
Common Planigale *Planigale maculate*	2	N	0	N/A	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. They are fierce carnivorous hunters and agile climbers, preying on insects and small vertebrates, some nearly their own size. They breed from October to January. The female builds a nest lined with grass, eucalypt leaves or shredded bark. Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney.
Eastern Cave Bat *Vespadelus troughtoni*	3	Y	10	10 nearby Bionet records exist, with the closest recorded 3kms Southwest in 2013. The remaining 9 records are located further south near four-mile creek.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.
Pandion cristatus Eastern Osprey	1.5	N	2	The two nearby Bionet records are approximately 3.5kms south of the site near Beresfield, however these are from 2009. No other more recent records exist within the locality.	The Osprey has a global distribution with four subspecies previously recognised throughout its range. However, recent studies have identified that there are two species of Osprey - the Western Osprey (*P. halietus*) with three susbpecies occurring in Europe, Asia and the Americas and the Eastern Osprey (*P. cristatus*) occurring between Sulawesi (in Indonesia), Australia and New Caledonia. Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Eastern Pygmy-possum *Cercartetus nanus*	2	N	0	N/A	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities.
Gang-gang Cockatoo *Callocephalon fimbriatum*	2	Y	2	Two nearby Bionet records exist, however both are from 2004, approximately 3-5kms south from the Subject Site.	The species favours tall mountain forests and woodlands (particularly heavily timbered/mature wet sclerophyll forests) in spring and summer. In winter and autumn, the species moves to lower latitudes and occupies drier more open eucalypt forests and woodlands including dry forest in coastal areas and is often found in urban areas.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	2	N	3	Three nearby Bionet records exist, with the closest recorded 3kms Southwest in 2016. The remaining two records are located scattered around four-mile creek.	The species inhabits open forest and woodlands of the coast where stands of She-oak occur. The species is dependent on large hollow-bearing eucalypts for nest sites.
Greater Glider *Petauroides volans*	2	N	0	N/A	The species is allocated to species credit because it occurs across a broad range of vegetation types and can be reliably detected from survey. Typically produce one young per year (in high quality habitat) but during poor conditions may only breed every second year.
Green and Golden Bell Frog *Litoria aurea*	2	N	0	N/A	Habitat for the species includes semi-permanent/ephemeral wet areas, within 1km of swamps, waterbodies or wet areas. In high altitude populations calling seasons are restricted to summer months. While chytrid is a potential threat to some populations of the species, other populations are subject to manageable threats. The survey efforts were considered adequate given the highly disturbed nature of the site and low quality of the habitat present. Additionally, no records of the species within the Atlas search are located within a 5km radius of the Subject Site.
Green-thighed Frog	1.5	N	0	N/A	A ground-dwelling frog that inhabits coastal forest and bushland. Calling males gather around temporary or semi-permanent ponds and flooded ditches after

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Litoria brevipalmata					heavy rain. Egg masses are often laid in temporary ponds. Tadpoles are predominately surface dwellers, but feed throughout the water body. Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland.
Wallum Froglet *Crinia tinnula*	1.5	N	N	N/A	Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.
Grey-headed Flying-fox *Pteropus poliocephalus*	2	N	51	Records for the species are scattered throughout the 10x10km search. No records are under 1km from the Subject Site, and no roosts are recorded on site.	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.
Koala *Phascolarctos cinereus*	2	N	1	Only one record of the species is present in the last 20 years surrounding the Subject Site, located approximately 4kms	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
				Northeast, recorded in 2020.	
Large Bent-winged Bat *Miniopterus orianae oceanensis*	3	Y	30	Thirty species sightings are listed as nearby Bionet records, with the closest record in 2008, under 1km east of the Subject Sight.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.
Large-eared Pied Bat *Chalinolobus dwyeri*	3	Y	2	Two nearby Bionet records exist, both from 2015, of the species approximately 5kms south from the Subject Site.	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.
Little Bent-winged Bat *Miniopterus australis*	3	Y	80	Plenty of Bionet records exist in the locality for the species, with two sightings in the Northern portion of the subject site from 2008.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. Their distribution consists of the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.
Little Eagle	1.5	N	3	Three records exist from Bionet within the locality,	Little Eagle are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit. The species nest in live

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Hieraaetus morphnoides				and two of which are within 3kms of the Subject Site from 2019.	(occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat (there are examples of nest trees in ACT). Breeding habitat is live (occasionally dead) large old trees within suitable vegetation and 1. the presence of a male and female; or 2. female with nesting material; or 3. an individual on a large stick nest in the top half of the tree canopy. Where a breeding site has been identified in accordance with the BAM the species polygon should be established by providing a circular buffer of 300m around the nest tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. Little Eagles are less likely than urban-adapted raptors to readily cross urban or peri-urban spaces to hunt. The 300m buffer is in accordance with the ACT offset guidelines for this species.
Uperoleia mahonyi Mahony's Toadlet	2	N	0	N/A	Emergency listed species. Observations indicate the species inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Recent studies suggest intact vegetation adjacent to and within water bodies is an important habitat feature for this species.
Masked Owl *Tyto novaehollandiae*	2	N	8	Eight records exist in the surrounding 10kms, with the closest record less than 1km away from the south of the Subject Site in 2018.	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.
Pink-tailed Legless Lizard *Aprasia parapulchella*	2	N	0	N/A	Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
					have been constructed by and are often still inhabited by small black ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows.
Powerful Owl *Ninox strenua*	2	N	14	Fourteen nearby Bionet records exist, with the closest recorded approx. 2kms Southwest in 2019. The remaining records are located further south scattered around four-mile creek.	The species inhabits a range of vegetation types from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tree hollows (≥0.5m deep) in large eucalypts (DBH 80-240cm) that are at least 150 years old. Powerful Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit.
Southern Myotis *Myotis macropus*	2	N	33	Plenty of records are scattered around and close-by the Subject Site. However the nearest in proximity, under 500m east and west of the site, are from 2008.	The species was allocated to species credit because it is dependent on waterways with pools of 3m wide or greater for foraging (which will be protected under legislation), habitat surrounding waterways is used for breeding and roosting. The species can be detected via survey using appropriate techniques (see Threatened Bat Survey Guide). All habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200m of waterbodies mapped.
Square-tailed Kite *Lophoictinia isura*	1.5	N	15	Fifteen of records are scattered around, west of the Subject Site. However, the nearest in proximity, under 500m west of the site, is from 2018.	In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Nesting sites generally located along or near water courses, in a fork or on large horizontal limbs. The species is allocated to dual credit because they tend to be sensitive to disturbance around nests. It will be difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites.

Species	Risk Weighting (BRW)	SAII (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
White-bellied Sea-Eagle *Haliaeetus leucogaster*	2	N	149	BioNet sightings are abundant within the locality and are as recent as 2022.	Terrestrial habitat includes coastal dunes, tidal flats, grassland, heathland, woodland and forest. Requires large emergent eucalypts for nesting. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.

The following Potential Credit Species has been excluded from the species credits species list in accordance with *Section 5.2.2.2 & 5.2.2.1 (a, b or c)* (refer to **Table 21)** for the Subject Site.

Table 21 – Potential Credit Species Excluded and Removed from BAM - C

Scientific Name	Common Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Assessment
Diuris praecox	Rough Doubletail		**Y**	**Y**		The extensive grazing and pasture improvement has reduced the inherent biodiversity of the site, causing habitat degradation for listed flora which both require intact native understorey and dense vegetation: Additionally, *Diuris praecox* was discounted as the Subject Site is not within Newcastle LGA, as was the given option within the BAM-C.
Persoonia pauciflora	North Rothbury Persoonia		**Y**	**Y**		The extensive grazing and pasture improvement has reduced the inherent biodiversity of the site, causing habitat degradation for listed flora which both require intact native understorey and dense vegetation: Additionally, *Persoonia pauciflora* was discounted as the Subject Site is not within 10kms of North Rothbury, as was the given option within the BAM-C.
Delma Impar	Striped Legless Lizard		**Y**			The Striped Legless Lizard (*Delma Impar*) has been discounted due to the degraded conditions of the grassland on site and absence of rocky habitat features.
Hoplocephalus bitorquatus	Pale-Headed Snake	**Y**				The Pale-Headed Snake (*Hoplocephalus bitorquatus*), as mentioned before, is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it

Scientific Name	Common Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Assessment
						appears to favour habitats close to riparian areas. The snake shelters during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. This species could also be discounted based on the degraded habitat within the Subject Site, which has been subject to underscrubbing and clearing over time. Additionally Pale-Headed Snake has a limited distribution. The species is absent from the 10km BioNet search and no records occur within the IBRA Subregion, with the closest record from 1994 over 15kms away in Paterson. The most recent and nearby records are in Cedar Brush Creek from 1998, and 2010. And the only other record below Tamworth is in Ourimbah in 1997. All other records of the species are over 250km north of Chisholm, past Gunnedah with most records north of Tamworth.
Lathamus discolor	Swift Parrot	**Y**				The location is out of the mapped important habitat range for the Swift Parrot (*Lathamus Discolor*).
Petrogale pencillata	Brush-Tailed Rock Wallaby	**Y**				The site does not contain habitat features such as karsts, caves, rocky formations or outcrops required for the Brush-tailed Rock Wallaby (*Petrogale penicillata).*
Anthochaera phrygiap	Regent Honeyeater	**Y**				The location is out of the mapped important habitat range for the Regent Honeyeater (*Anthochaera phrygia*).

Scientific Name	Common Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Assessment
Limicola falcinellus	Broad-billed Sandpiper	**Y**				The location is out of the mapped important habitat range for the Broad-billed Sandpiper (*Limicola falcinellus*).
Calidris ferruginea	Curlew Sandpiper	**Y**				The location is out of the mapped important habitat range for the Curlew Sandpiper (*Calidris ferruginea).*
Calidris tenuirostris	Great Knot	**Y**				The location is out of the mapped important habitat range for the Great Knot (*Calidris tenuirostris*).
Xenus cinereus	Terek Sandpiper	**Y**				The location is out of the mapped important habitat range for the Terek Sandpiper (*Xenus cinereus*).
Limosa limosa	Black-tailed Godwit	**Y**				The location is out of the mapped important habitat range for Black-tailed Godwit (*Limosa limosa*).

1.5.3 Field Survey Methods

Surveys are deemed to fulfill minimum survey requirement. Details of the flora and fauna survey are presented in **Table 22** and were conducted using relevant guidelines, in particular DPE survey guidelines for threatened plants (2020) and amphibians (2020), along with applicable EPBC guidelines (2010; 2011). Flora Survey Effort, Threatened Flora Sightings and Fauna Survey Effort is shown in **Figures 6** and **7**.

Field sheet data is provided in **Appendix D**, and flora and fauna species list for those species recorded during field surveys are provided in **Appendix B** and **Appendix C**.

1.5.3.1 Habitat Features Surveys

An assessment of the relative habitat values present within the Study Area was undertaken. This assessment focused primarily on the identification of specific habitat types and resources within the Study Area favoured by known threatened listed in **Section 1.5.2**. The assessment also considered the potential value of the Subject Site (and surrounding areas) for all major guilds of native flora and fauna. The assessment was based on the specific habitat requirements of each threatened fauna species in regards to their home range, feeding, roosting, breeding, movement patterns and corridor requirements.

Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages. In particular, the focus was put on documenting the presence of key habitat features such as tree hollows. Hollows are an important resource utilised by a variety of forest fauna and are particularly relevant for several of the likely key threatened species in this locality.

1.5.3.2 Flora Field Survey

All required flora survey techniques were utilised for targeted survey of the species listed in **Table 21** and guided by DPIE Threatened Flora Survey Guidelines (2020) and the BAM (2020).

The following survey methods were undertaken to record the presence of threatened species on site:

- Ground-truthing of vegetation mapping to identify all vegetation communities present onsite as well as segregate vegetation zones according to condition and current management practices.
- Seasonal threatened flora surveys utilising the two-phase grid-based systematic approach, targeting a range of threatened flora.
- Identification of all vascular plant species encountered during fieldwork. Subject Site coverage was both systematic to ensure all key points of the site were checked, and therein the Random Meander Technique (Cropper 1993) was utilised to maximise species encountered.
- Seven (7) BAM plots were undertaken in accordance with BAM 2020 by AEP.
- Updated/Refined Vegetation Community Mapping involving traversal over the entire Study Area, concentrating particularly on mapping the boundaries between the identified Biometric Vegetation Types of the BAM 2020 and refining the original mapping which involved a larger number of vegetation units.

1.5.3.3 Fauna Field Surveys

All required fauna survey techniques were utilised for targeted survey of the species listed in **Table 22** and guided by the *Threatened Species Survey and Assessment Guidelines* (2004). Survey effort is shown in **Figures 6** and **7**.

1.5.3.4 Incidental Observations

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

1.6 Survey Effort

The survey methods above were utilised across the Subject Site commencing in August 2022 to January 2023. **Table 22** outlines provides a summary of field surveys.

Table 22 – Field Survey Periods

Date	Time	Hours	Field activity	Targeted Species	No. of Persons on Site	Staff	Rainfall
25/8/2022	5:15pm - 7:20pm	4	Nocturnal Surveys (Spotlighting, Stagwatch, Call-Playback) Songmeters deployed General Incidentals	Powerful Owl, Masked Owl, Barking Owl, Koala, Bush-Stone Curlew, Grey-Headed Flying Fox	2	BY & NS	0
30/8/2022	6:00pm – 7:00pm	1	Nocturnal Surveys (Spotlighting, Stagwatch, Call-Playback) Songmeters collected 122hrs General Incidentals	Powerful Owl, Masked Owl, Barking Owl, Koala, Bush-Stone Curlew, Grey-Headed Flying Fox	1	IB	0
12/09/2022	9:00am - 3:30pm	13	BAM Vegetation Plots HBTs Habitat assessment General incidentals	All targeted species habitat	2	BY & AR	0
28/09/2022	9:00am – 3:00pm	18	Targeted 5m Flora Transects BAM Vegetation Plots SAT's General incidentals	*Diuris tricolor, Pterostylis chaetophora, Rutidosis heterogama, Cynanchum elegans, Monotaxis macrophylla* Koala	3	KD, BY & OA	2
12/10/2022	7:30am - 4:30pm	18	BAM Vegetation Plots Diurnal Bird Survey SAT's General Incidentals	Gang-Gang Cockatoo, Glossy Black Cockatoo, White-Bellied Sea-Eagle, Little Eagle, Square-Tailed Kite, Eastern Osprey Koala	2	KD & BY	0
17/10/2022	7:30am - 1:30pm	12	Diurnal Bird Survey Reptile Habitat assessment Targeted Flora Transects (Shrub and Tree) General Incidentals	Gang-Gang Cockatoo, Glossy Black Cockatoo, White-Bellied Sea-Eagle, Little Eagle, Square-Tailed Kite, Eastern Osprey Striped Legless Lizard, Pink-Tailed Legless Lizard *Callistemon linearifolius, Ozothamnus tesselatus, Pomaderris queenslandica, Prostanthera cineolifera, Grevillia parviflora* *Eucalyptus parramattensis, Eucalyptus glaucina, Melaleuca biconvexa, Eucalyptus pumila, Eucalyptus castrensis*	2	BY & BDJ	0
24/11/2022	9:00am - 12:30pm	7	Targeted 5m Flora Transects General Incidentals	*Thesium australe, Cryptostylis hunteriana, Asperula asthenes and Acacia bynoea*	2	DK & AG	0

Date	Time	Hours	Field activity	Targeted Species	No. of Persons on Site	Staff	Rainfall
5/12/2022	10:30am – 3:30pm	10	25 camera traps including 13 arboreal and 12 terrestrial and 2 Anabat Equipment Deployment General Incidentals	Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Large-eared Pied Bat, Eastern Cave Bat Brush-tailed Phascogale, Common Planigale, Greater Glider, Eastern Pygmy-possum, Koala	2	BD & KG	0
6/12/2022	8:50am - 10:10am	1.20	Aquatic Flora Surveys General Incidentals	*Maundia triglochinoides, Zannichella palustris, Persicaria elatior*	1	BY	0
9/12/2022	9:20am - 10:35am	1.15	Anabat Equipment Redeployment General Incidentals	Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Large-eared Pied Bat, Eastern Cave Bat	1	AG	0
13/12/2022	10:00am - 11:00am	1	Anabat Equipment Retrieval	Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Large-eared Pied Bat, Eastern Cave Bat	1	KD	4
14/12/2022	11:00am - 12:30pm	1.5	Anabat Equipment Redeployment	Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Large-eared Pied Bat, Eastern Cave Bat	1	KD	0
19/12/2022	8:30am – 12:30pm	6	Camera Equipment Rebait Anabat Equipment Retrieval General Incidentals	Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Large-eared Pied Bat, Eastern Cave Bat Brush-tailed Phascogale, Common Planigale, Greater Glider, Eastern Pygmy-possum, Koala	2	NS & AG	2.5
04/01/2023	8:30am – 11:00am	5	Camera Equipment Retrieval General Incidentals	Brush-tailed Phascogale, Common Planigale, Greater Glider, Eastern Pygmy-possum, Koala	2	NS & AM	0
22/01/2023	7:30-8:40pm	2.20	Frog Survey General Incidentals	Green and Golden Bell Frog, Green-Thighed frog, Wallum Froglet & Mahony's Toadlet	2	BY & RN	81.5
23/01/2023	7:30-8:50pm	2.40	Frog Survey General Incidentals	Green and Golden Bell Frog, Green-Thighed frog, Wallum Froglet & Mahony's Toadlet	2	BY & RN	0.5

1.6.1 Survey Effort Results

1.6.1.1 Habitat Trees

A total of seventeen (17) habitat trees and dead stags containing an assumed total of thirty-two (32) hollows were identified within the Subject Site. Surveys undertaken by AEP in September 2022 confirmed hollow locations and numbers, species and DBH, which is provided in **Table 23**. Eight (8) large hollows, thirteen (13) medium hollows and eleven (11) small hollows were identified within the Study Area. All bar two (2) of these hollow and fissure bearing trees will be impacted within the Subject Site that are located within Lot 315. Habitat tree locations are presented in **Figure 7** and the two retained trees as indicated in **Appendix A.**

Table 23 - Habitat Tree Detail

GPS Point ID	Scientific Name	DBH	S	M	L	Other Habitat Features	Retained
120	*Corymbia maculata*	80		1			N
121	*Eucalyptus moluccana*	120	1				N
122	*Corymbia maculata*	90			1		N
123	*Corymbia maculata*	90	1		1	Beehive in hollow	N
124	*Corymbia maculata*	90		1			N
125	Stag	60			1	Large stovepipe	Y
126	*Corymbia maculata*	100		1		Hollow spout	Y
127	*Corymbia maculata*	80		1			N
131	*Eucalyptus moluccana*	70	2	1			N
132	Ironbark sp.	90	2				N
133	*Corymbia maculata*	90		1			N
134	*Corymbia maculata*	110	1	2	4	1 x Large Hollow occupied by Galahs	N
135	*Eucalyptus moluccana*	80	1	1		ABT	N
HBT01	*Corymbia maculata*	110	1				N
HBT02	*Corymbia maculata*	90		1			N
HBT03	*Corymbia maculata*	100			1	In fork facing down	N
HBT04	*Corymbia maculata*	100	2	3			N
Total Hollows:			**11**	**13**	**8**	**Total HBTs removed:**	**15**

1.6.1.2 Water Features and Hydrology

No underground sources of water or aquifers feeding streams or wetlands occur on the Subject Site that would likely be affected by the Project. Above ground sources of water include three (3) farm dams of various sizes, and an unnamed mapped first order watercourse mapped across the Subject Site. All dams have been thoroughly surveyed for aquatic vegetation, which has been assigned as PCT 1736 - *Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter* (poor condition) for the large central dam only. The farm dams on site likely offer only marginal habitat values

for resident fauna, and have been subject to surveying for potential use of targeted species with two of those dams utilised in the Southern Myotis polygons produced. A preliminary inspection of the hydroline was undertaken during a field survey, it was noted that there was a lack of watercourse features reflecting a continuous flow across the Subject Site. Further assessment and consultation with Department of Planning Industry and Environment (Water) (DPIE -Water) is required to determine if *Section 91* of the *Water Management Act, 2000 (*WM Act*)* is triggered and most likely that a CAA is required.l

1.6.1.3 Other habitat features

The Subject Site possesses additional habitat features including small rock piles, piles of debris such as discarded appliances, building materials and corrugated iron sheets. Fallen logs and HBTs as given in **Table 24**, also provide habitat, in addition to the three (3) farm dams on site, that contain surrounding aquatic vegetation.

No caves, karsts or rocky outcrops occurred on site and are considered a habitat constraint for cave dwelling microbats. However, artificial structures such as agricultural infrastructure, discarded vehicles, storage sheds, old equestrian facilities, in addition to an abandoned farmhouse in the the patch of remnant planted vegetation along the southwestern boundary, have been surveyed for potential fauna habitat.

1.6.2 Species Credit Species Survey Results

Overall survey effort within the Subject Site (for plots, equipment deployment, targeted searches and habitat assessments) is detailed in **Table 24** and was conducted using relevant guidelines, in particular DPIE survey guidelines for threatened plants (2020) and amphibians (2020), along with applicable EPBC Act guidelines (2010; 2011). Survey periods are shown in **Table 19** and survey effort in **Figures 6** and **7**. **Table 24** presents the results of targeted surveys.

Table 24 – Species Credit Species

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
Flora											
Thesium australe Austral Toadflax	Nov-Feb	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 5-10m	24/11/2022	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of the site, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Melaleuca biconvexa Biconvex Paperbark	All year	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 10-20m	17/10/2022	Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The species was not found to be present during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Acacia bynoeana Bynoe's Wattle	All Year	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 5-10m	24/11/2022	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. Habitat is present on site in poor condition. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Eucalyptus parramattensis subsp. decadens Eucalyptus parramattensis decadens	All year	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 10-20m	17/10/2022	Occurs in low-lying, often swampy areas and in woodlands with associates such as *Eucalyptus racemosa, Eucalyptus globoidea and Angophora bakeri.* In the regional vegetation classification of the National Parks and Wildlife Service Earp's Gum occurs in two vegetation communities: Tomago Sand Swamp and the Kurri Sands Swamp (Bell 2006) communities, both of which occur on poor sandy soils from either Pleistocene sands or Permian sediments. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Rutidosis heterogama Heath Wrinklewort	All Year	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 5-10m	28/09/22	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides. Habitat is present on site in poor condition. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Monotaxis macrophylla Large-leafed Monotaxis	Aug-Feb	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 5-10m	28/09/22	The distribution and supposed rarity of *Monotaxis macrophylla* within NSW is related to the occurrence of fire. At least within NSW, the species has not been found in the absence of fire. No BioNet records of this species within 10km of the site. The species was not observed in targeted searches, no records exist within the immediate locality, and there is no evidence of fire within the site deeming it unsuitable for the species to occur, presence is considered unlikely.	N/A	N	N	N	N
Cryptostylis hunteriana Leafless Tongue Orchid	Nov-Jan	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 5-10m	24/11/2022	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. Occurs in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silver Top Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black She-oak (*Allocasuarina littoralis*). The species was not observed during	N/A	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
						targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.					
Maundia triglochinoides Maundia triglochinoides	November –March	Search the appropriate parts of the water body by using a traverse coverage appropriate for the species' growth form.	Y	Habitat Assessment Aquatic targeted flora surveys within suitable habitat in the Subject Site	6/12/22	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Potential habitat within the Development Site due to standing water, however, the species was not observed during targeted aquatic surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of the Subject Site, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Callistemon linearifolius Netted Bottle Brush	Oct-Jan	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 10m separation or 1km at 15m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 10-15m	17/10/22	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges. Habitat is present on site in poor condition; however, the species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Ozothamnus tesselatus Ozothamnus tesselatus	Sept-Oct	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 10m separation or 1km at 15m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 10-15m	17/10/22	Grows in eucalypt woodland, restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Habitat is present on site in poor condition; however, the species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Diuris tricolor Pine Donkey Orchid	Sept	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 5-10m	28/09/22	Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Habitat is present on site; however, the species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Eucalyptus pumila Pokolbin Mallee	All Year	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Y	Habitat Assessment Targeted Search Parallel Transects - 10-20m	17/10/2022	Little is known about this species habitat, and records indicate it is highly restricted. All eucalypts on site were surveyed, and this species was not detected. Additionally, no Bionet records are listed within the locality and the species has a highly restricted distribution, leaving it unlikely to occur on site or be impacted by the proposed development.	N/A	N	N	N	N
Pterostylis chaetophora Taree rustyhood	Sept-Nov	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering.	Y	Habitat Assessment Targeted Search Parallel Transects - 5-10m	28/09/22	The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Pomaderris queenslandica Scant Pomaderris	All Year	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 10m separation or 1km at 15m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 10-15m	17/10/22	Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Eucalyptus castrensis Singleton Mallee	All Year	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Y	Habitat Assessment Targeted Search Parallel Transects - 10-20m	17/10/2022	Little is known about this species habitat, and records indicate it is highly restricted. All eucalypts on site were surveyed, and this species was not detected. Additionally, no Bionet records are listed within the locality and the species has a highly restricted distribution, leaving it unlikely to occur on site or be impacted by the proposed development.	N/A	N	N	N	N
Prostanthera cineolifera	Sept-Oct	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of	Y	Habitat Assessment	17/10/22	Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands. Fire response is unknown, but other *Prostanthera* species are fire sensitive, with	N/A	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
Singleton Mint Bush		potential habitat average field traverse length 2km at 10m separation or 1km at 15m separation.		Targeted Parallel Flora Transects – 10-15m		recruitment occurring from the soil seed bank following a fire. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.					
Eucalyptus glaucina Slaty Red Gum	All Year	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 10-20m	17/10/2022	Grows in grassy woodland and dry eucalypt forest, on deep, moderately fertile and well-watered soils. All eucalypts on site were surveyed, and this species was not detected. Additionally, no Bionet records are listed within the locality and the habitat on site is in poor condition. The species is unlikely to occur on site or be impacted by the proposed development.	N/A	N	N	N	N
Grevillea parviflora subsp. parviflora Small-flower Grevillea	Aug-Nov	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 10m separation or 1km at 15m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 10-15m	17/10/22	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Also occurs in the Hunter in Kurri Sand Swamp Woodland. Hunter occurrences are usually 30-70m ASL. Marginally suitable habitat is present on site; however, the species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality.	N/A	N	N	N	N
Persicaria elatior Tall Knotweed	December - January	Targeted survey in suitable habitat including damp places, especially beside streams and lakes.	Y	Habitat Assessment Aquatic targeted flora surveys within suitable habitat in the Subject Site	6/12/22	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Potential habitat within the Development Site due to standing water, however, the species was not observed during targeted aquatic surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of the Subject Site, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Asperula Asthenes Trailing Woodruff	October – December	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Parallel Flora Transects – 5-10m	24/11/2022	Occurs in damp sites, often along riverbanks and known from Taree to Bulahdelah NSW. Marginal habitat in the Study Area, no known records within locality and most likely geographically restricted. The species was not observed during targeted surveys and presence is thus considered unlikely.	N/A	N	N	N	N
Cynanchum elegans White-flowered Wax Plant	All Year	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Targeted Search Parallel Transects - 5-10m	28/09/22	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp. integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. The species was not observed during targeted surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of potential habitat, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Zannichellia palustris Zannichellia palustris	October-January	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation.	Y	Habitat Assessment Aquatic targeted flora surveys within suitable habitat in the Subject Site	6/12/22	A submerged aquatic plant. Leaves 2-7 cm long by less than 1 mm wide. Grows in fresh or slightly saline stationary or slowly flowing water. NSW populations behave as annuals, dying back completely every summer. Potential habitat within the Development Site due to standing water, however, the species was not observed during targeted aquatic surveys and presence is considered unlikely due to the lack of Bionet records within the locality, and the degraded condition of the Subject Site, which is dominated by exotics and has been subject to heavy clearing.	N/A	N	N	N	N
Fauna											
Barking Owl *Ninox connivens*	May-Dec	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: at	Y	Nocturnal Surveys including Spotlighting, Stag	25/08/22 & 30/08/22	Requires large old trees with hollows for nesting. Hollows are present on site, however stag watch, call play-back and spotlighting surveys failed to detect the species. There is some foraging	N	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
		least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.		Watch and Call Play-back Songmeters Habitat Assessment	SM 25-30/08/2022 12/09/2022	potential on site, but the lack of BioNet records within the vicinity indicate that impact on the species from the proposed development is unlikely to occur.					
Brush-tailed Phascogale *Phascogale tapoatafa*	Dec-Jun	Fauna Survey guidelines in the Threatened species database collection outline that survey must be undertaken using baited cameras. Cameras must remain in place for a minimum of 4 weeks with cameras checked and baits replaced after 2 weeks. A minimum of 4 cameras, independent of the size of the subject land, must be used for sites up to 1 ha, then an additional 2 cameras for every ha of suitable habitat thereafter. That is, at least 22 working, baited, evenly spaced camera traps are required for the first 10 ha of suitable habitat.	Y	Camera Fauna Trapping equipment survey period (Including rebait)	5/12/22-4/01/23 Rebait 19/12/22	Inhabits dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also utilises heath, swamps, rainforest and wet sclerophyll forest. The species preferred habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. Marginal foraging and breeding habitat within the Study Area, however the condition is poor due to previous land use, underscrubbing and weed loads on the Subject Site. There are only 3 known records within the within locality, and the species wasn't detected during camera trap survey efforts.	N	N	N	N	N
Bush Stone-curlew *Burhinus grallarius*	All year	Habitat assessment & diurnal bird census Diurnal bird census – Flushing by walking through potential habitat. Spotlighting by foot or from a vehicle driven in first gear. Call playback - Sites for Bush Stone-curlew surveys should be 2-4km apart and conducted during the breeding season.	Y	Nocturnal Surveys including Spotlighting and Call Play-back Songmeters Habitat Assessment	25/08/22 & 30/08/22 25/08/-30/08/2022 12/09/22	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feeds on insects and small vertebrates, such as frogs, lizards and snakes. Nests on the ground in a scrape or small bare patch. The marginal habitat present within the Study Area is degraded, and no records from Bionet exist within the locality.	N	N	N	N	N
Common Planigale *Planigale maculate*	All year	The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney, although Port Stephens is considered to be the southern extent. Targeted survey efforts including spotlighting, camera trapping (over 30 nights), were undertaken within the Subject Site by AEP failed to detect any during recommended seasonality. No pitfall trapping was considered to be required due to marginal habitat and no BioNet records support this.	Y	Nocturnal spotlighting Camera Fauna Trapping equipment survey period (Including rebait)	25/08/22 & 30/08/22 5/12/22-4/01/23 Rebait 19/12/22	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. Potential habitat within Study Area. No records exist within the locality, and the surface cover on site is scarce, and likely only provides marginal habitat for the species. The species wasn't detected during equipment or nocturnal surveys.	N	N	N	N	N
Eastern Cave Bat *Vespadelus troughtoni*	Dec-Jan	Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat. All breeding habitat on or within 100m of the subject land and the area immediately surrounding the feature must be mapped. Artificial structures should be inspected and included on the map if the species is using these features for breeding.	Y	Anabat Detection equipment survey period (Including relocation and rebait) Habitat assessment	5/12/22-19/12/22 Rebait 9/12/22 and 14/12/2022	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Local records are few, and due to the lack of rocky caves or overhangs, it is unlikely that the species utilises the site apart from marginal foraging as acoustic recorders detected this species as being likely to be on site but could not be definitively identified. As no breeding habitat is present, species credits do not apply.	Y	Y	Y	N	N
Pandion cristatus Eastern Osprey	Apr-Nov	Habitat assessment – 30 minutes searching each relevant habitat. This matter has not been resolved as yet but it is likely that a species-time curve approach should be utilised for surveying diurnal birds. For example, the survey session for a particular day may cease when no additional	Y	Diurnal bird surveys Habitat assessment (Including stick nest searches)	12/09/22 12/10/22 17/10/22	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. No suitable foraging habitat present within the Study Area. Potential for breeding habitat, however no evidence of breeding was found during stick nest searches. Low number of records, none in immediate vicinity to Study Area.	N	N	N	N	N

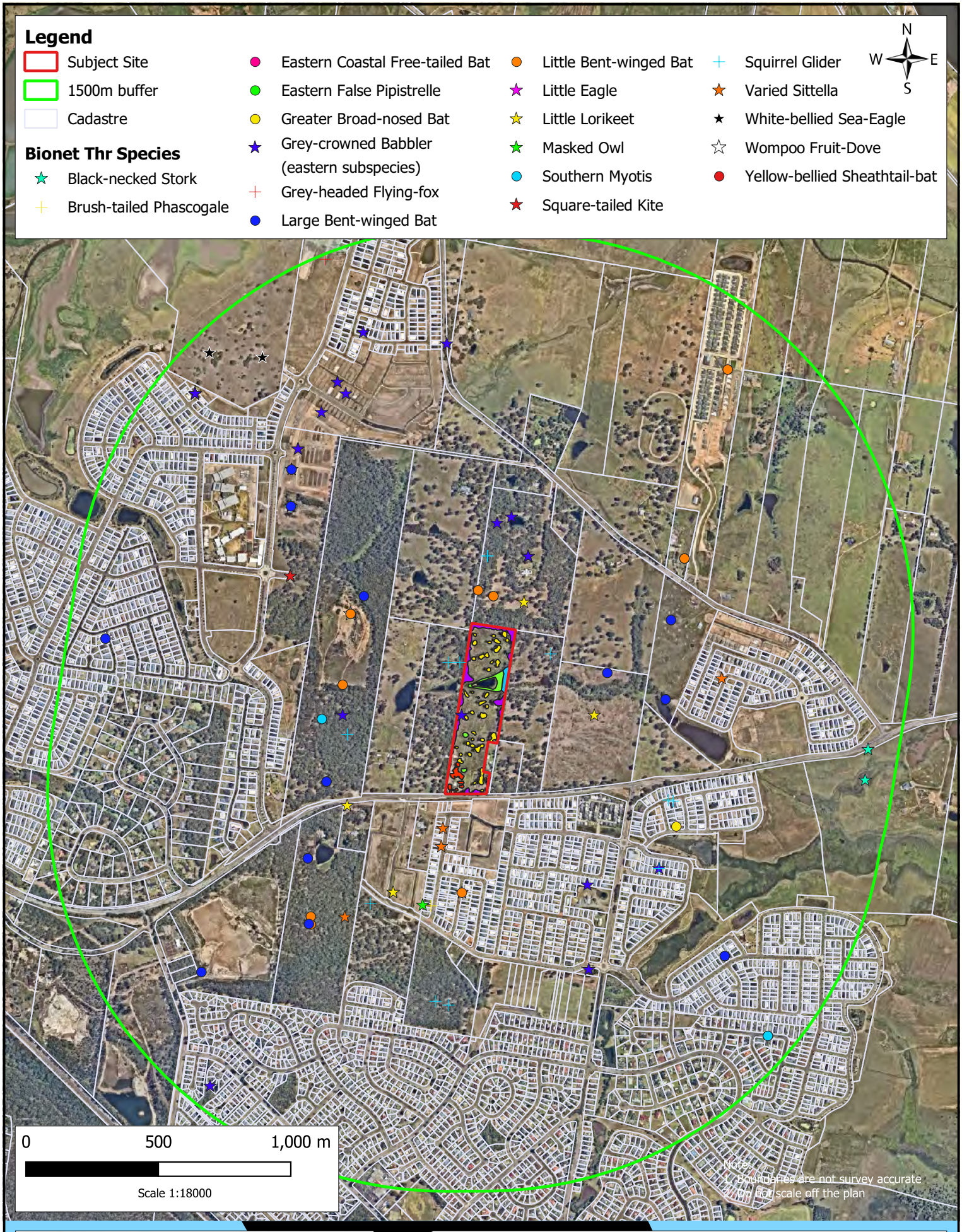
Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
		species are identified within a set time period. This approach better accommodates the variety of habitat types and birds found in NSW. Per stratification unit.		General Incidentals							
Eastern Pygmy-possum *Cercartetus nanus*	Oct-Mar	The minimum survey effort for site under 100ha should be 2 cameras per vegetation community or habitat type for 14 consecutive nights. Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	Y	Camera Fauna Trapping equipment survey period (Including rebait)	5/12/22-4/01/23 Rebait 19/12/22	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities. Although Ban*ksia serrata* is recorded within the Subject Site, no evidence of use nor any BioNet records within the vicinity, and the species was not located during camera trapping effort.	N	N	N	N	N
Gang-gang Cockatoo *Callocephalon fimbriatum*	Oct-Jan	1 Assessors should look for SIGNS OF BREEDING on site as follows; (a) lone adult males identified during the breeding season (October to January); or (b) an occupied nest. If breeding is presumed present, progress to Step 3. 2. Where signs of breeding on site are present, POTENTIAL NEST TREES should be identified. Potential nest trees are forest and woodland eucalypts containing hollows that are; (i) at least 9 m above the ground; and (ii) with hollow diameter of 10 cm or larger. 3. Where potential nest trees are identified on site, monitor for this species during the breeding season (October to January) to confirm the presence of any ACTUAL NEST TREES on site. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Area based survey methods	Y	Diurnal bird surveys Habitat assessment General Incidentals	12/09/22 12/10/22 17/10/22	The species favours tall mountain forests and woodlands (particularly heavily timbered/mature wet sclerophyll forests) in spring and summer. In winter and autumn, the species moves to lower latitudes and occupies drier more open eucalypt forests and woodlands including dry forest in coastal areas and is often found in urban areas. No BioNet sightings have been recorded within the vicinity since 2004, and habitat is potentially present, but degraded.	N	N	N	N	N
Glossy Black-Cockatoo *Calyptorhynchus lathami*	Jan-Sept	Area based survey methods. The identification of breeding habitat will require survey or an expert report.	Y	Diurnal bird surveys Habitat assessment General Incidentals	12/09/22	Glossy Black-Cockatoos feed almost exclusively on the seeds of several species of she-oak, and although *Allocasuarina* species were recorded within the Subject Site, there was no evidence of use nor any BioNet records within the vicinity. The species was undetected during diurnal bird surveys and across the whole survey period.	N	N	N	N	N
Greater Glider *Petauroides volans*	All year	Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Stag watching - Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset.	Y	Nocturnal spotlighting & stagwatch Camera Fauna Trapping equipment survey period (Including rebait)	25/8 & 30/8/2022 5/12/22-4/01/23 Rebait 19/12/22	The species occurs in eucalypt forests and woodlands along the east coast of Australia from north east Queensland to the Central Highlands of Victoria. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Occupy a relatively small home range with an average size of up to 3ha. Large hollows are present onsite; however, trees are scattered with evidence of under scrubbing, deeming the Subject Site unsuitable. No records within the locality.	N	N	N	N	N
Green and Golden Bell Frog *Litoria aurea*	Nov-Mar	Systematic day habitat search – one hour per stratification unit Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking	Y	Nocturnal spotlighting searches, stationary listening	22/01/2023 & 23/01/2023	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes or spike rushes. Breeding habitat in NSW includes water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats). Given the highly	N	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
		at approximately 1km per hour on 2 separate nights. Total effort for a 500m transect (section of the riparian area is approx. 135m) is 480mins, repeated 4 times over 2 consecutive nights following 50ml of rain within a 48hr period.		points and call playback.		disturbed nature of the site and low quality of the habitat present, no records of the species are found within the Atlas search and surveys did not detect this species, they are unlikely to be on site.					
Green-thighed Frog *Litoria brevipalmata*	Oct-Mar	Systematic day habitat search – one hour per stratification unit Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Total effort for a 500m transect (section of the riparian area that is located off site is approx. 135m) is 480mins, repeated 4 times over 2 consecutive nights following 50ml of rain within a 48hr period.	Y	Nocturnal spotlighting searches, stationary listening points and call playback.	22/01/2023 & 23/01/2023	Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, however, extends into drier forests in northern NSW and southern Queensland. The frogs are thought to forage in leaf-litter. The Subject Site is cleared and has been subject to under underscrubbing, leaving potential habitat as degraded. Additionally, little to no leaf litter is present, which is a distinct requirement of the species. Given the highly disturbed nature of the site and low quality of the habitat present, no records of the species are found within the Atlas search and surveys did not detect this species, they are unlikely to be on site.	N	N	N	N	N
Wallum Froglet *Crinia tinnula*	All Year	Systematic day habitat search – one hour per stratification unit Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Total effort for a 500m transect (section of the riparian area that is located off site is approx. 135m) is 480mins, repeated 4 times over 2 consecutive nights following 50ml of rain within a 48hr period.	Y	Nocturnal spotlighting searches, stationary listening points and call playback.	22/01/2023 & 23/01/2023	Although Wallum Froglets are found in a wide range of habitats, they are usually associated with acidic swamps on coastal sand plains and occur in sedgelands and wet heathlands and occasionally in swamp sclerophyll forests. It is unlikely for this species to occur as PCT 1598 (forested wetlands) and PCT 1736 (freshwater wetlands) are within the Subject Site and the species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Given the highly disturbed nature of the site and low quality of the habitat present, no records of the species are found within the Atlas search and surveys did not detect this species, they are unlikely to be on site.	N	N	N	N	N
Grey-headed Flying-fox *Pteropus poliocephalus*	All Year	Breeding camps will need to be identified by survey, as per OEH Guidelines. The initial search for camps should encompass any recorded camps and roosting habitat likely to occur on the subject land. If a camp is located the survey only needs to take place in the camp (that is the area occupied by the target species) to identify breeding females. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat.	Y	Nocturnal Surveys including Spotlighting, Stag Watch Songmeters Habitat Assessment	25/08/22 & 30/08/22 12/09/22	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. The species was heard during site surveys. No roosting camps were located on site, and given the highly mobile nature of the species, and the degraded condition of foraging habitat – it is unlikely that the proposed development will impact the species and no credit species apply.	N	Y	Y	N	N
Koala *Phascolarctos cinereus*	All Year	Call playback - 2 sites per stratification unit up to 200 hectares, plus an additional site per 100 hectares above 200 hectares. Each playback site must have the session conducted twice, on separate nights. Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Habitat assessment - 30 minutes searching each relevant habitat, including trees for scratch marks.	Y	Nocturnal Surveys including Spotlighting, Stag Watch and Call Play-back Songmeters Habitat Assessment Camera Fauna Trapping survey period Spot Assessment Technique	25/08/22 & 30/08/22 Noc's & CPB 25/08/22-3338\] 0/08/22 SM 12/09/22 habitat 5/12/22-4/01/23 Cam's	In New South Wales, Koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. There are suitable use tree species however, the site has only moderately suitable foraging habitat present within the Study Area, with only one record in the locality. Further assessment is addressed in **Appendix G**.	N	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
					28/09/22 & 12/10/22 SAT's						
Large Bent-winged Bat *Miniopterus orianae oceanensis*	Dec-Feb	Potential breeding habitat is caves, tunnels, mines or other structures known or suspected to be used by *M. schreibersii oceanensis* including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature. All breeding habitat including the cave, or other features, used for breeding and the area immediately surrounding this feature must be mapped.	Y	Anabat Detection equipment survey period (Including relocation and rebait)	5/12/22-19/12/22 Rebait 9/12 and 14/12	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops. Potential habitat on site, which is the abandoned infrastructure in the Southwest, has been searched. The species was definitively detected during the use of recording equipment and nearby BioNet records suggest that the species has been present in the locality, however, due to the degraded nature of the Subject Site, the proposed development is unlikely to significantly impact foraging habitat. However, no breeding habitat was present and as such, no species credits apply.	Y	Y	Y	N	N
Large-eared Pied Bat *Chalinolobus dwyeri*	Nov-Jan	Potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat. All breeding habitat on or within 100m of the subject land and the area immediately surrounding the feature must be identified.	Y	Anabat Detection equipment survey period (Including relocation and rebait)	5/12/22-19/12/22 Rebait 9/12 and 14/12	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Potential habitat on site, which is the abandoned infrastructure in the Southwest, has been searched, and the species was not detected during the use of recording equipment. Nearby BioNet records suggest that the species has been present in the locality, however, due to the degraded nature of the Subject Site, and lack of result from surveys, the proposed development is unlikely to impact any breeding or foraging habitat.	N	N	N	N	N
Little Bent-winged Bat *Miniopterus australis*		All breeding habitat including the cave, or other features, used for breeding and the area immediately surrounding this feature must be mapped. Species polygon boundaries should have a 100m radius buffer around an accurate GPS point location centred on the cave/feature entrance. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat	Y	Anabat Detection equipment survey period (Including relocation and rebait)	5/12/22-19/12/22 Rebait 9/12 and 14/12	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. Their distribution consists of the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Potential habitat on site, which is the abandoned infrastructure in the Southwest, has been searched. The species was definitively detected during the use of recording equipment and nearby BioNet records suggest that the species has been present in the locality, however, due to the degraded nature of the Subject Site, the proposed development is unlikely to significantly impact foraging habitat. However, no breeding habitat was present and as such, no species credits apply.	Y	Y	Y	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
Little Eagle *Hieraaetus morphnoides*	August-October	Habitat assessment – 30 minutes searching each relevant habitat. This matter has not been resolved as yet but it is likely that a species-time curve approach should be utilised for surveying diurnal birds. For example, the survey session for a particular day may cease when no additional species are identified within a set time period. This approach better accommodates the variety of habitat types and birds found in NSW. Per stratification unit.	Y	Diurnal bird surveys Habitat assessment including nest searches General Incidentals	12/09/22 12/10/22 17/10/22	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland, or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Potentially suitable habitat for nest building within the Study Area. There are only three BioNet records within the locality, and targeted surveys including stick nest searches failed to detect any sign of breeding or foraging from the species.	N	N	N	N	N
Uperoleia mahonyi Mahony's Toadlet	October-March	Combination of tadpole surveys, call surveys and nocturnal searches in suitable weather conditions around swamps, dams and flooded roadside ditches. Minimum of one 200-metre transect per water body or inundated area, repeated on a minimum of two separate nights. Total effort for a 500m transect (section of the riparian area that is located off site is approx 135m) is 480mins, repeated 4 times over 2 consecutive nights following 50ml of rain within a 48hr period.	Y	Nocturnal spotlighting searches, stationary listening points and call playback.	22/01/2023 & 23/01/2023	Current observations indicate Mahony's Toadlet inhabits ephemeral and semipermanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Known records are associated with shallow ephemeral/semipermanent water bodies with limited flow of water. Aquatic vegetation at breeding sites includes sedges (*Schoenoplectus spp., Baumea spp. and Lepironia articulata*) and Broadleaf Cumbungi (*Typha orientalis*). Potential suitable habitat within Study Area, however the site is cleared and has been subject to under scrubbing, leaving potential habitat as degraded. Additionally, no white sand is present, which is a distinct requirement of the species. Given the highly disturbed nature of the site and low quality of the habitat present, no records of the species are found within the Atlas search and surveys did not detect this species, they are unlikely to be on site.	N	N	N	N	N
Masked Owl *Tyto novaehollandiae*	May-Aug	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: · at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	Y	Nocturnal Surveys including Spotlighting, Stag Watch and Call Play-back Songmeters Habitat Assessment	25/08/22 & 30/08/22 SM 25-30/08/2022 12/09/2022	Lives in dry eucalypt forest and woodlands from sea level to 1100m. Optimal habitat includes an open understory and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Masked Owls nest in large hollow eucalypts (diameter at breast height at minimum 90 cm), with hollows greater than 40cm wide and 100cm deep and at least 3m above the ground. Potential foraging and roosting habitat is present within the Study Area, and eight (8) BioNet records surround the locality. Targeted surveys conducted in August, however, failed to detect the species, hence it is unlikely that the species utilises the site.	N	N	N	N	N
Aprasia parapulchella Pink-tailed Legless Lizard	Sept-May	Searches restricted to an area of relatively homogeneous habitat within each site and a search beneath all rocks that can be turned is made. Rock cover density rather than fixed area size determines a plot, and 150–200 rocks need to be turned to be reasonably confident of determining the species' presence.	Y	Targeted reptile habitat searches Habitat assessment	12/09/22 17/10/22	Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. There is marginally suitable habitat within the Subject Site. However, no BioNet records of this species within 10km of the site and the species was not observed in targeted surveys, hence, presence is considered unlikely.	N	N	N	N	N
Powerful Owl *Ninox strenua*	May-Aug	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	Y	Nocturnal Surveys including Spotlighting, Stag Watch and Call Play-back Songmeters Habitat Assessment	25/08/22 & 30/08/22 SM 25-30/08/2022 12/09/2022	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpos cupressiformis* (Cherry Ballart) and a number of	N	N	N	N	N

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y/N)	Species Credits Apply (Y/N)
						eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. There is potential foraging and roosting habitat present within the Subject Site, however most associated species are absent. Additionally, no species were detected during targeted surveys and no active roost hollows were identified. Nearby BioNet records suggest that the species has been identified within the locality, but it is unlikely that the proposed development will have an impact.					
Southern Myotis *Myotis macropus*	Oct-Mar	16 nights with a minimum four nights of acoustic detectors, located in areas of greatest potential activity.	Y	Anabat Detection equipment survey period (Including relocation and rebait)	5/12/22-19/12/22 Rebait 9/12 and 14/12	This species generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. Potential foraging habitat exists within the Subject site, three farm dams. Potential roosting habitat, (hollow-bearing trees) occur within the Development Site. BioNet records are scattered throughout the locality, and the species was detected during targeted surveys using acoustic recording equipment as being likely to be on site but could not be definitively identified. However, applying the precautionary principal, species credits have been incorporated. **Refer Figure 9** Species Polygon which does not include the most southern small farm dam as this water body was unsuitable for the species due to the amount of algae present. **SPECIES CREDIT**	Y	Y	Y	N	Y
Square-tailed Kite *Lophoictinia isura*	Sept-Jan	Habitat assessment – 30 minutes searching each relevant habitat. Diurnal Bird Census.	Y	Diurnal bird surveys Habitat assessment including nest searches General Incidentals	12/09/22 12/10/22 17/10/22	Found in a variety of timbered habitats including dry woodlands and open forests. Nesting sites generally located along or near water courses. Potentially suitable habitat for nest building within the Study Area. There a few scattered BioNet records within the locality, however, targeted surveys including stick nest searches failed to detect any sign of breeding or foraging from the species.	N	N	N	N	N
White-bellied Sea-Eagle *Haliaeetus leucogaster*	July-December	Habitat Assessment Diurnal Bird Census Targeted Surveys. Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat	Y	Diurnal bird surveys Habitat assessment including nest searches General Incidentals	12/09/22 12/10/22 17/10/22	This species hunts for fish, turtles and sea snakes however will feed on carrion along the waterline. The White-bellied Sea-Eagle most often nests in trees 30 m above the ground. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Potential roosting habitat present within the site and species is highly mobile, so may fly over Study Area. Moderate number of database records, some in proximity to the Study Area. Species was not located during targeted surveys, nor any evidence of use of the Subject Site.	N	N	N	N	N

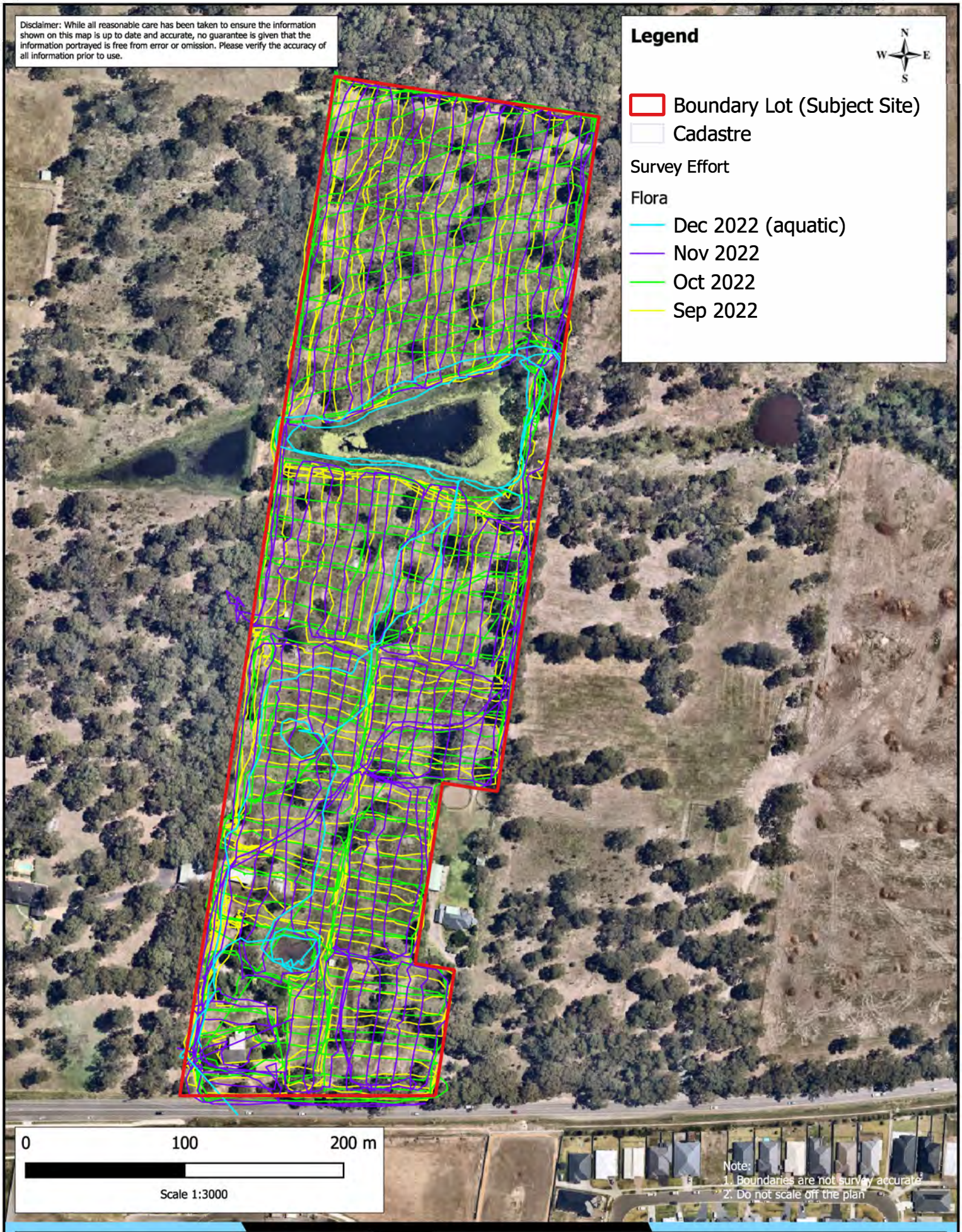


AEP

Title: Figure 5 - Bionet Threatened Species Date: January 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson AEP ref: 2713



AEP

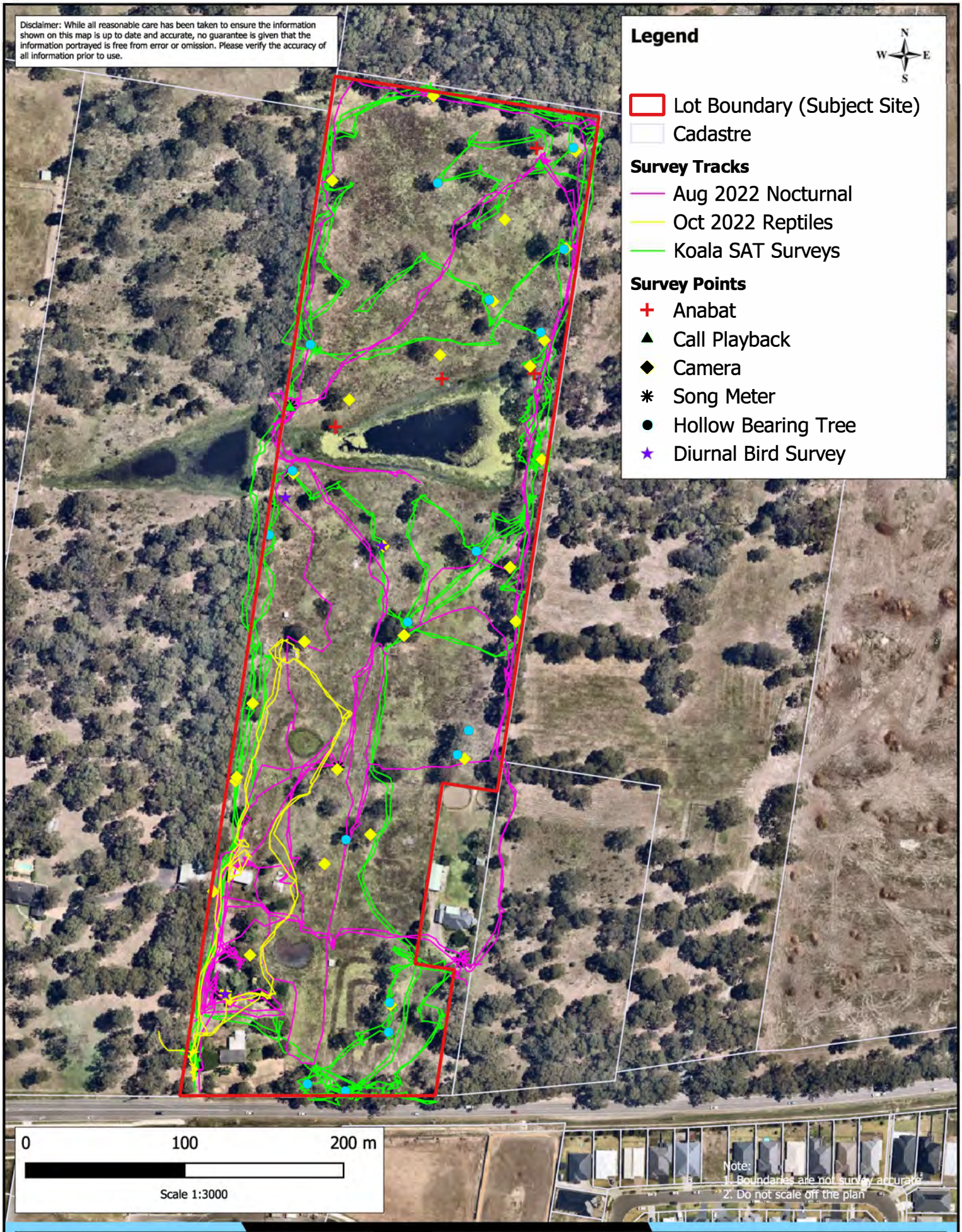
Title: Figure 6 - Flora Survey Effort

Date: April 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson

AEP ref: 2713



AEP

Title: Figure 7 - Fauna Survey Effort Location: 523 Raymond Terrace Rd, Chisholm

Date: April 2023

Client: ACG Clovelly Road Pty Ltd C/ ADW Johnson

AEP ref: 2713

AEP

Figure 8 - Impact Area and Retained Trees

Date: May 2023

Location: 523 Raymond Terrace Road, Chisholm

Client: ACG Clovelly Road Pty Ltd C/- ADW Johnson

AEP ref: 2713

AEP

Figure 9 - Myotis Species Polygon

Date: April 2023

Location: 523 Raymond Terrace Rd, Chisholm

Client: ACG Clovelly Road Pty Ltd C/- ADW Johnson

AEP Ref: 2713

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

2.1 Avoid and Minimise Summary

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

The Avoid and Minimise strategy for the development (in accordance with Section 8 of the BAM), is discussed in greater detail in **Table 25** below. The prescribed impact risk assessment and mitigation measures (in accordance with Section 9 of the BAM) are included in **Tables 25** to **32** below. The following measures in **Section 2.2** have been provided to help mitigate the impacts of construction and the ongoing operation of the proposed development on the biodiversity values identified within the Subject Site and surrounds

2.2 Impact Avoidance Measures

2.2.1 Project Design

The proposed residential subdivision sits within the southern-central portion of the newest precinct (Chisholm Central) within Stage 2 of the Thornton North Urban Release Area (TNUAR). On completion, the TNURA anticipates accommodating approximately 5,000 residential lots (or 12,500 residents) and is one of the few sites in the Lower Hunter that has potential to provide significant land supply to address housing affordability.

The "Thornton North – Stage 2" rezoning (which the development sits within) occurred on 23rd September 2011. Stage 2 rezoned approximately 350ha of land from Zone 1(b) Secondary Rural Land to Zone 2(a) Residential (now R2) and Zone 7(c) Environment Protection General (now E2), to facilitate the development of 2,500 dwellings and protection of areas of ecological significance for threatened flora and fauna species.

The Development Footprint is the result of a design process which has sought to incorporate avoid and minimise principals, whilst providing for the residential demand within the growing township of Chisholm, on the outskirts of East Maitland. Consideration of linkages to the existing surrounding development such as road, stormwater facilities and other services such as electricity and water supplies had to be considered in the design to ensure the proposed development could provide these services to the residents. The ecological assessment undertaken during the rezoning process determined the Subject Site had little to no biodiversity values due to its location and existing high levels of disturbance and clearing.

The TNUAR process identified key areas within the region to ensure the areas of biodiversity value and connectivity within the region were retained. Such areas are Tilligerry State Conservation Area and Northeast of the Subject Site at Wallaroo National Park. As well as the BV mapped land at Woodberry Swamp, 2kms Southeast from the site. The surrounding higher quality vegetation, when evaluated considering the disturbed, poorer quality vegetation across the Subject Site, illustrates that the development is located within the most suitable, disturbed portions of the broader locality.

The development design went through an iterative process enabling retention of vegetation along Raymond Terrace Road, which protects two habitat trees and is presented in **Appendix A**.

Figure 8 shows the areas of impacts to surrounding vegetation in the context of the Study Area.

2.2.2 Water quality and Hydrology

- An Erosion and Sedimentation Control Plan (ESCP) should be prepared for the proposal following guidelines from *Landcom* (2004), as well as a Stormwater Management Plan (SMP);
- Best practice erosion and sedimentation controls should be put in place to limit offsite movement of materials into the adjacent vegetation; and
- Erosion and sedimentation controls should be checked daily and maintained in working order especially after rain events.

2.2.3 Protection and Management of Retained Vegetation

- Prior to construction commencing, the Project Ecologist will inspect the exclusion flagging tape alignment to ensure it adequately delineates the areas of retained trees and vegetation from the development footprint;
- No machinery or material is to be stored within retained vegetation or within the dripline of retained trees;
- Trees to be removed are to be felled in the opposite direction of the retained vegetation where possible; and
- Effective weed control should be used on site, ensuring that appropriate methods are used to eliminate and dispose of high threat exotic weeds and highly competitive weeds.

2.2.4 Tree Management

- Tree Protection Zones need to be determined for any trees identified for retention within the development footprint to ensure suitable protection measures are in place; and
- Landscape tree plantings should use species that are commensurate with the surrounding vegetation community where practical.

2.2.5 Fencing

No barbed wire is to be used within the Subject Site. Fencing within the Subject Site is to prevent incursions by fauna into the construction site; and following completion the Industrial area of the development.

2.2.6 General Construction & Operation

Site specific Avoid and Minimise measures are discussed in **Table 25** and **Table 26**, while **Table 27** to **Table 30** outline the direct and indirect impacts associated with the development and how they are to be mitigated. The development's 'Avoid and Minimise' strategy (in accordance with Section 8 of the BAM), is discussed in greater detail in **Table 25**.

The following measures are provided to help mitigate impacts of the construction and ongoing operation of the proposed development on the biodiversity values on adjoining land:

- For the clearing phase, retained vegetation located on the edges of the development footprint will be delineated by flagging tape, fencing and signage indicating an environmental protection zone. This will allow fauna to egress the development area as needed. Following the completion of clearing works, permanent delineation features such as logs should be installed to protect the retained vegetation during operational phase of the development;

- Vegetation clearing is to be timed to avoid cold weather periods where overnight temperatures are forecast to be less than 12°C. Cold weather is likely to make it difficult for resident hollow dependent fauna to successfully relocate. This is particularly relevant for low body-weight species;
- A staged approach to clearing is to be undertaken to provide fauna the opportunity to disperse outside the area of impact. Staging to include Phase 1 Clearing: Underscrubbing, Phase 2 Clearing: Removal of non-habitat trees, and Phase 3 Clearing: Removal of habitat and connecting trees;
- All clearing works (Stage 1, 2 and 3) are to be undertaken under the supervision of the Project Ecologist;
- Clearing should occur in a direction from previously disturbed lands towards retained lands;
- Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained;
- All clearing works are to be attended by a suitable equipped and experienced ecologist to deal appropriately with any displaced fauna species;
- All hollow-bearing features will be sectionally lowered by tree climbers (where safe to do so);
- Any fauna rescued during vegetation clearing is to be assessed for injuries, and subsequently released to a suitable nearby location; this may require holding fauna until dusk for release in accordance with relevant animal ethics licencing and standards;
- If any fauna is injured during vegetation clearing, they are to be taken promptly to a nearby veterinarian or suitable wildlife carer contact;
- In addition, prior to clearing of any vegetation, an ecologist is to inspect the area for any signs of resident fauna requiring attention, and in particular nesting birds. Where such is identified, appropriate strategies are to be developed and instigated to minimise impacts. Pre-clearance surveys to include diurnal surveys, stag watching and nocturnal surveys;
- Civil Construction staff are to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Installation of nest boxes within the retained lands within the Subject site, retained parental land or council approved lands prior to construction to mitigate the removal of HBTs within the development footprint and provide supplementary roosting / nesting habitat for any potential resident fauna species that utilise such features;
- Any suitable hollows recovered during clearing works should be reconditioned into suitable hollows and installed in retained lands in addition to the manufactured nest boxes;
- All manufactured boxes are to be industry best-practice including either marine or hardwood plywood with a minimum thickness of 15mm;
- Boxes will have hinged lids to enable maintenance of the boxes;
- Installation methods are to be used that will not inhibit growth of the host tree;
- All cleared vegetation is to be mulched on site and spread to help stabilise any exposed soil and minimise offsite movement of biomass. Fallen timber and hollow logs identified to be retained to be relocated into the retained lands;

- Live mulch and topsoil of local provenance is an ideal way to begin rehabilitation of conservation lands;
- Plantings will be incorporated in the landscape design of the proposed development site to provide future resources for native fauna in the area;
- Implement hygiene protocols for machinery are to prevent the spread of weeds outside the development site;
- Best practice erosion and sedimentation (ERSED) and dust suppression control methods are to be adopted, monitored and maintained throughout any vegetation clearing works, particularly for downstream areas. Such are to be in accordance with “Soils and Construction – Managing Urban Stormwater” published by Landcom;
- Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise downstream hydrology changes; and
- Any bushfire protection measures in the form of Asset Protection Zones (APZs) or defendable space are to be incorporated within the development footprint to avoid requirements for additional vegetation removal in surrounding areas.

Table 25 – Avoid and Minimise Impacts on Biodiversity Values

Objectives/Requirements	Evidence of compliance
Locate the proposal to avoid or minimise direct and indirect impacts on native vegetation, threatened species, threatened ecological communities and their habitat.	
Knowledge of biodiversity values should inform decisions about the location of the proposal. The initial assessment of biodiversity values from Stage 1 may be used to inform the early planning of the route or location of a proposal.	Avoid and minimise principles were considered through the planning stage of the proposed development as well as the location within TNUAR and the Thornton North – Stage 2 rezoning. The location of the land on the Subject Site within the growing township of Chisholm has been zoned for R1 General Residential development, therefore, the proposal is considered the most appropriate use for the Subject Site. Furthermore, the proposal has been designed to follow the principles of avoid and minimise by utilising lower quality cleared land that has been subject to clearing and management, whilst areas within the broader locality containing higher quality vegetation, such as the BV mapped land in Woodberry Swamp and the C2 zoned lands in the Precinct, will be avoided, illustrating that the development is located within the most suitable, disturbed part of the landscape. The proposed subdivision design is the result of an iterative process which has sought to avoid impacts to biodiversity values by preferring a Subject Site with lower biodiversity value. The proposed design avoids areas of higher biodiversity value within the broader landscape, and seeks to meet residential demand by utilising the entirety of the cleared highly disturbed, exotic grasslands, and some remnant native vegetation that the site comprises of. This development design, has been revised over the course of the project through an iterative design process to retain two (2) hollow bearing trees with front road set back from Raymond Terrace Road. The impact area in its entirety, consisting of PCT1600, PCT1598 and PCT1736, has moderate to high levels of degradation, with high weed loads and presence of high-threat exotics (HTE). Clusters of moderate quality native vegetation border all sides of the Subject Site, and connect into adjacent lots.
Selecting a final proposal location may be an iterative process. Decisions may need to be revisited after all field surveys have been completed.	The proposed residential subdivision sits within the southern-central portion of the newest precinct (Chisholm Central) within Stage 2 of the Thornton North Urban Release Area (TNUAR). On completion, the TNURA anticipates accommodating approximately 5,000 residential lots (or 12,500 residents) and is one of the few sites in the Lower Hunter that has potential to provide significant land supply to address housing affordability. The "Thornton North – Stage 2" rezoning (which the development sits within) occurred on 23rd September 2011. Stage 2 rezoned approximately 350ha of land from Zone 1(b) Secondary Rural Land to Zone 2(a) Residential (now R2) and Zone 7(c) Environment Protection General (now E2), to facilitate the development of 2,500 dwellings and protection of areas of ecological significance for threatened flora and fauna species. The Subject Site is located within an area that has been historically partially cleared and used for livestock. Surveys were undertaken on the basis of the proposed development design as shown in **Appendix A** with 2 habitat trees retained and minimisation in land form disturbances. Once surveys were completed, it was confirmed that the proposed location to be developed was optimal considering the avoidance of higher quality vegetation in the wider area.
Impacts from clearing native vegetation and threatened species habitat can be avoided or minimised by locating the proposal in areas: *a) lacking biodiversity values* *b) where the native vegetation or threatened species, habitat is in the poorest condition (i.e., areas that have a low vegetation integrity score)* *c) that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or a highly cleared PCT.* d) *outside of the buffer area around breeding habitat features such as nest trees or caves.*	a) The proposed location of the subdivision was chosen on the basis of its occurrence on disturbed land, avoiding the areas of higher biodiversity values and BV mapped land nearby the Subject Site, to allow connectivity to be maintained. b) The proposed subdivision is located on a Subject site primarily consisting of disturbed grassland and regenerating woodland. The majority of vegetation within the Subject Site comprises cleared, exotic degraded grassland land (7.81ha) with a low VIS or has a VIS not exceeding 15. c) The Subject Site does not impact upon any habitat for species that have the highest biodiversity risk weighting as listed within the Guidance to assist a decision-maker to determine a serious and irreversible impact. The Subject DA Footprint does impact upon TECs, however as described above the VIS of these TECs ranges from moderate to degraded vegetation located within cleared and highly exotic paddock. d) No habitat features being used for breeding by known threatened species on site were identified. There is no area of important habitat mapped for the Regent Honeyeater, Swift Parrot, Plains-wanderer or migratory shorebirds identified within the site. No nest trees for threatened species were identified during the current assessment or caves.
When selecting a proposal's location, all of the following should be analysed. Justification for the decisions in determining the final location must be based on consideration of: *a) alternative modes or technologies that would avoid or minimise impacts on biodiversity values* *b) alternative routes that would avoid or minimise impacts on biodiversity values* *c) alternative locations that would avoid or minimise impacts on biodiversity values* *d) alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values.*	a) The Subject Site was considered an appropriate location given its zoning as R1 – General residential land. Within the current context of the development, the site has been chosen within a lot that consists of large areas of exotic grassland and native vegetation subject to edge effects. Water Sensitive Urban Design will be implemented to minimise impacts on biodiversity values linked to hydrology and water quality. b) The location of the proposed routes when considering the existing road network and avoidance of areas of higher biodiversity value are considered to be optimal. c) The design process has sought to avoid impacts to biodiversity values by preferring a Subject Site with lower biodiversity value. The proposed design avoids areas of higher biodiversity value within the broader landscape, and seeks to meet residential

Objectives/Requirements	Evidence of compliance
	demand by utilising the entirety of the cleared highly disturbed, exotic grasslands where the majority of VISs are below 15, and some remnant native vegetation that the site comprises. d) The chosen Subject Site is the most ideal location for the development when considering the broader locality, as it only serves as marginal habitat and provides little connectivity compared to other patches of vegetation nearby.
The proposal may also list and map site constraints, such as: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	Bushfire protection zones have been provided over perimeter roads, existing infrastructure buffers, and cleared areas surrounding the development where required in accordance with bushfire protection requirements. Temporary APZs will be required on the east and west boundaries; however, these can be managed to retain all existing trees as part of Inner Protection Areas (IPA) requirements. Servicing constraints have been considered and the proposal has met the required standards. Residential lots are located outside the flood planning area defined by the Maitland City Council LEP Flood Planning Map and flooding has not been considered by the proposal.
In the BDAR or BCAR, the assessor must document and justify any actions taken to avoid or minimise impacts through careful location of the proposal.	As detailed above, the final development footprint is the only feasible option to enable the project to progress due to the approved road infrastructure on adjoining allotments. Considering the location of the development footprint in the context of the broader locality, it has the least impact to biodiversity values, native vegetation, connectivity routes and fauna movements whilst still being located on appropriately residential zoned land which has access to services.
Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
The BDAR or BCAR must document the reasonable measures taken by the proponent to avoid or minimise clearing of native vegetation and threatened species habitat during proposal design, including placement of temporary and permanent ancillary construction and maintenance facilities. The types of measures that can be used to demonstrate this include: *a) Reducing the proposal's clearing footprint by minimising the number and type of facilities* *b) Locating ancillary facilities in areas that have 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 with the lowest vegetation integrity scores)* *d) Locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g., an endangered ecological community (EEC) or critically endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAII)* *e) Actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.*	a) The proposal has been designed to follow the principles of avoid and minimise by utilising a lot with lower quality cleared land that continues to be subject to underscrubbing and management. b - d) All infrastructure required for the Subject Site has been designed either within areas already required to be cleared as part of roads or to avoid as much native vegetation as possible. e) Appropriate protection measures during and after construction, including fencing will be implemented to avoid any impacts to adjacent areas of higher biodiversity value.
The BDAR or BCAR must document and justify efforts to avoid or minimise impacts through design.	The Development Footprint is the result of a design process which has sought to incorporate avoid and minimise principals, whilst providing for the residential demand within the growing township of Chisholm, on the outskirts of East Maitland. Consideration of linkages to the existing surrounding development such as road, stormwater facilities and other services such as electricity and water supplies had to be considered in the design to ensure the proposed development could provide these services to the residents. The ecological assessment undertaken during the rezoning process determined the Subject Site had little to no biodiversity values due to its location and existing high levels of disturbance and clearing. The TNUAR process identified key areas within the region to ensure the areas of biodiversity value and connectivity within the region were retained. Such areas are Tilligerry State Conservation Area and Northeast of the Subject Site at Wallaroo National Park. As well as the BV mapped land at Woodberry Swamp, 2kms Southeast from the site. The surrounding higher quality vegetation, when evaluated considering the disturbed, poorer quality vegetation across the Subject Site, illustrates that the development is located within the most suitable, disturbed portions of the broader locality. A number of development footprint iteration plans were considered with the final design enabling retention of vegetation along Raymond Terrace Road, which protects two habitat trees and is presented in **Appendix A**.

Table 26 – Prescribed Impact Avoidance and Minimisation

Objectives/Requirements	Evidence of compliance
Avoiding and Minimising Prescribed Biodiversity Impacts during Project Planning	
The timing and extent of a prescribed impact on the habitat of threatened entities can be difficult to assess and adequately offset through the provision of biodiversity credits. 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 be readily replaced or offset, it is important that measures to avoid or minimise impacts are undertaken and are clearly documented in the BDAR or BCAR.	No biodiversity values in addition to those noted in the BDAR i.e., direct and indirect impacts to biodiversity were identified for the Subject Site. Direct and indirect impacts are considered in **Tables 27, 28 and 29** of the BDAR.
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
To avoid or minimise prescribed biodiversity impacts, the proponent must consider how to: *a) Locate surface works to avoid direct impacts on the habitat features identified in Chapter 6* *b) Locate subsurface works, in both the horizontal and vertical planes, to avoid and minimise operations beneath the habitat features identified in Chapter 6. For example, locating longwall panels away from geological features of significance, groundwater-dependent plant communities and their supporting aquifers* *c) Locate the proposal to avoid severing or interfering with corridors connecting different areas of habitat and migratory flight paths, to important habitat or local movement pathways* *d) Optimise the proposal layout to minimise interactions with threatened entities; for example, design a wind farm that has:* *i. 100 m turbine-free buffers around features that attract and support aerial species, such as forest edges, riparian corridors, wetlands, ridgetops and gullies* *ii. turbine-free corridors in zones of regular movement for species of concern, to avoid a barrier effect* *e) locate the proposal to avoid impacts on water bodies or hydrological processes*	a) The Subject Site: i. Does not contain karsts, caves, crevices, cliffs. Present within the site are areas containing abundant small rocks and rock piles. No other features of geological significance supporting threatened species and ecological communities are present; ii. Does contain rocks as discussed above, which may support habitat for threatened species; iii. Contains human made structures. However, no evidence of use by microbats was found on site.; iv. Does not contain non-native vegetation supporting threatened species and threatened ecological communities absent; v. Wind turbines are not a feature of the development proposed. vi. Given that the development will be for local roads with a maximum speed limit of 50km/hr, the likelihood of vehicle strike is considered much lower than higher speed roads. b) No sub-surface work is expected as a result of the proposed development. c) The land on which the development is proposed would only provide connectivity between different areas of habitat for highly mobile species as the site is fragmented from other areas of vegetation. d) Discussed above. e) The Subject DA Footprint will impact upon three (3) man-made dams. A first order watercourse is mapped within the central portion of the site although upon initial inspection does not meet the criteria of a continuous stream however a CAA is likely to be required. It is proposed to remove the large dam/ basin from the existing drainage line and reconstruct a drainage channel and riparian corridor to convey upstream flows through the site to the downstream receiving waters. The northern catchment will be conveyed to the reconstructed channel and riparian corridor via stabilised headwalls. The southern catchment will be conveyed to a detention/ biofiltration basin to limit the peak flows leaving the site to predeveloped flows before discharging to the existing table drain in the northern verge of Raymond Terrace Road via a stabilised headwall. The Subject Site is part of the larger Thornton North Urban Release Area (TNURA) Eastern Precinct, and it was determined that the Subject Site does not require detention or water quality facilities for the northern catchment allowing the large dam/ basin to be removed and the corridor be reconstructed into a drainage channel and riparian corridor. **Refer Appendix I** – Stormwater Management Plan Figure 2 Catchment Area of TNURA Study Overall the stormwater detention provided by the proposed OSD basin in the southern catchment will allow the limiting of the post-development critical peak discharges leaving the site to less than that of pre-development for all design storm events up to the 1% AEP storm event; thereby not increasing the risk of flood inundation to existing downstream development and not increasing the demand on the downstream stormwater infrastructure. The treatment train process of rainwater tanks, GPTs, and a detention/ bioretention basin have been designed to effectively reduce the nutrients and gross pollutants from stormwater runoff from the proposed development. Hydrological and hydraulic modelling has shown that the stormwater measures proposed meet or exceed the water quantity and quality objectives set by MCC. An Erosion and Sedimentation Control Plan has also been prepared for construction of the proposed development also complying with Council's requirements.
When locating a proposal, the following need to be analyzed 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 proposal is located that would avoid or minimise prescribed impacts.*	a) Water Sensitive Urban Design will be implemented to minimise prescribed impacts on biodiversity values linked to hydrology and water quality. b) The proposed development footprint is the only feasible option to enable the project to progress due to the approved road infrastructure on adjoining allotments as part of the overall TNUAR and Thorton North Stage 2 proposals. c) The development footprint was considered to be the most appropriate due to the location and quality of areas of remnant native vegetation and approved zoning for such. Alternative locations would have led to higher impacts on biodiversity and as such, the current location is considered to be optimal in the context of the larger precinct plans. d) Discussed above.

Objectives/Requirements	Evidence of compliance
Justifications for a proposal's location should identify any other site constraints that the proponent has considered in determining the location and design of the proposal, such as: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	a) AEP are given to understand that all required asset protection zones (APZs) and defendable spaces are contained within the proposed Subject Site. b) AEP is given to understand that flood planning levels and servicing constraints have been considered and the proposal has met the required standards. c) Access and services will be provided via existing carriageways and infrastructure.
The assessor must document and justify in the BDAR or BCAR all efforts to avoid, or the reasonable measures proposed to minimise, prescribed impacts when choosing the proposal's location.	Discussed above.
Designing a Project to Avoid and Minimise Prescribed Biodiversity 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. 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.*	a) i. It is not envisaged that any works will impact on features of geological significance, groundwater dependent communities or supporting aquifers. ii. The project design has sought to avoid impacts to biodiversity where possible, however the location of the site and the completed plans require the use of the entire Study Area. However, given the cleared, managed and exotic condition of the Subject Site, the use of this location will reduce the demand on other biodiversity corridors in the broader region. b) It is recommended that powerlines be buried rather than overhead so that flight paths for threatened fauna in the locality are maintained and avoid impacts such as powerline strike. A rural style 'post and rail' fence placed at the edge of the proposed development is recommended along with a low-speed limit within the development will mean that even if animals enter the Subject Site, they are unlikely to be struck by vehicles. c) The project has been designed to reduce filling as much as feasible land in order to minimise downstream impacts. Implementation of WSUD will be incorporated into the project design. d) The Subject DA Footprint will impact upon three (3) man-made dams. A first order watercourse is mapped within the central portion of the site although upon initial inspection does not meet the criteria of a continuous stream however a CAA is likely to be required. The Stormwater Management Plan prepared by ADW Johnson Pty Ltd (refer **Appendix I**), states that it is proposed to remove the large dam/ basin from the existing drainage line and reconstruct a drainage channel and riparian corridor to convey upstream flows through the site to the downstream receiving waters. The northern catchment will be conveyed to the reconstructed channel and riparian corridor via stabilised headwalls. The southern catchment will be conveyed to a detention/ biofiltration basin to limit the peak flows leaving the site to predeveloped flows before discharging to the existing table drain in the northern verge of Raymond Terrace Road via a stabilised headwall. The Subject Site is part of the larger Thornton North Urban Release Area (TNURA) Eastern Precinct, and it was determined that the Subject Site does not require detention or water quality facilities for the northern catchment allowing the large dam/ basin to be removed and the corridor be reconstructed into a drainage channel and riparian corridor. Overall the stormwater detention provided by the proposed OSD basin in the southern catchment will allow the limiting of the post-development critical peak discharges leaving the site to less than that of pre-development for all design storm events up to the 1% AEP storm event; thereby not increasing the risk of flood inundation to existing downstream development and not increasing the demand on the downstream stormwater infrastructure. The treatment train process of rainwater tanks, GPTs, and a detention/ bioretention basin have been designed to effectively reduce the nutrients and gross pollutants from stormwater runoff from the proposed development. Hydrological and hydraulic modelling has shown that the stormwater measures proposed meet or exceed the water quantity and quality objectives set by MCC. e) An Erosion and Sedimentation Control Plan has also been prepared for construction of the proposed development also complying with Council's requirements. The project design process incorporates MUSIC (Model for Urban Stormwater Improvement Conceptualisation) water quality modelling to determine stormwater treatments to ensure post-development water quality at least maintains pre-development conditions.
The proposed measures must be evidence-based and directed towards the threatened entities identified in Chapter 6. The BDAR or BCAR must document the designs that are proposed to avoid or minimise prescribed impacts	Field surveys have been carried out to identify threatened species within the area or presence has been assumed. The development has been designed to follow the principles of avoid and minimise by utilising cleared and degraded land where possible. Due to loss of native vegetation and hollow-bearing trees, nest boxes may need to be installed in retained vegetation to provide suitable habitat for arboreal fauna to further mitigate any impacts of the development.

2.3 Assessment of Impacts

Section 8 of the BAM states that the BDAR "must assess the impacts of the project on native vegetation and habitat". In addition to this, Sections 9.1.4 and 9.2 require that further assessment be produced for any impact, including biodiversity impacts, expected in land surrounding the Subject Site. **Tables 27** to **30** provide a summary of measures proposed to avoid and minimise direct, indirect, prescribed and residual impacts on biodiversity.

Table 27 – Direct Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Native vegetation	Construction and Operation	Removal of 2.42ha of native vegetation including potential habitat for 49 ecosystem credit species.	The location of the proposed subdivision has sought to avoid direct impacts to native vegetation where possible that will facilitate in maintaining connectivity for local fauna movement in the larger area. However, the location of the site and the completed plans require the use of the entire Study Area. Given the cleared, managed and exotic condition of the Subject Site, the use of this location will reduce the demand on other areas of higher quality vegetation in the broader region. Where relevant, compensatory habitat in the form of nest boxes will be installed to compensate for the loss of hollow-bearing trees.	Operation and Post-operation	Council Project coordinator	HR	HR
Habitat in the form of tree hollows	Pre-Construction and Construction	Removal of tree hollows providing habitat for native birds and mammals. Removal of 15 HBTs, with potential for use by fauna.	All hollows removed during the clearing process will be replaced at a ratio of 1:1 with salvaged hollows and/or nest boxes in order to ensure no net loss of hollow resources. Nest boxes are to be installed in retained habitat within the site by qualified ecologists and according to the Habisure system (Franks & Franks 2006) or similar. Where suitable trees are not present poles are to be installed within retained land to provide suitable location for the installation of nest boxes.	Pre-Construction	Project coordinator Project Ecologist	HR	MR
Fauna home range and connectivity	Pre-Construction and Construction	Disturbance to fauna habitat during pre-operation clearing and construction.	Installation of a fauna-protecting fence, including relevant signage, to create a fauna protection zone which coincides with the tree protection zone. A permanent fence should be installed once construction of the new development is complete.	Pre-, during and post-operation	Project coordinator Construction staff Site manager Project Ecologist	HR	LR
Fauna home range and connectivity	Operation	Reduction in connectivity	The location of the proposed subdivision has sought to avoid direct impacts to native vegetation where possible and with the retention of 2 HBTs pending an Arborist Assessment. However, the location of the site and the completed plans require the use of the entire Study Area.. Given its cleared, managed and exotic condition, the Subject Site only provides marginal connectivity due to the lack of midstory species and minimal canopy cover. The use of this location will reduce the demand on other biodiversity corridors in the broader region. Additionally, is recommended that landscaping include native species commensurate with the local vegetation communities.	Pre-, during and post-operation	Council Project coordinator Ecologists	MR	MR
Reduction of biodiversity values	Pre-Construction, Construction and Operation	Damage to retained trees	Installation of a fence as per the item above, including relevant signage, to create a tree protection zone where relevant. Communication of fence location and mapping to all staff involved in clearing and construction operations. Regular inspection of fence by Project Ecologist to monitor and fix if and where necessary.	Pre- and during-operation	Project coordinator Construction staff Site manager Project Ecologist	HR	LR
	Construction	Sediment run-off into retained vegetation area	Best practice erosion and sedimentation (ERSED) control methods to be adopted, enforced and maintained throughout vegetation works, so as to avoid any movement of sediment resulting from clearing and construction into unwanted areas. Where practical, clearing and excavation will be restricted to drier periods.	During development	Project coordinator Construction staff Site manager Project Ecologist	MR	LR
		Change in stream flow and structure	Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise hydrology changes.	During development and Operational	Project coordinator Construction staff Site manager Project Ecologist	MR	LR

Table 28 - Prescribed Impact Assessment

Subject of Prescribed Impact	Project Phase	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Habitat of threatened species or ecological communities associated with: (I) Karst, caves, crevices, cliffs and other geological features of significance or (ii) rocks, or (iii) human made structures, or (iv) non-native vegetation	Human-made structures are present on site. However, no evidence of use by threatened species was identified. Present within the site are areas containing abundant small rocks and piles of debris that also had no evidence of use by threatened species. No other features of geological significance supporting threatened species and ecological communities are present;					
Connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	Construction and operation	The location of the proposed subdivision has sought to avoid direct impacts to native vegetation where possible, however, the location of the site and the completed plans require the use of the entire Study Area. Given its cleared, managed and exotic condition, the Subject Site only provides marginal connectivity due to the lack of midstory species and minimal canopy cover. The use of this location will reduce the demand on other biodiversity corridors in the broader region. Additionally, is recommended that landscaping include native species commensurate with the local vegetation communities.	Pre-operation and operation	Council Project coordinator Project Ecologist	MR	MR
Movement of threatened species that maintains their lifecycle	Construction and operation	Vegetation clearing and resulting habitat clearing are unlikely to affect movement of threatened species due to the absence of evidence of site use by such species. Nearby areas with higher biodiversity value will continue to support connectivity for highly mobile species	Pre-operation and operation	Council Project coordinator Project Ecologist	MR	LR
Water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	Construction and operation	Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise hydrology changes. Best practice erosion and sedimentation (ERSED) control methods to be adopted, enforced and maintained throughout vegetation works, so as to avoid any movement of sediments resulting from clearing and construction into the retained vegetation lands.	Pre-operation and operation	Project coordinator Project Ecologist	MR	LR
Wind turbine strikes on protected animals	No wind turbines will be installed on site. Not applicable.					
Vehicle strikes on threatened species or on animals that are part of a TEC	Construction and operation	Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection. During operation, such impacts will be mitigated through the introduction of low-speed limits as well as speed limiting devices on the precinct's roads.	Pre-operation and operation	Project coordinator Construction staff Site manager Project Ecologist	HR	MR

Table 29 – Indirect Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Noise	Pre-operation and Construction	Noise during construction due to clearing works and related vehicular traffic. Potential disturbance to threatened species or reduced viability of adjacent retained habitat zone.	Timing of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP) which will include a Noise Mitigation Plan.	Pre-operation and Operation	Project coordinator Construction staff Site manager	HR	MR
	Operation	Noise due to traffic. Potential disturbance to threatened species within the surrounding area.	Suitable fencing to be installed and maintained between development and retained lands to prevent access and reduce potential interaction with threatened species. Standard residential speed limits should apply which would limit traffic noise.	During operations and Operational	Civil Contractor	MR	LR
Vibration	Construction	Disturbance to fauna which may lead to displacement to adjacent areas.	Conditions of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP).	During construction	Project coordinator Site manager Construction staff	HR	MR
Dust	Construction	Dust deposits on native flora and fauna habitat, resulting in disturbance to and reduced viability of adjacent habitat.	Dust levels during operations managed according to an approved CEMP: • Daily monitoring of dust generated by construction activities; and • Dust suppression measures (setting maximum speed limits and application of dust suppressants) will be implemented during construction works to limit dust on site.	During construction	Project coordinator Site manager Construction staff	LR	LR
Light spill	Construction	Disturbance to nocturnal fauna, thus reducing viability of the adjacent habitat.	Optimal construction methods as per an approved CEMP will reduce instances of light spill. Such measures will include limiting use of lights where necessary and directing lights in such a way as to limit impact on adjacent vegetated lands. Light-sensitive threatened species are unlikely to occur on site.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Disturbance to nocturnal fauna, thus reducing viability of adjacent retained habitat zone.	Provision of lighting will be in accordance with an approved CEMP. Permanent lighting shall be designed to minimise light spill into surrounding vegetation.	During operations	Civil Contractor	MR	LR
Non-native vegetation	Construction	Soil disturbance may lead to proliferation of exotic flora (including invasive weeds) through seeds and vegetation fragments.	As per an approved CEMP: • Appropriate handling of mulch created from the removal of exotic vegetation; • Appropriate cleaning of all construction equipment to limit the risk of weed seed and fragments to adjacent retained areas; and • Chemical and manual treatment of weeds where applicable.	During construction	Project coordinator Site manager Construction staff	MR	LR
Visual amenity	Construction	Rubbish and waste retained onsite attracting native fauna.	Activities on the Site will be managed in accordance with an approved CEMP and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Rubbish and waste retained onsite attracting native fauna.	Suitable fencing to be installed and maintained between development and surrounding natural areas to deter access and degradation of retained lands.	During operations	Civil Contractor	LR	LR

Table 30 – Residual Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation / Minimisation	Residual Impact Description	Impact to be offset (See Section 2.3.2)
Reduction of biodiversity values	Construction Operation	Clearing of 2.42ha of native vegetation	The Subject Site location has sought to avoid most areas of higher biodiversity values; however, the location of the site and the completed plans require the use of the entire Study Area. Given its cleared, managed and exotic condition, the Subject Site only provides marginal connectivity due to the lack of midstory species and minimal canopy cover. The use of this location will reduce the demand on other biodiversity corridors in the broader region. It is therefore considered to be situated in an optimal part of the parent lot.	PCT 1600 – 1.87ha PCT 1598 – 0.18ha PCT 1736 – 0.37ha	Yes
		Removal of 15 HBTs with potential for use by fauna	Installation of 15 nest boxes, as well as any recovered hollows in the Subject Site. To be installed within retained lands in the broader appropriately zoned land within the TNURA development area. Where suitable trees are not present poles are to be installed within retained land to provide suitable location for the installation of nest boxes.		Yes
Noise, dust, light spill	Pre-operation and Operation	Disturbance to local fauna	Application of CEMP as mentioned above.	Noise, dust and light spill will still occur but a low magnitude, thus keeping the impact on local fauna to a low level	No

Table 31 – Risk Matrix

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

CRITICAL	CR
HIGH RISK	HR
MEDIUM RISK	MR
LOW RISK	LR

Table 32 – Assessment Criteria

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

2.4 Summary of Potential Impacts on Biodiversity

2.4.1 Prescribed Impacts Requiring Offsetting

No prescribed impacts are relevant to the Subject Site.

2.4.2 Vegetation Clearance Requiring Offsetting

The development would result in the loss of approx. 2.42ha of native vegetation. The future Vegetation Integrity Scores will be zero for all areas.

The BAM Calculator valued the loss of 0.18ha of PCT 1598 at 5 Credits, 1.88ha of PCT 1600 at 37 credits and 0.37ha of PCT 1736 at 7 credits, giving a total of 49 Ecosystem Credits.

2.4.3 Species Credit Species

The proposal will require the following Species credits to offset the residual impact of the proposed development for Southern Myotis:

- 42 x Southern Myotis.

Impact areas requiring offset are shown in **Figure 9**.

2.4.4 Vegetation Clearance Not Requiring Offsetting

Vegetation clearance not requiring offsetting includes 7.81ha of exotic grassland, exotic canopy, manmade dams, farming infrastructure, access tracks and water bodies

2.4.5 Impacts requiring offset

2.4.5.1 Ecosystem Credits

As per Section 10.3 of the BAM, the removal of native vegetation within the site will require offsetting to achieve the 'no net loss standard' detailed within Section 11 of the BAM. To calculate the required offsets in the form of ecosystem credits, the BAM Calculator has taken into consideration the impact area and the projected loss in vegetation integrity score along with the biodiversity risk weighting of the PCT. Details of each along with the required credit outputs is provided in **Table 33**. A total of 49 ecosystem credits are required to offset the proposed development. Impact areas requiring offset are shown in **Figure 8**.

Table 33 – Ecosystem Credit Requirements

Vegetation Zone	Condition	Impact Area (ha)	Future VIS	Vegetation Integrity Score Loss	Biodiversity Risk Weighting	Credit Requirements
PCT 1598	Moderate	0.18	-	59.1	2.0	5
PCT 1600	Degraded - Canopy Only	0.87	-	26.3	2.0	11
PCT 1600	Moderate	0.99	-	52.1	2.0	26
PCT 1736	Poor	0.37	-	36.9	2.0	7
Total		**2.42**	**-**	**-**	**-**	**49**

2.4.5.2 Species Credits

If a Species Credit species is either identified on the site during survey, assumed to be present, or confirmed present within an expert report, a 'species polygon' is required to be produced for the area of suitable habitat within the site for the species. The size of this polygon is entered into the BAM Calculator, which determines the number of credits required to offset the removal of suitable habitat based upon the quality of habitat and biodiversity risk weighting of the species. Refer **Figure 9** for Southern Myotis polygon and **Table 34** for species credits.

Table 34 – Species Credit Requirements – *Myotis macropus*

Vegetation Zone	Condition	Impact Area (ha)	Biodiversity Risk Weighting	Credit Requirements
PCT 1598	Moderate	0.18	2.0	5
PCT 1600	Degraded - Canopy Only	0.58	2.0	8
PCT 1600	Moderate	0.83	2.0	22
PCT 1736	Poor	0.37	2.0	7
Total		**2.42**	**-**	**42**

2.5 Biodiversity Credit Report

The Biodiversity Credit Report generated within the BAM Calculator is provided in **Appendix E** and includes potential offset variations that are applicable to the proposal.

Conclusion

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

The vegetation within the site was found to be commensurate with PCT 1600, 1598 and 1736 within various conditions. The remainder of the site predominantly comprised non-native grazed pasture / cleared areas.

The Development Footprint is the result of a design process which has sought to incorporate avoid and minimise principals, whilst providing for the residential demand within the growing township of Chisholm, on the outskirts of East Maitland. Consideration of linkages to the existing surrounding development such as road, stormwater facilities and other services such as electricity and water supplies had to be considered in the design to ensure the proposed development could provide these services to the residents. The ecological assessment undertaken during the rezoning process determined the Subject Site had little to no biodiversity values due to its location and existing high levels of disturbance and clearing.

The TNUAR process identified key areas within the region to ensure the areas of biodiversity value and connectivity within the region were retained. Such areas are Tilligerry State Conservation Area and Northeast of the Subject Site at Wallaroo National Park. As well as the BV mapped land at Woodberry Swamp, 2kms Southeast from the site. The surrounding higher quality vegetation, when evaluated considering the disturbed, poorer quality vegetation across the Subject Site, illustrates that the development is located within the most suitable, disturbed portions of the broader locality.

A number of development footprint iteration plans were considered with the final design enabling retention of vegetation along Raymond Terrace Road, which protects two habitat trees and is presented in **Appendix A**

The proposal will require impact to 2.42ha of native vegetation described as PCT 1600, 1598 and 1736. As a result, a total of 49 Ecosystem Credits and 42 Species Credits for Southern Myotis that will be required to be retired to offset the residual impacts to native vegetation and achieve a no net loss standard.

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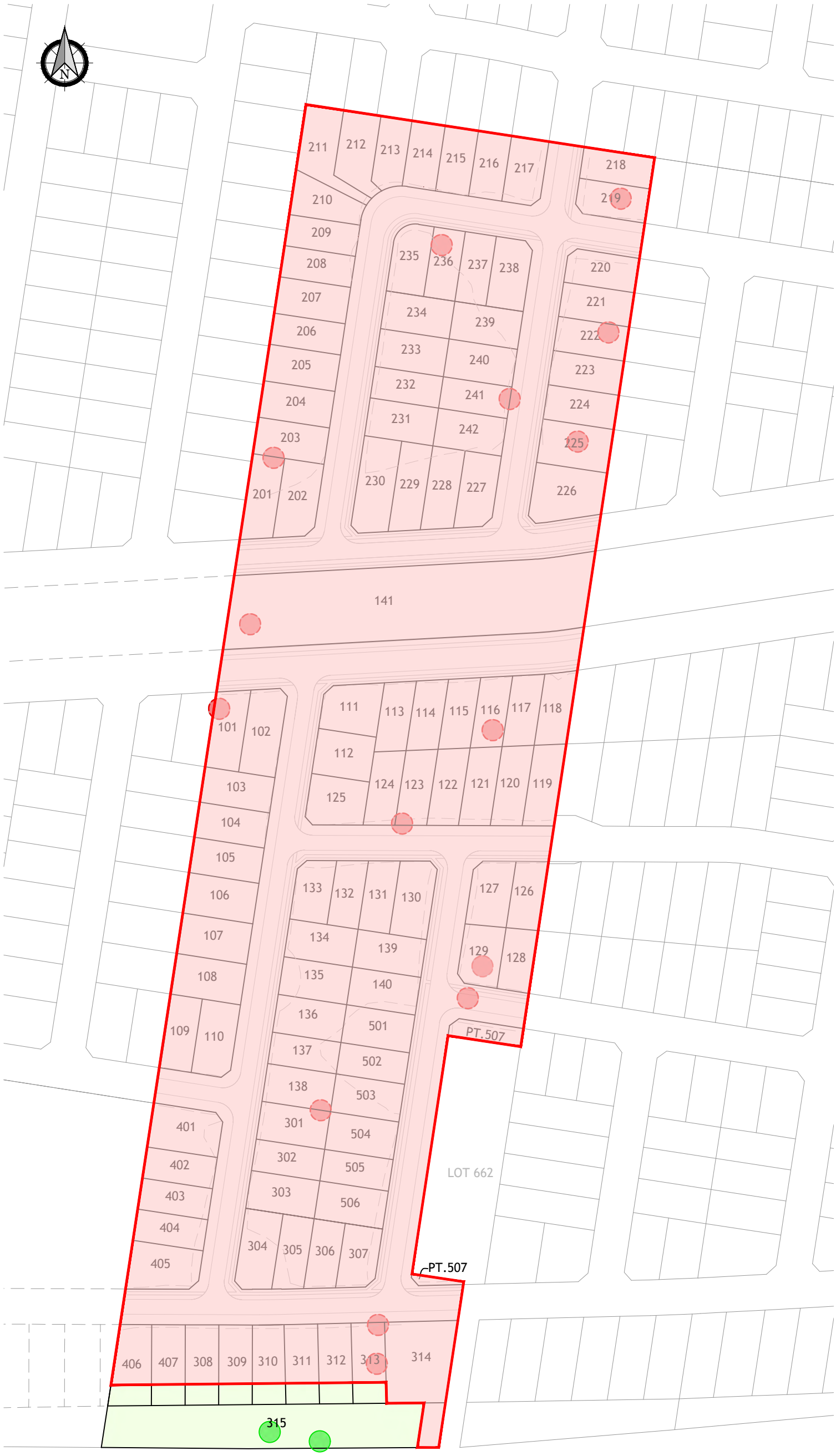
Appendix A – Development Plan

190873-ESK-004[B]



ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
B	09/05/23	TREE COUNT UPDATED	L.K.	N.D.	DATUM: N/A CONTOUR INTERVAL: N/A	A1 1:500 — 0 12.5 25.0m — A3 1:1000	

working beyond expectations

drawing title:

DISTURBANCE PLAN
FRONT SETBACK ONLY

location: 523 RAYMOND TERRACE ROAD CHISHOLM

council: MCC

dwg ref: 190873-ESK-004

client: ACG CLOVELLY ROAD PTY LTD

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• urban design • visualisation • development feasibility • surveying • infrastructure • superintendency • social impact • town planning • civil engineering • project management

Plotted By: Nathan Delaney; Plot Date: 09/05/23 10:21:35AM; Cad File: S:\190873\DWG\ENGINEERING\ESK\190873-ESK-004[B].DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.

Appendix B – Flora Species List

Family	Scientific Name	Common Name
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Corymbia maculata*	Spotted Gum
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Convolvulaceae	*Dichondra repens*	Kidney Weed
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Cyperaceae	*Carex inversa*	Knob Sedge
Cyperaceae	*Cyperus gracilis*	Slender Flat Sedge
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Plantaginaceae	*Plantago lanceolata**	Ribwort
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Fabaceae	*Glycine clandestina*	Twining Glycine
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Lolium perrenne**	Perennial Ryegrass
Poaceae	*Briza maxima**	Quaking Grass
Verbenaceae	*Lantana camara**	Lantana
Lobeliaceae	*Lobelia purpurascens*	Whiteroot
Poaceae	*Oplismenus aemulus*	Basket Grass
Crassulaceae	*Bryophyllum delagoense**	Mother of Millions
Fabaceae	*Hardenbergia violacea*	False Sarsparilla
Verbenaceae	*Verbena bonariensis**	Purpletop
Poaceae	*Cenchrus clandestinum**	Kikuyu
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Fabaceae	*Trifolium repens**	White Clover
Poaceae	*Avena barbata**	Bearded Oats
Poaceae	*Eragrostis curvula**	African Lovegrass
Poaceae	*Cymbopogon refractus*	Barbwire Grass
Poaceae	*Imperata cylindrica*	Blady Grass
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Fabaceae	*Acacia falcata*	Sickle Wattle
Fabaceae	*Acacia parvipinnula*	Silver-stemmed Wattle
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae	*Glycine microphylla*	Small-leaf Glycine
Poaceae	*Sporobolus africanus**	Parramatta Grass
Haloragaceae	*Myriophyllum latifolium*	

Family	Scientific Name	Common Name
Loranthaceae	*Dendrophthoe vitellina*	Mistletoe
Juncaceae	*Juncus spp.*	
Poaceae	*Paspalidium distans*	
Lemnaceae	*Spirodela punctata*	Duckweed
Poaceae	*Lachnagrostis aemula*	Blown Grass
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Malvaceae	*Hibiscus heterophyllus subsp. heterophyllus*	Native Rosella
Asteraceae	*Taraxacum officinale**	Dandelion
Juncaceae	*Juncus cognatus**	
Poaceae	*Vulpia spp.**	Rat's-tail Fescue
Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Moraceae	*Ficus rubiginosa*	Port Jackson Fig
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Melaleuca bracteata*	Black Tea-tree
Myrtaceae	*Corymbia eximia*	Yellow Bloodwood
Myrtaceae	*Acmena smithii*	Lillypilly
Fabaceae	*Indigofera australis*	Native Indigo
Myrtaceae	*Syzygium luehmannii*	Small-leaved Lilly Pilly
Myrtaceae	*Callistemon viminalis*	Weeping Bottlebrush
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Lamiaceae	*Lamium amplexicaule**	Dead Nettle
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Araceae	*Pistia stratiotes**	Water Lettuce
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Juncaceae	*Juncus usitatus*	Common Rush
Poaceae	*Briza minor**	Shivery Grass
Marsileaceae	*Marsilea mutica*	
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark
Caryophyllaceae	*Petrorhagia dubia**	
Oleaceae	*Notelaea ovata*	Mock Olive
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany
Verbenaceae	*Verbena litoralis**	
Santalaceae	*Exocarpos cupressiformis*	Native Cherry
Fabaceae	*Trifolium dubium**	Yellow Suckling Clover
Fabaceae	*Vicia sativa**	Common vetch
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Iridaceae	*Romulea rosea**	

Family	Scientific Name	Common Name
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus moluccana*	Grey Box
Solanaceae	*Solanum americanum**	Glossy Nightshade
Caryophyllaceae	*Stellaria media**	Common Chickweed
Poaceae	*Setaria parviflora**	Slender Pigeon Grass
Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark
Oleaceae	*Notelaea longifolia*	Mock Olive, Large Mock-olive
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Agavaceae	*Yucca spp.**	
Alstroemeriaceae	*Alstroemeria spp.**	
Amaryllidaceae	*Clivia miniata**	Natal Lily
Apiaceae	*Foeniculum vulgare**	Fennel
Araliaceae	*Schefflera arboricola**	
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm
Arecaceae	*Syagrus romanzoffiana**	Cocos Palm
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus Fern
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush
Asteraceae	*Facelis retusa**	Annual Trampweed
Bignoniaceae	*Tecoma spp.**	
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose
Orchidaceae	*Dendrobium speciosum*	Rock Lily
Euphorbiaceae	*Euphorbia peplus**	Spurge
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Euphorbiaceae	*Euphorbia spp.**	
Brassicaceae	*Lepidium africanum**	Common Peppercress
Phormiaceae	*Dianella longifolia*	Blue Flax Lily
Phyllanthacece	*Phyllanthus tenellus**	Hen and Chicken
Oxalidaceae	*Oxalis spp.*	
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree
Fabaceae	*Medicago polymorpha**	Burr Medic
Pittosporaceae	*Hymenosporum flavum*	Native Frangipani
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Poaceae	*Dichelachne crinita*	Long-hair Plume Grass
Poaceae	*Microlaena stipoides*	Weeping Grass
Poaceae	*Aristida vagans*	Three-awn Speargrass
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass

Family	Scientific Name	Common Name
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Chenopodiaceae	*Einadia nutans subsp. linifolia*	Climbing Saltbush
Euphorbiaceae	*Poranthera microphylla*	Small Poranthera
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Liliaceae	*Chlorophytum comosum**	Spider Plant
Fabaceae	*Desmodium rhytidophyllum*	
Malvaceae	*Malva parviflora**	Small-flowered Mallow
Poaceae	*Briza subaristata**	
Caryophyllaceae	*Paronychia brasiliana**	Brazilian Whitlow
Onagraceae	*Oenothera spp.**	
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass
Poaceae	*Themeda triandra*	Kangaroo Grass
Oleaceae	*Olea europaea subsp. cuspidata**	African Olive
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Proteaceae	*Grevillea robusta*	Silky Oak
Ranunculaceae	*Ranunculus inundatus*	River Buttercup
Oxalidaceae	*Oxalis articulata**	
Pinaceae	*Pinus spp.**	
Pontederiaceae	*Eichornia crassipes**	Water Hyacinth
Oxalidaceae	*Oxalis perennans*	Yellow-flowered Wood Sorrel
Poaceae	*Bromus cartharticus**	Prairie Grass
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Scrophulariaceae	*Veronica plebeia*	Creeping Speedwell
Solanaceae	*Solanum prinophyllum*	Forest Nightshade
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Typhaceae	*Typha orientalis*	Cumbungi
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade
Strelitziaceae	*Strelitzia nicolai**	
Vitaceae	*Cayratia clematidea*	Native Grape

* Denotes an exotic species.

Appendix C – Fauna Species List

EXPECTED FAUNA SPECIES LIST

The following list includes fauna species that could be reasonably expected to occur on the Subject Site at some point, given site attributes and location.

“Threatened species listed under the BC Act or the EPBC Act are indicated in bold font.

Surveyed Observations used within Site:

- Observed (O);
- Heard (W);
- Scat (P);
- Miscellaneous (M);
- Track/scratchings (F); and
- Nest (E), Burrow (FB).

Bat Records used within Site:

- Observed (O);
- Definitely (D);
- Possible or within Species Group (P); and
- Likely (L).

Survey Equipment used to observe fauna within the Subject Site:

- Anabat (A);
- Songmeter (SM);
- Camera Trap (CT); and

Harp Trap (HT).

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
			Amphibia			
Crinia signifera	Common Eastern Froglet	P		114	W, O	
Litoria caerulea	Green Tree Frog	P		41		
Litoria dentata	Bleating Tree Frog	P		13	W, O	
Litoria fallax	Eastern Dwarf Tree Frog	P		76	W, O	
Litoria latopalmata	Broad-palmed Frog	P		17		
Litoria peronii	Peron's Tree Frog	P		100	W	
Litoria tyleri	Tyler's Tree Frog	P		20		Q
Litoria verreauxii	Verreaux's Frog	P		17	W	
Limnodynastes peronii	Brown-striped Frog	P		83	W	
Limnodynastes tasmaniensis	Spotted Grass Frog	P		50	W	
			Reptilia			
Chelodina longicollis	Eastern Snake-necked Turtle	P		20	O	
Carlia tetradactyla	Southern Rainbow-skink	P		14		
Eulamprus quoyii	Eastern Water-skink	P		16	O	Q
Lampropholis delicata	Dark-flecked Garden Sunskink	P		37	O	
Tiliqua scincoides	Eastern Blue-tongue	P		83		
Varanus varius	Lace Monitor	P		5		
Hemiaspis signata	Black-bellied Swamp Snake	P		1		
Pseudechis porphyriacus	Red-bellied Black Snake	P		46	O	
Pseudonaja textilis	Eastern Brown Snake	P		8		
			Aves			
Alectura lathami	Australian Brush-turkey	P		1		
Synoicus ypsilophora	Brown Quail	P		16	O	
Anas castanea	Chestnut Teal	P		438	O	
Anas gracilis	Grey Teal	P		386		
Anas rhynchotis	Australasian Shoveler	P		200		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Anas superciliosa	Pacific Black Duck	P		508	O	
Aythya australis	Hardhead	P		212		
Chenonetta jubata	Australian Wood Duck	P		362	O, W	
Cygnus atratus	Black Swan	P		322	O	
Malacorhynchus membranaceus	Pink-eared Duck	P		137		
Poliocephalus poliocephalus	Hoary-headed Grebe	P		71		
Tachybaptus novaehollandiae	Australasian Grebe	P		249	O	
Columba livia	Rock Dove			50	O	
Geopelia humeralis	Bar-shouldered Dove	P		35		
Ocyphaps lophotes	Crested Pigeon	P		373	O	
Spilopelia chinensis	Spotted Turtle-Dove			286		
Podargus strigoides	Tawny Frogmouth	P		63	O	Q
Anhinga novaehollandiae	Australasian Darter	P		210		
Microcarbo melanoleucos	Little Pied Cormorant	P		206		
Phalacrocorax carbo	Great Cormorant	P		159		
Phalacrocorax sulcirostris	Little Black Cormorant	P		257	O	
Phalacrocorax varius	Pied Cormorant	P		91	O	
Pelecanus conspicillatus	Australian Pelican	P		283		
Ardea intermedia	Intermediate Egret	P		140	O	
Ardea pacifica	White-necked Heron	P		95		
Bubulcus ibis	Cattle Egret	P		253		
Casmerodius modesta	Eastern Great Egret	P		240		
Egretta garzetta	Little Egret	P		69		
Egretta novaehollandiae	White-faced Heron	P		322	O	AR
Nycticorax caledonicus	Nankeen Night Heron	P		49		
Platalea flavipes	Yellow-billed Spoonbill	P		67		
Platalea regia	Royal Spoonbill	P		237		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Plegadis falcinellus	Glossy Ibis	P		29		
Threskiornis moluccus	Australian White Ibis	P		233		
Threskiornis spinicollis	Straw-necked Ibis	P		254		
Circus approximans	Swamp Harrier	P		163		
Haliastur sphenurus	Whistling Kite	P		194	? (unidentified raptor, possibly whistling kite 17/10	
Falco berigora	Brown Falcon	P		31		
Falco cenchroides cenchroides	Nankeen Kestrel	P		90		
Falco longipennis	Australian Hobby	P		82		
Falco peregrinus	Peregrine Falcon	P		41		
Fulica atra	Eurasian Coot	P		310		
Gallinula tenebrosa	Dusky Moorhen	P		201	O, W	
Porphyrio porphyrio	Purple Swamphen	P		349	O, W	Q
Himantopus himantopus	Black-winged Stilt	P		234		
Recurvirostra novaehollandiae	Red-necked Avocet	P		69		
Elseyornis melanops	Black-fronted Dotterel	P		79		
Erythrogonys cinctus	Red-kneed Dotterel	P		34		
Vanellus miles	Masked Lapwing	P		382	O, W	
Cacatua galerita	Sulphur-crested Cockatoo	P		334	O,W	
Cacatua sanguinea	Little Corella	P		203	O,W	
Cacatua tenuirostris	Long-billed Corella	P		120	O	
Eolophus roseicapilla	Galah	P		522	O	
Zanda funereus	Yellow-tailed Black-Cockatoo	P		82		
Alisterus scapularis	Australian King-Parrot	P		83	O, W	
Glossopsitta concinna	Musk Lorikeet	P		25		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Platycercus elegans	Crimson Rosella	P		14		
Platycercus eximius	Eastern Rosella	P		404	O,W	Q
Psephotus haematonotus	Red-rumped Parrot	P		171		
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	P		163		
Trichoglossus haematodus	Rainbow Lorikeet	P		514	O,W	
Eudynamys orientalis	Eastern Koel	P		99		
Heteroscenes pallidus	Pallid Cuckoo	P		20		
Scythrops novaehollandiae	Channel-billed Cuckoo	P		81	O	
Ninox novaeseelandiae	Southern Boobook	P		13	W	
Ceyx azureus	Azure Kingfisher	P		9		
Dacelo novaeguineae	Laughing Kookaburra	P		273	O, W	Q
Todiramphus sanctus	Sacred Kingfisher	P		94		Q
Eurystomus orientalis	Dollarbird	P		97		
Cormobates leucophaea	White-throated Treecreeper	P		91		
Ptilonorhynchus violaceus	Satin Bowerbird	P		29	O	
Malurus cyaneus	Superb Fairy-wren	P		461	W, O	Q
Malurus lamberti	Variegated Fairy-wren	P		40		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P		80		
Acanthiza lineata	Striated Thornbill	P		58		
Acanthiza nana	Yellow Thornbill	P		84		
Acanthiza pusilla	Brown Thornbill	P		68		
Pardalotus punctatus	Spotted Pardalote	P		149		
Pardalotus striatus	Striated Pardalote	P		66		
Acanthorhynchus tenuirostris	Eastern Spinebill	P		76		
Anthochaera carunculata	Red Wattlebird	P		95		
Caligavis chrysops	Yellow-faced Honeyeater	P		309	O	

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Entomyzon cyanotis	Blue-faced Honeyeater	P		66		
Manorina melanocephala	Noisy Miner	P		491	O, W	Q
Manorina melanophrys	Bell Miner	P		100		
Meliphaga lewinii	Lewin's Honeyeater	P		77		
Melithreptus brevirostris	Brown-headed Honeyeater	P		30		
Melithreptus lunatus	White-naped Honeyeater	P		53		
Myzomela sanguinolenta	Scarlet Honeyeater	P		100		
Philemon corniculatus	Noisy Friarbird	P		83		
Phylidonyris niger	White-cheeked Honeyeater	P		35		
Pomatostomus temporalis temporalis	**Grey-crowned Babbler (eastern subspecies)**	**V**		**47**	**O,W**	**Q**
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P		332	O	
Colluricincla harmonica	Grey Shrike-thrush	P		61		
Pachycephala pectoralis	Golden Whistler	P		131		
Pachycephala rufiventris	Rufous Whistler	P		74		
Oriolus sagittatus	Olive-backed Oriole	P		70		
Sphecotheres vieilloti	Australasian Figbird	P		72		
Artamus leucoryn	White-breasted Woodswallow	P		125		
Cracticus nigrogularis	Pied Butcherbird	P		344		Q
Cracticus torquatus	Grey Butcherbird	P		162		Q
Gymnorhina tibicen	Australian Magpie	P		787	O	Q
Strepera graculina	Pied Currawong	P		83		
Rhipidura albiscapa	Grey Fantail	P		275	W, O	
Rhipidura leucophrys	Willie Wagtail	P		451	O	Q
Corvus coronoides	Australian Raven	P		527	O	

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Grallina cyanoleuca	Magpie-lark	P		665	O	Q
Eopsaltria australis	Eastern Yellow Robin	P		96		
Cisticola exilis	Golden-headed Cisticola	P		215		
Acrocephalus australis	Australian Reed-Warbler	P		214		
Cincloramphus timoriensis	Tawny Grassbird	P		62		
Poodytes gramineus	Little Grassbird	P		140		
Hirundo neoxena	Welcome Swallow	P		409	O	
Petrochelidon ariel	Fairy Martin	P		87		
Petrochelidon nigricans	Tree Martin	P		110		
Acridotheres tristis	Common Myna			448		
Sturnus vulgaris	Common Starling			242		
Zosterops lateralis	Silvereye	P		145		
Dicaeum hirundinaceum	Mistletoebird	P		71		
Neochmia temporalis	Red-browed Finch	P		140	O	
Passer domesticus	House Sparrow			36		
Anthus novaeseelandiae	Australian Pipit	P		125		
Mammalia						
Antechinus stuartii	Brown Antechinus	P		121		
Petaurus breviceps	Sugar Glider	P		93	O	Q
Pseudocheirus peregrinus	Common Ringtail Possum	P		20		
Acrobates pygmaeus	Feathertail Glider	P		23		Q
Trichosurus vulpecula	Common Brushtail Possum	P		141	O	Q
Macropus giganteus	Eastern Grey Kangaroo	P		54	O	Q
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	**51**	**W**	
Pteropus scapulatus	Little Red Flying-fox	P		1		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Rhinolophus megaphyllus	Eastern Horseshoe-bat	P		17		
Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**	**V**		**7**	**D**	**U**
Austronomus australis	White-striped Freetail-bat	P		53	D	U
Micronomus norfolkensis	**Eastern Coastal Free-tailed Bat**	**V**		**41**	**D**	**U**
Ozimops planiceps	South-eastern Free-tailed Bat	P		5	D	U
Ozimops ridei	Eastern Free-tailed Bat	P		43	D	U
Chalinolobus gouldii	Gould's Wattled Bat	P		88	D	U
Chalinolobus morio	Chocolate Wattled Bat	P		56	D	U
Falsistrellus tasmaniensis	**Eastern False Pipistrelle**	**V**		**32**	**P**	**U**
Myotis macropus	**Southern Myotis**	**V**		**33**	**P**	**U**
Nyctophilus geoffroyi	Lesser Long-eared Bat	P		18	P	U
Nyctophilus gouldi	Gould's Long-eared Bat	P		23	P	U
Nyctophilus sp.	long-eared bat	P		46		
Scoteanax rueppellii	**Greater Broad-nosed Bat**	**V**		**24**	**D**	**U**
Scotorepens orion	Eastern Broad-nosed Bat	P		32		
Vespadelus darlingtoni	Large Forest Bat	P		3	P	U
Vespadelus pumilus	Eastern Forest Bat	P		16	P	U
Vespadelus regulus	Southern Forest Bat	P		5	P	U
Vespadelus troughtoni	**Eastern Cave Bat**	**V**		**10**	**P**	**U**
Vespadelus vulturnus	Little Forest Bat	P		91	P	U
Miniopterus australis	**Little Bent-winged Bat**	**V**		**80**	**D**	**U**
Miniopterus orianae oceanensis	**Large Bent-winged Bat**	**V**		**30**	**D**	**U**
Rattus fuscipes	Bush Rat	P		9		Q
Rattus rattus	Black Rat			23		Q
Rattus sp.	rat	P		1		
Vulpes vulpes	Fox			44	O	Q

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Oryctolagus cuniculus	Rabbit			17	P	

Appendix D – BAM Plot Data

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
*Ehrharta erecta**	Panic Veldtgrass	15	20			20	20	5
*Lantana camara**	Lantana		2			0.3	20	
Eucalyptus robusta	Swamp Mahogany						15	
Melaleuca bracteata	Black Tea-tree						15	
*Bromus cartharticus**	Prairie Grass						15	5
*Phoenix canariensis**	Canary Island Date Palm						8	
*Asparagus plumosus**	Climbing Asparagus Fern						8	
Hymenosporum flavum	Native Frangipani						7	
Grevillea robusta	Silky Oak						7	
*Strelitzia nicolai**							7	
Hibiscus heterophyllus subsp. heterophyllus	Native Rosella						6	
*Cinnamomum camphora**	Camphor Laurel						5	
*Ligustrum lucidum**	Large-leaved Privet						5	
Corymbia eximia	Yellow Bloodwood						5	
*Tecoma spp.**							5	
*Pinus spp.**							4	
*Sida rhombifolia**	Paddy's Lucerne	5	5			5	4	10
Acmena smithii	Lillypilly						4	
Syzygium luehmannii	Small-leaved Lilly Pilly						4	
*Euphorbia spp.**							4	
*Bidens pilosa**	Cobbler's Pegs	3	0.3	0.3		0.4	3	1
*Olea europaea subsp. cuspidata**	African Olive						3	
Casuarina glauca	Swamp Oak						3	
Callistemon viminalis	Weeping Bottlebrush						3	
*Syagrus romanzoffiana**	Cocos Palm						3	
*Lolium perrenne**	Perennial Ryegrass		2			10	2	1
Lobelia purpurascens	Whiteroot	0.5	2	10		2	2	5
Breynia oblongifolia	Coffee Bush		0.5			1	2	
*Foeniculum vulgare**	Fennel						2	
Dichondra repens	Kidney Weed		5			2	1	4
*Verbena bonariensis**	Purpletop	2	1	3		10	1	5
Ficus rubiginosa	Port Jackson Fig						1	
*Yucca spp.**							1	
*Solanum mauritianum**	Wild Tobacco						1	
*Solanum nigrum**	Black Nightshade, Black-berry Nightshade						1	

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
*Cenchrus clandestinum**	Kikuyu	25	1	30		5	0.5	10
*Sonchus oleraceus**	Common Sow-thistle	0.3	0.2				0.5	0.2
Dianella longifolia	Blue Flax Lily		0.2			0.5	0.5	
Eucalyptus microcorys	Tallowwood						0.5	
Melaleuca linariifolia	Snow in Summer						0.5	
*Alstroemeria spp.**							0.5	
Cupaniopsis anacardioides	Tuckeroo					0.1	0.5	
*Chlorophytum comosum**	Spider Plant						0.4	
Dendrobium speciosum	Rock Lily						0.4	
*Plantago lanceolata**	Ribwort	5	5	5		1	0.3	15
*Sporobolus africanus**	Parramatta Grass	0.5	0.5			2	0.3	0.3
*Schefflera arboricola**							0.3	
*Phyllanthus tenellus**	Hen and Chicken						0.3	
*Hypochaeris radicata**	Flatweed	0.5	1	0.2		0.5	0.2	2
Glycine clandestina	Twining Glycine					0.2	0.2	0.5
*Euphorbia peplus**	Spurge						0.2	
*Medicago polymorpha**	Burr Medic						0.2	
*Malva parviflora**	Small-flowered Mallow						0.2	
*Senecio madagascariensis**	Fireweed	4	1	5		0.3	0.1	3
*Asparagus aethiopicus**	Asparagus Fern						0.1	
*Ochna serrulata**	Mickey Mouse Plant						0.1	
*Lysimachia arvensis**	Scarlet Pimpernel	0.5	5	0.3		0.2	0.1	0.2
*Vulpia spp.**	Rat's-tail Fescue					0.3	0.1	
*Vicia sativa**	Common vetch	0.1		0.5			0.1	
*Clivia miniata**	Natal Lily						0.1	
*Facelis retusa**	Annual Trampweed						0.1	
*Cerastium glomeratum**	Mouse-ear Chickweed						0.1	
*Oxalis articulata**							0.1	
Cayratia clematidea	Native Grape						0.1	
*Bryophyllum delagoense**	Mother of Millions					6		
*Eragrostis curvula**	African Lovegrass					0.5		
*Pistia stratiotes**	Water Lettuce				6			
*Axonopus fissifolius**	Narrow-leaved Carpet Grass			3				
*Romulea rosea**				0.5				
*Briza subaristata**								0.4

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
*Eichornia crassipes**	Water Hyacinth							
Eucalyptus amplifolia	Cabbage Gum		15					
Eucalyptus tereticornis	Forest Red Gum		15					
Corymbia maculata	Spotted Gum	25	8			40		25
Eucalyptus globoidea	White Stringybark		5			4		
*Briza maxima**	Quaking Grass		2			3		1
Oplismenus aemulus	Basket Grass		2					
Hardenbergia violacea	False Sarsparilla		1			1		
*Trifolium repens**	White Clover	1	1	0.3		0.3		15
Cymbopogon refractus	Barbwire Grass		1					
Imperata cylindrica	Blady Grass		1					
Glycine microphylla	Small-leaf Glycine		0.5					
Dendrophthoe vitellina	Mistletoe		0.5			1		0.5
Paspalidium distans			0.5			3		
Lachnagrostis aemula	Blown Grass		0.5					
Brachyscome multifida	Cut-leaved Daisy		0.3					
Ozothamnus diosmifolius	Ball Everlasting		0.3					
Pandorea pandorana	Wonga Vine		0.3					
Leucopogon juniperinus	Prickly Beard-heath		0.3					
Indigofera australis	Native Indigo		0.3					
Juncus usitatus	Common Rush		0.3		3			0.7
*Briza minor**	Shivery Grass	0.5	0.3			0.2		0.1
*Petrorhagia dubia**			0.3					
Notelaea ovata	Mock Olive		0.3					
Entolasia stricta	Wiry Panic		0.3			0.5		
Exocarpos cupressiformis	Native Cherry		0.3					
*Trifolium dubium**	Yellow Suckling Clover	0.1	0.2			0.3		0.2
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush		0.2			0.4		
*Lepidium africanum**	Common Peppercress		0.2					
Dianella caerulea	Blue Flax-lily		0.2					
Aristida vagans	Three-awn Speargrass		0.2					
Eragrostis leptostachya	Paddock Lovegrass		0.2					
Wahlenbergia gracilis	Australian Bluebell		0.1					
Einadia nutans subsp. linifolia	Climbing Saltbush		0.1					
Poranthera microphylla	Small Poranthera		0.1					

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
Desmodium rhytidophyllum			0.1					
*Paronychia brasiliana**	Brazilian Whitlow		0.1					
*Oenothera spp.**			0.1					
Oxalis perennans	Yellow-flowered Wood Sorrel	0.1	0.1	0.1				
Solanum prinophyllum	Forest Nightshade		0.1					
Centella asiatica	Swamp Pennywort			1	0.3			0.3
Parsonsia straminea	Common Silkpod							
Allocasuarina torulosa	Forest Oak							
Einadia nutans	Climbing Saltbush	0.5						
Carex inversa	Knob Sedge							0.3
Cyperus gracilis	Slender Flat Sedge					1		
Eleocharis sphacelata	Tall Spike-rush				30			
*Avena barbata**	Bearded Oats					0.5		
Acacia falcata	Sickle Wattle							
*Cynodon spp.**		15	5	10	5	10	0.5	10
Acacia parvipinnula	Silver-stemmed Wattle							
Daviesia ulicifolia	Gorse Bitter Pea							
Myriophyllum latifolium					0.1			
Juncus spp.		0.2						
Spirodela punctata	Duckweed				0.2			
*Taraxacum officinale**	Dandelion					0.3		
*Juncus cognatus**						0.3		
*Lamium amplexicaule**	Dead Nettle					0.1		
Marsilea mutica					2			
Eucalyptus paniculata	Grey Ironbark					15		
Eucalyptus acmenoides	White Mahogany							
*Verbena litoralis**		0.3		0.5				
Eucalyptus fibrosa	Broad Leaved Ironbark	15						
Eucalyptus crebra	Narrow-leaved Ironbark							
Eucalyptus moluccana	Grey Box							
*Solanum americanum**	Glossy Nightshade	1						
*Stellaria media**	Common Chickweed	0.3						
*Setaria parviflora**	Slender Pigeon Grass	0.3						
Eucalyptus siderophloia	Northern Grey Ironbark							
Notelaea longifolia	Mock Olive, Large Mock-olive					0.2		
*Modiola caroliniana**	Red-flowered Mallow	0.2						

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
*Phytolacca octandra**	Inkweed	0.2						
Ludwigia peploides subsp. montevidensis	Water Primrose				0.3			
Oxalis spp.								0.1
Glochidion ferdinandi	Cheese Tree	0.1						
Bursaria spinosa	Native Blackthorn							
Dichelachne crinita	Long-hair Plume Grass							1
Microlaena stipoides	Weeping Grass					5		
Dichelachne micrantha	Short-hair Plume Grass					0.5		
Sporobolus creber	Slender Rat's Tail Grass					0.5		
Sporobolus elongatus	Slender Rat's Tail Grass							
Themeda triandra	Kangaroo Grass							
Persicaria decipiens	Slender Knotweed				0.3			
Ranunculus inundatus	River Buttercup				0.3			
Veronica plebeia	Creeping Speedwell							
Typha orientalis	Cumbungi							
	Overall species count: 156	**30**	**58**	**17**	**12**	**44**	**66**	**30**
** indicates exotic*	**Exotic species count: 69**	**22**	**22**	**13**	**2**	**24**	**44**	**19**
^ indicates non-endemic native eg WA or SA species not naturally occuring	**Exotic Cover %**	**79.8**	**53.2**	**58.6**	**11**	**76.5**	**127.4**	**84.4**
	HTE %	**47**	**24.3**	**38.3**	**6**	**32.5**	**77.2**	**19.4**
Composition Condition	**Tree (TG)**	3	4	0	0	5	10	1
	Shrub (SG)	0	6	0	0	1	5	0
	Grass & grasslike (GG)	1	10	0	2	7	0	3
	Forb (FG)	3	11	3	6	3	4	3
	Fern (EG)	0	0	0	0	0	0	0
	Other (OG)	0	4	0	0	3	2	2
Structure Condition	**Tree (TG)**	40.1	43	0	0	59.3	43	25
	Shrub (SG)	0	2	0	0	1	30.5	0
	Grass & grasslike (GG)	0.2	6.2	0	33	10.9	0	2
	Forb (FG)	1.1	8.3	11.1	1.5	4.5	3.9	9.3
	Fern (EG)	0	0	0	0	0	0	0

Scientific Name	Common Name	Plot 1	Plot 3	Plot 2	Plot 4	Plot 5	Plot 6	Plot 7
	Other (OG)	0	2.3	0	0	2.2	0.3	1
	High Threat Exotics	**47**	**24.3**	**38.3**	**6**	**32.5**	**77.2**	**19.4**

Date: 12/9	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 1	Bearing: 30	Observers: BY
Starting point Easting / Northing: 0373001, 6374262			End point Easting / Northing:		

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Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata ✓	25	1				Einadia nutans ✓	0.5		Senecio mad ✓	4	50
E. fibrosa ✓	15	1				Lobelia purp ✓	0.5		Plantago lance ✓	5	
Glochidion ferd ✓	0.1	1				Oxalis ~~sp.~~ perennans ✓	0.1		Briza minor ✓	0.5	
									Trifolium ~~campestre~~ dubium? ✓	0.1	
									Lysimachia arvense ✓	0.5	
									Bidens pilosa ✓	3	
									Stellaria media ✓	0.3	
									Cynodon dactylon ✓	15	
									Setaria ~~sp.~~ parviflora ✓	0.3	
									Hypochaeris radicata ✓	0.5	
						Vicia sativa ✓	0.1		Sida rhombifolia ✓	5	
						Sporobolus ~~sp.~~ africanus ✓	0.5		Verbena littoralis ✓	0.3	
						~~Solanum purple infl~~ black berry	~~0.3~~		Verbena bon. ✓	2	
						Modiola caroliniensis ✓	0.2		Trifolium repens ✓	1	
						Solanum ~~nigrum~~ americanum ✓	1		Kikuyu ✓	25	
						Sonchus oleraceus ✓	0.3		Ehrharta erecta ✓	15	
						Juncus sp. ✓	0.2		Phytolacca octandra ✓	0.2	
Total Cover DO FIRST	40						85				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m 23

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants. 18 '8

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

Date: 12/09/22	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 1	Bearing: 30°	Observers: BY
Starting point Easting / Northing: 0373001, 6374262			End point Easting / Northing:		

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Arrival time: 11 am **Departure time:** 11:55 **Weather:** fine, warming up

TWO Transect photos (one landscape one Portrait) taken [X]

1000m² plot **Mapped Vegetation community:** 1600

Transect GPS points taken [X]

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm
< 5 cm	(P) / (A)
5 - 9 cm	P / (A)
10 – 19 cm	P / (A)
20 – 29 cm	P / (A)
30 – 49cm	(P) / A
50 -79cm	# 1
>80cm	# 1

Count of Hollow Bearing Trees

Total 1

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

8, 2, 4

Total metres 14

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	15	80	5			100
2	30	60	10			100
3	15	85				100
4	15	80	5			100
5	5	90	5			100
Average	16	79				100

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

Exotic dominance, few natives, Scattered large paddock trees

Habitat features, comments and incidental fauna observations:

Overgrown paddock, barbwire fences, Kangaroo scat

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.
Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

Date: 12/9	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 2	Bearing: 92	Observers: BY
Starting point Easting / Northing: 0373009, 6374348			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						Lobelia purp ✓	10		Kikuyu ✓	30	
									Cynodon dact. ✓	10	
									Verbena bon ✓	3	
									Senecio mad ✓	5	
									Vicia sativa ✓	0.5	
									Plantago lance ✓	5	
									Axonopus fissifolius ✓	3	
									Trifolium repens ✓	0.3	
									Lysimachia arvense ✓	0.3	
									Verbena littoralis ✓	0.5	
									Hypochaeris radicata ✓	0.2	
									Romulea (pink med flower) ✓ onion weed rosea	0.5	
									Bidens pilosa ✓	0.3	
									Oxalis perennans ✓	0.1	
									~~Viola hederacea~~ Centella asiatica ✓	~~0.5~~ 1	
Total Cover DO FIRST						70 - 80%					

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

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

30

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

Date: 12/09	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 2	Bearing: 92	Observers: BY
Starting point Easting / Northing: 0373009, 6374348			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 12 **Departure time:** 12:40 **Weather:** Warm, Sunny

TWO Transect photos (one landscape one Portrait) taken ☑

1000m² plot **Mapped Vegetation community:** disturbed.

Transect GPS points taken ☑

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

Leaf Litter Cover within 5 x 1m² sub-plots

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

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

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	20	75	5			100
2	15	80	5			100
3	45	55				100
4	70	30				100
5	65	25	10			100
Average	43					100

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

Highly dist paddock, regen eucalypts on edges of properly. (outside plot)

Habitat features, comments and incidental fauna observations:

Thick grass, tall in places

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

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

modified plot 10x40.

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 12/9	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 3	Bearing: 185	Observers: BY, AR
Starting point Easting / Northing: 0373124, 6374560			End point Easting / Northing:		

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	8	2	Ozothamnus diosmifolius	0.3	5	Cynodon dactylon	5		Sida rhombifolia	5 ~~10~~	
E. tereticornis	15	5	Exocarpos cupressiformis	0.3	2	Paspalidium distans	0.5		Plantago lanceolata	5	
E. globoidea	5	5	Breynia oblongifolia	0.5	5	~~Ka~~ Hardenbergia violacea	1		Bidens pillosa	0.3	
E. amplifolia	15	5	Indigophora ~~sp~~ australis	0.3		Glycine (~~clandestina~~) microphylla	0.5		Hypochaeris radicata	1	
			Notelaea ~~sp~~ ovata	0.3	2	Dichondra repens	5		Ehrharta erecta	20	
			Leucopogon juniperinus	0.3	1	Cymbopogon refractus	1 ~~0.5~~		~~Sporobolus elongatus~~	~~0.2~~	
						Lobelia purp.	2		Sporobolus africanus	0.5	
			Dianella caerulea	0.2	1	Eragrostis leptostachya	0.2		Verbena bon.	1	
			Briza minor	0.3		Entolasia stricta	0.3		Lysimachia arvense	5	
			Trifolium ~~campestre~~ dubium?	0.2		~~Kennedia rubicunda~~ Maekawaea rhytidophylla	0.1	1	Kikuyu	1	
			Pandorea pandorana	0.3	1	Oxalis perennans	0.1		Lolium perenne	2	
Solanum prinophyllum	0.1	1	Wahlenbergia ~~sp.~~ gracilis	0.1	5	Brachyscome multifida ?	0.3		Senecio mad.	1	
Imperata cyl.	1		Poranthera microphylla	0.1	20	Lomandra multiflora	0.2		Paronychia brasiliana	0.1	
~~Glycine clandestina~~ Dendrophthoe vitellina?	0.5		Briza maxima	~~2~~ 1		Einadia ~~sp~~ nutans ssp linifolia	0.1		Oenothera sp.	0.1	
Aristida vagans	0.2		~~Lomandra looking dark inflorescence~~	~~0.3~~		Dianella longifolia ?	0.2	2	Lepidium ~~draba~~ africanum	0.2	
Lantana camara	2	2	Petrorhagia dubia	0.3		~~Panicum~~ Lachnagrostis aemula	0.5		Trifolium repens	1	
			Oplismenus aemulus	2		Juncus ~~sp~~ usitatus	0.3		Sonchus oleraceus	0.2	
Total Cover DO FIRST	40-50			<2			<70				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m ~~39.5~~ 50

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

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

E. umbra (outside plot)
E. moluccana
Lomandra long.

Date: 12/9/22	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 3	Bearing: 200	Observers: BY, AR
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 1. **Departure time:** **Weather:** clear r sunny

TWO Transect photos (one landscape one Portrait) taken ☐

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A 1	
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A 11	Total 0
20 – 29 cm	(P) / A IIII	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A IIII	4, 6, 1.5
50 -79cm	# 1	
>80cm	#	Total metres 11.5

Leaf Litter Cover within 5 x 1m² sub-plots

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

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

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	~~50~~ 60	30	10			100
2	55	40	5			100
3	18	80	2			100
4	25	~~50~~ 60	15			100
5	5	95	0			100
Average	32.6	61	6.4			100

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

Modified plot along levi bank for main dam. sloping down to wet area along boundary fence

Habitat features, comments and incidental fauna observations:

Litoria fallax.

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

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

Date: 12/9	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 4	Bearing: 337	Observers: BY, AR
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						Marsilea mutica ✓	2	500+			
						Ranunculus inundatus ✓	0.3				
						Juncus usitatus ✓	3	100+			
						Pistia stratiotes ✓	6				
						Cynodon dactylon ✓	5				
						Eleocharis sphacelata ✓	30				
						Ludwigia peploides subsp montevidea ✓	0.3				
						Persicaria decipiens ✓	0.3				
						~~Azolla~~ Landoltia punctata ✓	0.2				
						Myriophyllum latifolium ✓	0.1				
						Centella asiatica ✓	0.3				
Total Cover DO FIRST											

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

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

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

Modified plot 10 × 40

← 50 | 40 | 20

AEP — ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28/9/22	Job number: 2713	Site: 523 Raymond Terrace Rd, Chisholm	Plot ID: 5	Bearing: 257	Observers: BY
Starting point Easting / Northing: 0373030, 6374109			End point Easting / Northing:		

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	3+ 40	5	Lantana camara	0.3		Briza maxima	3		Hardenbergia violacea	~~0.5~~ 1	1
E. fibrosa?/paniculata	~~20~~ 15	3	Breynia oblongifolia	~~0.4~~ 1		Lolium perenne	10		Dianella revoluta (mid leaf serrated)	0.5	5
E. globoidea	4	2	Notelaea longifolia	0.2		Plantago lanceolata	1		Dichondra repens	2	
			Tutheroo	0.1	1	Hypochaeris rad	0.5		Paspalidium distans?	3	
						Vulpia sp.	0.3	*	Sporobolus creber	0.5	
						Sporobolus africanus	2		Entolasia stricta	0.5	
						Cynodon dactylon	10		Lomandra multiflora	0.4	
						Setaria parv	0.5		Lobelia purp-	2	
						Trifolium repens	0.3		Glycine clandestina	0.2	
			Eragrostis curvula	0.5		Bidens pilosa	0.4		Microlaena stip.	5	
			Verbena bon.	0.5	10	Trifolium dubium	0.3		Dendrophthoe vitellina	1	1
			Lamium amplexicaule (Lamiaceae - weed)	0.1	*?	Briza minor	0.2		Cyperus gracilis	0.1	1
			Taraxacum officinale	0.3		Scarlet pimpernel	0.2				
			Avena - bearded oats	0.5		Juncus cognatus	0.3				
			Kikuyu	5		Sida rhombifolia	5				
			Mother of millions	6		Senecio mad.	0.3				
			Dichelachne micrantha / Plume grass	0.5	✓*	Ehrharta erecta	20				
Total Cover DO FIRST							80-85				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m 83

Willie wagtail

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

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

Date: 28/09	Job number: 2713	Site: 523 Raymond Terrace Rd	Plot ID: 5	Bearing:	Observers: BT
Starting point Easting / Northing:			End point Easting / Northing: 0372967, 6374113		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

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

TWO Transect photos (one landscape one Portrait) taken ☑

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm
< 5 cm	(P) / A
5 - 9 cm	(P) / A
10 – 19 cm	(P) / A
20 – 29 cm	(P) / A
30 – 49cm	(P) / A
50 -79cm	# 1
>80cm	# 1

Count of Hollow Bearing Trees

Total 1

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

~~IIII IIII IIII IIII~~

Total metres 20

Leaf Litter Cover within 5 x 1m² sub-plots

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

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

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	70	20	10			100
2	10	80	10			100
3	15	85				100
4	25	70	5			100
5	35	60	5			100
Average						100

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

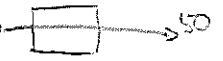
Disturbed understorey - roadside trees / edge of site - some regen & natives persisting

Habitat features, comments and incidental fauna observations: - plot represents residual edge - higher native & regrowth.

Minimal - log pile - overgrown grass, trees ~~on~~ adjacent to road may allow ~~fauna~~ connectivity for fauna - gliders etc.

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

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may hove large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

quadrat 10–30 along 50m 

Date: 12/10/22	Job number: 2713	Site: 523 Raymond Terrace	Plot ID: 7	Bearing: 136	Observers: BY+KD
Starting point Easting / Northing: 0372971, 6374578			End point Easting / Northing: 0373000, 6374537		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	25	10				~~Lotus~~ Disinachia arvensis	0.2	10	Plantago lanceolata	15	
Dendrophthoe vitellina	0.5	1				Hypericum radicata	2	25	Sida rhombifolia	10	
						Centella asiatica	0.5		Cynodon dactylon	10	
						Juncus sp. usiensis ?	0.7		Lolium perenne	1	
						Dichelachne crinita ? (plum)	X		Verbena bonariensis	5	
						Sporobulus africanus	0.3		Lobelia purpurascens	5	
						~~Kennedia~~ ?			Trifolium repens	15	
						Briza maxima	X		Glycine sp. cladalin	0.5	
						Briza subaristida	0.4		Bidens pilosa	1	
						Briza minor	0.1		Trifolium dubium	0.2	
						Oxalis sp.	0.1		Carex inversa ?	0.3	
						Sonchus oleraceus	0.2	1	Centrus clandestinus	10	
									Dichondra repens	4	
									Senecio madagascensis	3	
									Bromus catharticus	5	
									Cynara cardunculus	5	
Total Cover DO FIRST							90+				

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

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

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

56
70

Date: 12/10/22	Job number: 2712	Site: 523 Raymond Terrace	Plot ID: 7	Bearing: 136	Observers: BY + RD
Starting point Easting / Northing: 0372971, 6374578			End point Easting / Northing: 0373000, 6374537		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

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

TWO Transect photos (one landscape one Portrait) taken [BY]

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken [ ] BY

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	
5 - 9 cm	(P) / A	
10 – 19 cm	P / (A)	Total 1
20 – 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length ~~||||~~ ||||
30 – 49cm	P / (A)	
50 -79cm	# 11	
>80cm	# 1	Total metres 9

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	5%	75%	10%			100
2	10%	80%	5%			100
3	60%	30%	10%			100
4	30%	60%	5%			100
5	5%	80%	15%			100
Average						100

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

Exotic pasture paddock with regenerating C. mac's ie 23 small, 3 large trees, thick lush ground cover near dam. Noshwood large. Trifolium dominant + Sida, Rhom.

Habitat features, comments and incidental fauna observations:

~~Crinia signifera~~ Litoria fallax Swamp Hen, Ducks, Welcome Swallows, Dragonfly sp, Rainbow lorikeets, Noisy Minar, Kookaburra.

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.
Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

523 Raymond Terrace Rd

Date: 12/10/22	Job number:	Site: 2713	Plot ID: 6	Bearing: 265	Observers: BY + KD
Starting point Easting / Northing: 0372955, 6374169			End point Easting / Northing:		

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ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. Robusta	15 ~~20~~		Lantana camara	20		~~Yucca filamentosa~~			Cynodon dactylon	0.5	
Cupaniopsis anacardioides	0.5		Callistemon viminalis ~~viminalis~~	7	✓	~~Atropa belladonna~~			Cenchrus clandestinum	0.5	
	/		Melaleuca linariifolius	0.5		Solanum nigrum	1		Sonchus oleraceus	0.5	
C. eximia	5		Breynia oblongifolia	2		Chlorophytum comosum	0.4		Synapis arvensis	0.1	10
Pinnus sp.	4	✓	Strelitzia nicolai ~~reginae~~	7		Sida rhombifolia	4		Asparagus plumosus sp.	8	200
Acmena smithii	4		Melaleuca bracteata ~~nodosa~~ sp.	15		Ehrharta erecta	20		Cayratia clematidea	0.1	1
Camphor laurel	5		Tecoma sp.	5		Bromus catharticus	15		Vicia sativa	0.1	1
Ficus rubiginosa ~~macrophylla~~	1		Phoenix canariensis	8		Phyllanthus tenellus	0.3		Chenopodium album ~~Einadia sp.~~	1	
Hibiscus elatus	6	✓	Schefflera arboricola	0.3		Lolium perenne	2 ~~0.5~~		Lobelia purpurascens	2	
Cocos palm	3	✓ 2	Yucca sp.	1		Bidens pilosa	3		Alstroemeria sp.	0.5	
Grevillia robusta	7 ~~15~~		LOWER Olea europaea ssp cuspidata	3		Ochna serrulata	0.1	1	Foeniculum vulgare	2	
Ligustrum lucidum	15		Senecio Madagascariensis	0.1	3	Euphorbia peplus ~~Eu Phorb sp.~~	0.2		Medicago polymorpha	0.2	
Casuarina glauca	3		Sporobolus africanus ~~sp.~~	0.3	10	Hypochaeris radicata	0.2	10	Oxalis ~~sp.~~ articulata	0.1	
E. microcorys	0.5		Vulpia ~~Volupia~~ sp.	0.1	5	Malva parviflora	0.2	5	Verbena bonariensis	1	
Hymenosporum flavum	7	✓	Facelis retusa	0.1	5	Plantago lanceolata	0.3	10+	Dendrobium speciosum	0.4	3
Euphorbia tirucalli	4	✓	Chickweed sp. Cerastium glomeratum	0.1	10	Dichondra repens	1		Clivia miniata	3	10
Syzygium luehmannii ~~australe~~	4		Cenchrus clandestinum ←	0.2	1	Solanum mauritianum	1		Commelina cyanea ~~eximea~~	0.1	1
Total Cover DO FIRST	60?			40+		Dianella longifolia (tall)	0.5 ~~20~~	1	Asparagus aethiopicus	0.1	3

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

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

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

< 50

→ 10 x 40m modified plot

Fraxinus griffithii

Date: 14/10/22	Job number: 2713	Site: 523 Raymond Terrace Chisholm	Plot ID: 6	Bearing:	Observers: BY + KD
Starting point Easting / Northing:			End point Easting / Northing:		

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Arrival time: **Departure time:** **Weather:** overcast but sunny 18°C

TWO Transect photos (one landscape one Portrait) taken ✓ BY

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ✓ BY.

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
regen < 5 cm	(P) / A	
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total 0
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	(P) / A	
50 -79cm	# 1	
>80cm	#	Total metres 15m

Leaf Litter Cover within 5 x 1m² sub-plots

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

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

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

	Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
1	90%	10%	–	–	–	100
2	65%	10%			5% branch.	100
3	20%	15%	5%	60%	–	100
4	85%	10%	5%			100
5	75%	20%	5%			100
Average						100

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

Remnants of prior garden however covered in lantana, planted natives + exotics

Habitat features, comments and incidental fauna observations:

Piles of rocks, rubbish, beside old chicken coops, pot plants, thick dense, some logs. – large + numerous

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

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

Appendix E – Biodiversity Credit Report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00034989/BAAS19076/22/00034990

Proposal Name
2713 Chisholm

BAM data last updated *
14/04/2023

Assessor Name
Natalie S Black

Assessor Number
BAAS19076

BAM Data version *
58

Proponent Names

Report Created
19/05/2023

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Part 4 Developments (General)

Date Finalised
19/05/2023

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

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Not a TEC	1.9	37	0	37
1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	0.2	0	5	5
1736-Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.4	0	7	7

1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749, 3328, 3446, 3634	-	1598_moderate	No	5	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.

1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter

1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 1178, 1589, 1600, 1601, 3431, 3442, 3446	Hunter-Macleay Dry Sclerophyll Forests >=70% and <90%	1600_canopy	Yes	11	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.
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 1178, 1589, 1600, 1601, 3431, 3442, 3446	Hunter-Macleay Dry Sclerophyll Forests >=70% and <90%	1600_moderate	Yes	26	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

1736-Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911, 3958, 3962, 3964, 3965, 3967, 3971, 3973, 3975, 3976	-	1736_poor	No	7	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

Species	Vegetation Zone/s	Area / Count	Credits
Myotis macropus / Southern Myotis	**1600_canopy, 1600_moderate, 1598_moderate, 1736_poor**	2.0	42.00

BAM Biodiversity Credit Report (Like for like)

Credit Retirement Options

Like-for-like credit retirement options

Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00034989/BAAS19076/22/00034990

Proposal Name
2713 Chisholm

BAM data last updated *
14/04/2023

Assessor Name
Natalie S Black

Assessor Number
BAAS19076

BAM Data version *
58

Proponent Name(s)

Report Created
19/05/2023

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Part 4 Developments (General)

Date Finalised
19/05/2023

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

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Not a TEC	1.9	37	0	37.00
1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	0.2	0	5	5.00
1736-Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.4	0	7	7.00

1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749, 3328, 3446, 3634	-	1598_moderate	No	5	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Forested Wetlands	Tier 3 or higher threat status	1598_moderate	No	5	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 1178, 1589, 1600, 1601, 3431, 3442, 3446	Hunter-Macleay Dry Sclerophyll Forests >=70% and <90%	1600_canopy	Yes	11	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.

	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 1178, 1589, 1600, 1601, 3431, 3442, 3446	Hunter-Macleay Dry Sclerophyll Forests >=70% and <90%	1600_moderate	Yes	26	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 2 or higher threat status	1600_canopy	Yes (including artificial)	11	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 2 or higher threat status	1600_moderate	Yes (including artificial)	26	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1736-Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911, 3958, 3962, 3964, 3965, 3967, 3971, 3973, 3975, 3976	-	1736_poor	No	7	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Freshwater Wetlands	Tier 3 or higher threat status	1736_poor	No	7	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Myotis macropus / Southern Myotis	**1600_canopy, 1600_moderate, 1598_moderate, 1736_poor**	2.0	42.00

Credit Retirement Options

Like-for-like options

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

Appendix F – Site Photographs

Above: View from southern centre of Subject Site, looking south towards Raymond Terrace Road

Below: View looking west over paddock of exotic forbs and grasses

Above: Exotic grasses and forbs, including Fireweed in paddock

Below: Large dam located in central portion of Study Area

Above: Overflow from dam in northern portion of Study Area

Below: Drainage line from large dam

Above: Sugar Glider sighted on camera trap in Study Area

Below: Sacred Kingfisher sighted on camera trap in Study Area

Above: Tawny Frogmouth sighted on camera trap in Study Area

Below: Grey-crowned Babbler sighted on camera trap in Study Area

Above: View from start of Plot 2, demonstrating disturbed exotic paddock condition

Below: View from start of Plot 3, PCT 1598 in Moderate condition

Appendix G – Other Legislation

EPBC Act Assessment

A Protected Matters Search of an area of 5km radius of the Study Area was conducted in January 2023 for Matters of National Environmental Significance as relevant to the Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act). The following Matters of National Significance are considered in this assessment.

World Heritage Properties:

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

National Heritage Places:

The site is not a National Heritage place, and it is not in close proximity to any such place.

Wetlands of International Significance (declared Ramsar wetlands):

The site is within the buffer area of one (1) declared Ramsar wetlands;

- Hunter estuary wetlands (approximately 9km upstream)

While upstream from these wetland areas it is not expected that the development would have significant negative impacts upon these areas given the distances involved and the type of development proposed.

Great Barrier Reef Marine Park:

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

Commonwealth Marine Areas:

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

Threatened Ecological Communities:

From a search of the EPBC Act Protected Matters website (26/08/2022 and rechecked 22/03/2023), listed five (5) Threatened Ecological Communities (TECs) that were considered likely to occur within a 5km radius of the Study Area.

Three (3) Critically Endangered Ecological Communities;

- Central Hunter Valley eucalypt forest and woodland
- Lowland Rainforest of Subtropical Australia
- River-flat eucalypt forest on coastal floodplain of southern New South Wales and eastern Victoria

Two (2) Endangered Ecological Communities:

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

The vegetation communities present on site PCTs 1600, 1598 and 1736 are likely commensurate with their associated TEC's at a state level and PCT 1600 at a federal level is further discussed with a review of vegetation zones that was undertaken against the Conservation Advices for:

Central Hunter Valley eucalypt forest and woodland.
Review of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s266B) Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community* for the potential association with PCT 1600 within the Subject Site is assessed in **Tables** below. As such, the provisions of the Conservation

Advice do not apply and the PCT within the Subject Site does not qualify as *Central Hunter Valley eucalypt forest and woodland.*

Table - The Key diagnostic characteristics of *Central Hunter Valley eucalypt forest and woodland*

Diagnostic characteristics	**Site comments**
It occurs in the Hunter River catchment (typically called the Hunter Valley region);	Yes
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks;	Yes
It does not occur on alluvial flats, river terraces, aeolian sands Triassic sediments, or escarpments	Yes
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height	Yes
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. E. maculata) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); OR a fifth species, *Allocasuarina luehmannii* (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species	Yes *Corymbia maculata*
Allocasuarina torulosa (forest oak/ she-oak, rose she-oak/oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent from the canopy of a patch	No. *Allocasuarina Torulosa, Eucalyptus acmenoides* and *E Fibrosa* are present.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	Ground layer of natives was sparse / predominantly managed comprising mostly exotic species across the site. Some native grasses were present.
Although most of the vegetation associated with this PCT is highly fragmented and located on the perimeter of the Subject Site, the vegetation on site meets most of the key diagnostic characteristics of the TEC. As such the thresholds for this community require assessment to determine if the vegetation on site meets the thresholds as outlined in the conservation advice for the TEC.	

Table - EPBC – Condition Thresholds for TEC

<table>
<tr><th>Category and Rationale</th><th>Threshold</th><th>Comment</th></tr>
<tr><td>Class A. High quality condition e.g. A larger patch with good quality native understorey</td><td>Patch size is ≥ 5 ha; AND ≥ 50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.</td><td>Patch size is greater than 5ha with approximately 0.99ha (0.87ha is canopy only PCT 1600 and not associated with the EEC) within the Subject Site but potentially connected to larger continuous patches of native vegetation in the area.

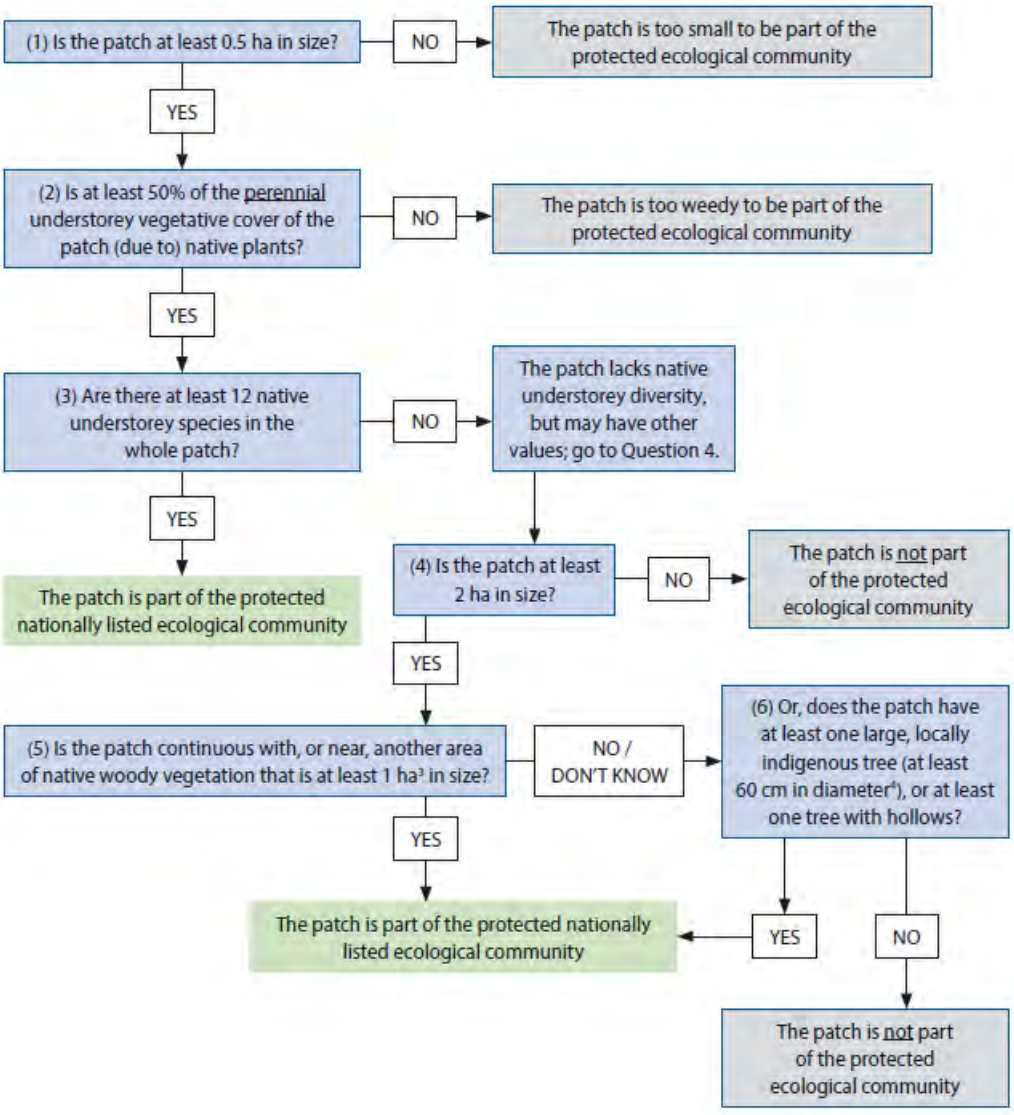
Approximately 43 perennial understorey species were identified. Out of those understorey species, sixteen (16) were native species and all were perennials. The patch did not contain greater than 50% native perennial understorey but it did contain more than 12 native species.
<table>
<tr><td>BAM Plot</td><td>Exotic sp.</td><td>Perennial natives</td><td>% understory exotic cover</td><td>HTE %</td></tr>
<tr><td>B1 canopy</td><td>22</td><td>4</td><td>79.8</td><td>47</td></tr>
<tr><td>B5 remnant</td><td>24</td><td>12</td><td>76.5</td><td>32.5</td></tr>
<tr><td>B7 regen</td><td>19</td><td>8</td><td>84.4</td><td>19.4</td></tr>
</table>
The patch did not meet the class A category.</td></tr>
<tr><td>Class B. High quality condition e.g. A patch with high quality native understorey</td><td>Patch size is ≥ 0.5 ha AND ≥ 70% of perennial vegetative cover in each layer present is native; AND the patch contains at least 12 native understorey species.</td><td>Patch size is greater than 0.5ha with approximately 0.99ha (0.87ha is canopy only PCT 1600 and not associated with the EEC) within the Subject Site but potentially connected to larger continuous patches of native vegetation in the area.

Less than 70% (approximately an average of 20%) cover is native perennial vegetation across the layers. The patch does contain at least 12 native understory species.
<table>
<tr><td>BAM Plot</td><td>% exotic cover</td><td>% native cover</td></tr>
<tr><td>B1 canopy</td><td>79.8</td><td>20.2</td></tr>
<tr><td>B5 remnant</td><td>76.5</td><td>23.5</td></tr>
<tr><td>B7 regen</td><td>84.4</td><td>15.6</td></tr>
</table>
The patch did not meet the class B category.</td></tr>
</table>

Category and Rationale	Threshold			Comment
Class C. Moderate quality condition e.g. A patch with good quality native understorey	Patch size is ≥ 0.5 ha; AND ≥ 50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.			The patch size is greater than 0.5ha with approximately 0.99ha (0.87ha is canopy only PCT 1600 and not associated with the EEC) within the Subject Site but potentially connected to larger continuous patches of native vegetation in the area. Less than 50% (approx. 20%) cover is native perennial vegetation across the layers. The patch does contain twelve (12) native understorey species. The patch did not meet the class C category.
Class D. Moderate quality condition e.g. A moderate to large sized patch with: connectivity to a native vegetation area; or a mature tree; or a tree with hollows.	Patch size is ≥ 2 ha; AND ≥ 50% of perennial understorey vegetative cover is native; AND			The patch size is greater than 2ha with approximately 0.99ha (0.87ha is canopy only PCT 1600 and not associated with the EEC) within the Subject Site but potentially connected to larger continuous patches of native vegetation in the area. Less than 50% (approx. 20%) cover is native perennial vegetation across the layers.
	The patch is contiguous with another patch of native woody vegetation [25] ≥ 1 ha in area	or	The patch has at least one large locally indigenous tree (≥ 60 cm dbh[26]), or at least one tree with hollows.	The patch of vegetation is contiguous with another patch of native woody vegetation [25] ≥ 1 ha in area There is patchy connectivity between canopy trees within the paddocks however canopy only is not considered to be EEC and potential continuous patches are off site. The patch does include at least one large locally indigenous tree (≥ 60 cm dbh[26]) AND at least one tree with hollows. As per condition threshold *"The condition thresholds mean that small, degraded patches—such as individual paddock trees, short narrow patches, or remnants where the understorey has been largely replaced by weeds—are excluded from the listed ecological community and any actions that may impact them do not need to be considered under the EPBC Act*". As per the description above the understorey has been largely replaced by weeds. The patch did not meet the class D category.
Although the Subject Site contains some connected vegetation along the boundary perimeters with some scattered paddock trees, larger areas of continuous vegetation can be mapped in a south westerly direction towards Sugarloaf State Conservation Area (>14kms away) and the Watagans National Park, albeit with the Main Northern Highway and the New England Highway intersecting any potential corridor linkages. Land more than 1km north, east and west of the Subject Site consist of cleared lands with minimal scattered trees and no connected remnant vegetation, plus water bodies and urban development. As the site does not meet the condition thresholds described above and the broader patches of vegetation in better condition to the west won't be impacted, it is considered that the impacts to the native vegetation on site are negligible and unlikely to significantly impact the ecological community on site and will not require a federal referral.				

Additionally, utilising the below flow chart, the Subject Site cannot be considered to be part of a protected nationally listed ecological community due to the lack of perennial understory cover and is considered to be too weedy to be a part of such.

Figure 1: Flowchart to help identify which areas (patches) of the Central Hunter Valley eucalypt forest and woodland ecological community meet the minimum condition thresholds for national protection



Threatened Species:

Threatened species listed under the EPBC Act considered likely to occur on site were assessed from field inspections/surveys, Bird Data and using the BioNet Atlas search tool within a 10km search radius from the Study Area, indicating that seventy-three (73) listed threatened species may occur on or within vicinity of the site. With most recent records assessed, the one (1) EPBC Act listed threatened species was found on site, the Grey-headed Flying Fox.

Site inspection did not identify any evidence of Grey-headed Flying Foxes roosting within the Study Area. The Study Area does not provide high quality habitat for roosting camps, lacking vegetation with dense canopy. No roosting camps were located within the Study Area and, given the species' high mobility and degraded condition of the Study Area's foraging habitat, it is unlikely that the proposed development will impact the species.

Southern Myotis has been included in Species credit offsets and all other threatened species identified within the Subject Site have been incorporated into ecosystem credits as no breeding habitat was identified and marginal foraging available only.

Migratory Species:

A total of fifty-six (56) EPBC listed migratory species have potential to utilise the site on an irregular basis. The limited number and sporadic nature of records close to the Study Area appear to reflect opportunistic rather than regular use of any habitat considered of importance to any threatened species.

It is not considered that the development of this land is likely to significantly affect the availability of potential habitat for such mobile species, or disrupt migratory patterns. Additionally, the Subject Site and Study Area are not mapped as important areas for Migratory Shorebirds.

EPBC Act Assessment Conclusion:

No Matters of National Environmental Significance (specifically in this instance threatened species, threatened ecological communities or listed migratory species) are expected to be impacted upon significantly as a result of the proposal, therefore, an EPBC Act Referral is considered unlikely to be required, due to the extent of the proposed development an application is being prepared.

Water Management Act 2000

The DPIE (Water) administers the WM Act and is required to assess activities carried out on waterfront land. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 meters of the highest bank of the river, lake or estuary. Certain activities within this land are defined as a 'controlled activity' and requires approval from the Office of Water.

Three (3) artificial dams and one (1) regionally mapped first-order stream leading from the largest dam, that are mapped within the project area. The largest dam in the central north of the site, forms a part of a series of dams between neighbouring properties in an easterly aspect. The waterbodies were inspected during a field survey conducted by AEP (August 2022), however there was no evidence of a continuous watercourse leading from or to the dam. The mapped hydroline was considered to have been an original creek line, but now functions as a part of the overflow system between the dams on each property and has no natural flow, defined bed or bank area. It is proposed to remove the large dam/ basin from the existing drainage line and reconstruct a drainage channel and riparian corridor to convey upstream flows through the site to the downstream receiving waters and will be managed under a landscape plan to ensure maintenance can be achieved.

The 'Guidelines for controlled activities on waterfront land: Riparian corridors' (2018) states that "where a watercourse does not exhibit the features of a defined channel with bed and banks, the NRAR may determine that the watercourse is not waterfront land for the purposes of the WM Act". The mapped hydroline is not considered to exhibit the features of a defined channel with bed and banks and therefore should not be subject to the WM Act. Confirmation from DPE (Water) on this matter is required prior to proceeding as a Controlled Activities (CAA) may be required.

Fisheries Management Act 1994

A man-made dam and a first-order hydroline are mapped within the site, with two additional smaller dams that were identified during site inspection. Both dams are primarily covered in algae, although the large dam, connected to the hydroline, contains areas of native aquatic vegetation and open water. The hydroline is likely to be an original creek line, but now functions as an overflow system between dams on neighbouring properties and shows considerable signs of erosion. Site inspection confirmed that the hydroline no longer functions as a natural watercourse and contains no bed or bank. As no natural streams or waterways are to be impacted by this development, no further assessment under the *Fisheries Management Act 1994* is required.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 4 Koala Habitat Protection 2021 Assessment

State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC SEPP) commenced on the 1st March 2022, under the Environmental Planning and Assessment Act 1979, and repealing the previous State Environmental Planning Policy (Koala Habitat Protection) 2020 and State Environmental Planning Policy (Koala Habitat Protection) 2021. The aims of Chapter 4 – Koala Protection 2021 are to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The land which comprises the Subject Site does not have an approved koala plan of management. According to the BC SEPP 2021, the policy applies if:

4.9 Development assessment process—no approved koala plan of management for land

(1) This clause applies to land to which this Policy applies if the land—

(a) has an area of at least 1 hectare (including adjoining land within the same ownership), and

(b) does not have an approved koala plan of management applying to the land.

(5) However, despite subclauses (3) and (4), the council may grant development consent if the applicant provides to the council –

(a) information, prepared by a suitably qualified and experienced person, the council is satisfied demonstrates that the land subject of the development application –

i. does not include any trees belonging to the koala use tree species listed in Schedule 2 for the relevant koala management area, or

ii. is not core koala habitat,

The entirety of Lot 100 DP 847510 comprises 10.23 ha, over which Chapter 4 of the Biodiversity and Conservation SEPP applies. Furthermore, the site does not have an approved Koala plan of management applying to the land. Site inspections identified that the Subject Site contains trees that belong to the koala use tree species listed in Schedule 2 for the relevant koala management area, listed below:

- *Allocasuarina torulosa*
- *Casuarina glauca*
- *Corymbia eximia*
- *Corymbia maculata*
- *Eucalyptus acmenoides*
- *Eucalyptus amplifolia*
- *Eucalyptus crebra*
- *Eucalyptus fibrosa*
- *Eucalyptus globoidea*
- *Eucalyptus microcorys*
- *Eucalyptus moluccana*
- *Eucalyptus paniculata*
- *Eucalyptus robusta*
- *Eucalyptus siderophloia*
- *Eucalyptus tereticornis*

In regards to identifying core koala habitat, core koala habitat is defined as;

> *(a) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or*
>
> *(b) an area of land which has been assessed by a qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years.*

Koala Investigation Results

As important koala trees were identified on site additional assessments were undertaken to determine if koalas were present on site and to determine if the site was core koala habitat as per the definitions above.

Survey effort for Koalas included:

- Target searches including nocturnal searches (25 & 30/08/2022);
- Spot Assessment Technique (SAT) (Phillips & Callaghan 2011) – 4 SATs undertaken within Study Area (28/09/2022 & 12/10/2022);
- Call playback (25 & 30/08/2022);
- Passive Song Meter recording (25/08/2022 – 30/08/2022); and
- Camera trapping (5/12/2022 – 4/1/2023).

Targeted surveys failed to identify any sign of koala utilisation of the site. Desktop assessment of local records shows that koala records in the area are sparse, with only one (1) record from 2020 north east of site located in Hinton, approximately 4 kms from the Subject Site. This record is unlikely to be associated with the Subject Site, given that it is separated from the Subject Site by the Hunter River, a series of roads and agricultural lands, with low habitat and connectivity value. As such, the site is unlikely to be Core Koala Habitat; however, taking a precautionary approach, a Tier 2 Assessment has been undertaken.

Tier 2 Assessment

Part A: Presence of highly suitable Koala Habitat

Determine the PCT (using suitable methods) and if PCT have Schedule 2 listed trees an assessment must be undertaken to determine koala presence.

Site inspections confirmed that the Subject Site contains the following PCTs:

- 1598: *Forest Red Gum grassy open forest on floodplains of the lower Hunter*
- 1600: *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter*

These PCTs contain the following Schedule 2 listed trees:

1598

- *Eucalyptus tereticornis;*
- *Eucalyptus punctata; and*
- *Angophora floribunda.*

1600

- *Corymbia maculata;*

- *Eucalyptus fibrosa;*
- *Eucalyptus crebra; and*
- *Eucalyptus moluccana.*

All species above, aside from *Angophora floribunda,* formed part of the native canopy present within the Study Area and Subject Site. Other Schedule 2 tree species noted above that were present within the Subject Site were potentially planted native species. Therefore, the site is deemed to have highly Suitable Koala Habitat and a Tier 2 Assessment is required.

Assess BioNet for records - All records within set distance (2.5km OR 5km) in the last 18 years apply = Core Habitat. Requiring a Part B Assessment to determine koala presence.

An assessment of BioNet showed one (1) record within 5km of the Study Area in the last 18 years.

Figure - BioNet Atlas Koala records, 5km radius from Subject Site in the last 18 years

<u>Part B Assessment</u>

I) Koala Presence – Spot Assessment Technique, Nocturnal Survey and Call Playback

Searches for scats following the SAT (Phillips and Callaghan, 2011) were conducted in locations where Potential Koala Habitat (PKH) was present. No Koala scats or tree scratch marks were found during searches at the bases of one hundred and twenty (120) Schedule 2 listed trees within the Subject Site and Study Area whilst completing (four) 4 SAT's.

Nocturnal surveys did not record any evidence of koala habitation, nor did call playback record any response. Furthermore, Song Meter deployed in the Study Area did not record any koalas, nor did camera trapping record any evidence.

ii) Koala Records

One (1) koala sighting (refer **Figure above**) was recorded within 5km of the Study Area within the last 18 years, but none were recorded within the Subject Site.

Records within these maximum distances must only be considered after a careful examination of the broader landscape. That is, within areas of contiguous habitat or between areas of habitat with connectivity. For example, a record from 2.5km from the subject site must not be used if natural or artificial landscape features would prevent koalas from the area with the record ever moving to the site (e.g., due to large rivers, roads, fences or built-up areas).

The single BioNet 2020 record is located more than 2.5kms away with the Hunter River, a series of roads and agricultural lands with low habitat and connectivity value connecting this to the Subject Site. As such, the site is unlikely to be Core Koala Habitat; however, taking a precautionary approach, a Tier 2 Assessment has been undertaken (refer **Table below**).

Table - Koala Assessment

Principles	Criteria	Assessment
Introduction	Describe the nature of the proposed development.	The proposal is the development of a staged subdivision for residential lots. Some areas of native vegetation will be impacted by the development Out of the areas identified within the Subject Site, a total of 2.42 ha of native vegetation is proposed to be removed or modified.
	Define how the SEPP applies to the proposed development.	Refer above to Tier 1 and Tier 2 Assessment.
Koala habitat values – addressing criteria 1 and 2	Describe the site area, including the general environment and condition, location and extent of the development area and any other areas that may be directly or indirectly impacted by the proposed development.	The Subject Site located at 523 Raymond Terrace Road, Chisholm, NSW comprises 10.23 ha of forested vegetation and cleared agricultural areas. Development would entail the removal of all vegetation on site. The proposal has been designed to avoid or mitigate as many impacts to biodiversity as possible under the Avoid and Minimise principle as set out in BAM 2020.
	Provide details of koala survey as undertaken in accordance with Appendix C. This should include details of the results of the koala surveys, including how the site area meets the definition of core koala habitat and mapping that shows habitat areas and koala records within the site area and adjoining areas.	Four (4) SATS (28/09/2022 & 12/10/2022), nocturnal surveys (25 & 30/08/2022), call playback (25 & 30/08/2022), passive Song Meter recording (25/08/2022 – 30/08/2022) and camera trapping (05/12/2022 – 04/01/2022) were conducted within the Study Area.
	Describe the site context (including mapping showing habitat that might be associated with vegetation in the adjoining landscape and records within the vicinity of the site area) and provide an analysis of the koala habitat values (including how koalas might use the site area and the relative importance of the site area to a local koala population).	PCTs 1598 and 1600 were identified within the Study Area. These PCTs have Schedule 2 listed trees and multiple species were listed within the Study Area. Given that surveys failed to find evidence of Koala usage or habitation within the Study Area, it is considered that there is no current local population present that would utilise the site.

Principles	Criteria	Assessment
Measures taken to avoid impacts to koalas – addressing criteria 3, 4, 5, 6, 7 and 8	Describe the site selection process, including how koala habitat was taken into account and any avoidance outcomes achieved through this process.	Targeted surveys failed to identify any sign of koala utilisation of the site. As such, it was determined that it is unlikely that Koalas are present within the Study Area.
	Describe how the proposed development avoids or minimises direct impacts to koala habitat and habitat function within the site area.	The Avoid and Minimise process has been undertaken: locating the development on lands predominantly cleared, disturbed or under scrubbed. Given that it is highly likely that no koala population is present, no further action was considered necessary.
Analysis of potential impacts – addressing criteria 9	Identify the residual direct impacts to koalas and koala habitat within the site area, including the nature and extent of impacts and the likely implications for the viability of a local koala population.	Surveys failed to find any sign of koala presence within the Study Area, in which most of this area has been disturbed, managed or cleared.
	Identify the relevant potential indirect impacts to koalas and koala habitat within the site area and adjacent habitat areas, including the nature and extent of potential indirect impacts and the likely implications for the viability of a local koala population.	Desktop and field surveys did not produce evidence of a local koala population in the Study Area or surrounds. The development is proposed on lands that have been disturbed, managed or cleared. With this in consideration, it is unlikely that any local koala populations will be impacted by the proposed development.
Plan to manage and protect koalas and their habitat – addressing criteria 10, 11, 12 and 13	Describe the management measures that will be implemented as part of proposed construction and operations to manage the direct and indirect impacts identified. These measures should be outcomes focussed and include performance targets.	As stated above, the proposed development occurs on lands that have been disturbed, managed or cleared, on which no evidence of koala usage was recorded. Hence, impacts on local koala populations are not expected to occur.
	Describe any compensatory measures that will be delivered, including an analysis of the suitability of these measures against criteria 9 and 10.	No specific koala offsets required because of the lack of a koala population that could utilise the site.
	Outline a plan for monitoring, adaptive management and reporting against the key outcomes and performance targets.	Not applicable, as no local koala population is likely to be present.

Conclusion

Field surveys identified that the site contained suitable habitat, with multiple Schedule 2 listed trees recorded within the Study Area, hence further assessment was required. Detailed koala surveys, including SATs, nocturnal surveys, call playback and passive Song Meter recording were undertaken on site, but no koalas or evidence of koala usage was detected within the Subject Site

or Study Area. Additionally, desktop assessment showed that there is only one (1) record of a koala within 5 km of the Study Area, in 2020. This record is located approximately 4.5km north of the Study Area in Hinton, beyond acres of agricultural lands, a series of roads and the Hunter River, an area with poor connectivity and habitat value. Additionally, the Subject Site is situated on lands of disturbed or cleared native vegetation, with surrounding lots in similar condition. As no koalas were identified as present on or using the site, the site is not considered to be core koala habitat and it is not anticipated that the proposal will impact koalas in the present or future.

Appendix H – Anabat report

AEP

ECOLOGY | BIODIVERSITY OFFSETS | BUSHFIRE

Bat Call Summary Report

523 Raymond Terrace Road, Chisholm NSW

28 April 2023

AEP Ref: 2713

P 0420 624 707 E INFO@ANDERSONEP.COM.AU
10 DARVALL ST CARRINGTON NSW 2294 ABN 57 659 651 537

1.0 Method

Analysis of bat echolocation calls was undertaken using Anabat Insight software. Identification was carried out utilising Pennay et al. (2004) along with comparison from recorded reference calls associated with the Sydney Basin.

Reference calls used were obtained from the NSW database and AEP confirmed bat call collection.

All calls were viewed, with unique calls tagged and identified. Calls that were too short (three pulses or less) were not analysed and tagged as unknown.

Certain microbat species have similar call frequencies, call shape and other characteristics which can make identification to species impossible using just call analysis. Where it was not possible to differentiate calls due to similar call characteristics the call was marked as species group.

Table 1: Confidence ratings of bat call sequences

Confidence	Description
Definite	Call has been identified to a particular species and could not be confused with another species.
Probable	Call has been identified to a particular species, with a low chance that it could be confused with another species.
Possible	Call has been identified to a particular species, but there is a moderate chance of confusion with another species.
Species group	Call could not be identified as a particular species due to call characteristics (poor quality/short sequence, bat species with overlapping frequencies, etc).
Unknown	Call sequences that are too short or of very poor quality.

2.0 Differentiation of species with similar calls

Separation of species with similar calls is possible using particular call characteristics, a short description of characteristics used to distinguish species is included in **Table 2**. Note that it is not always possible to separate similar calls and is affected by the length and quality of recorded calls.

Species names are based on the Australian Chiroptera taxonomic list (Reardon et al. 2015) with changes made to keep the naming conventions in line with DPIE.

Table 2: Call characteristics used to differentiate species

Species	Characteristic
Miniopterus australis/ Vespadelus pumilus	Differences in frequency or presence of a down-sweeping tail indicating *M.australis*.
Chalinolobus morio/ Vespadelus sp.	Presence of a down-sweeping tail on majority of calls indicated *C.morio.*
Vespadelus troughtoni / Vespadelus vulturnus / Vespadelus pumilus	It is not currently possible to differentiate between *V.vulturnus* and *V.troughtoni* on call characteristics alone. *V.pumilus* can be differentiated only when call frequency is above 54khz.
Ozimops ridei / Micronomus norfolkensis	Call frequency and alternation of pulses within the call indicates *M.norfolkensis*.
Ozimops ridei / Ozimops planiceps	Differentiated using characteristic frequency.
Chalinolobus gouldii	Differentiated from other species by frequency and presence of curved alternating calls.
Austronomus australis	Differentiated using characteristic frequency.
Saccolaimus flaviventris	Differentiated using characteristic frequency.
Rhinolophus megaphyllus	Differentiated using characteristic frequency and shape.
Myotis macropus/ Nyctophilus spp.	*M.macropus* differentiated based on calls with initial slope >400 OPS and pulse intervals <75ms. Secondary characters used include central kink and slope variances between pulses. Requires high quality calls and is not always reliable.
Scotorepens orion / Scoteanax rueppellii	Calls from these species are very similar. Differentiation is based on the characteristic frequency and the frequency of the knee when compared to the characteristic frequency.
Falsistrellus tasmaniensis	Can be differentiated within good call sequences from *Scotorepens orion / Scoteanax rueppellii* based on length of pre-characteristic.
Miniopterus orianae oceanensis/ Vespadelus sp.	*M.orianae* oceanensis differentiated based on call timing, shape and frequency.
Vespadelus regulus / Vespadelus darlingtoni	These species are not differentiated from each other by us.

It should be noted that the number of call sequences for specific species does not allow for a quantitative understanding of the numbers present on site. Instead, it should be taken as an idea of activity within the site for that particular species. It is not possible to compare activity levels between species due to differences in species detectability, foraging strategies and call characteristics.

3.0 Results

21,160 call sequences were recorded of which 1897 were analysable (not short calls or noise files). Species that were identified definitively include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Micronomus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Ozimops planiceps* (Southern Free-tailed Bat)
- *Ozimops ridei* (Ride's Free-tailed Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

Bats that are likely to be on site but could not be definitively identified (i.e. those that were classified as possible or within a species group) include:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus geoffroyi* (Lesser Long-eared Bat)
- *Nyctophilus gouldi* (Gould's Long-eared Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus pumilus* (Eastern Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)
- *Vespadelus vulturnus* (Little Forest Bat)

While all care has been taken it should be noted that certain bat species are difficult to identify by bat call and others may not have been recorded by the detectors. It is therefore recommended that a habitat assessment should be used in conjunction with this analysis to determine the likely occurrence of other bat species.

4.0 Sample Time vs Frequency graphs

A sample call for each unique bat species, that was identified (definitive/probable), is included below.

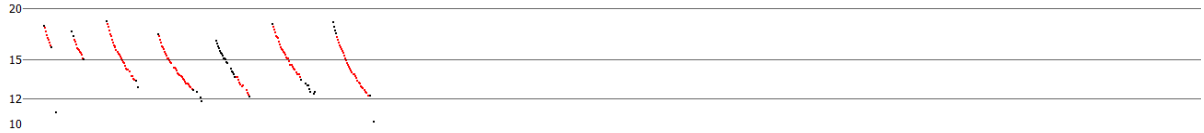


Figure 1 – *Austronomus australis* definite call

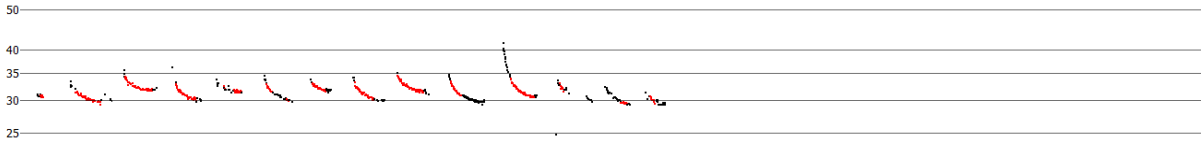


Figure 2 – *Chalinolobus gouldii* definite call

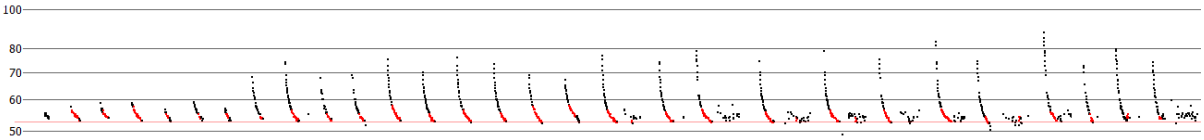


Figure 3 – *Chalinolobus morio* probable call

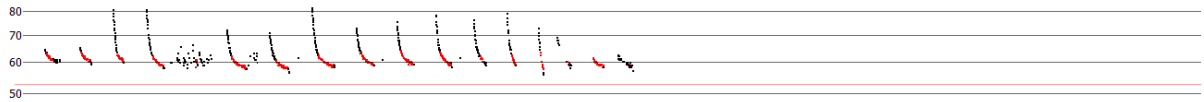


Figure 4 – *Miniopterus australis* definite call

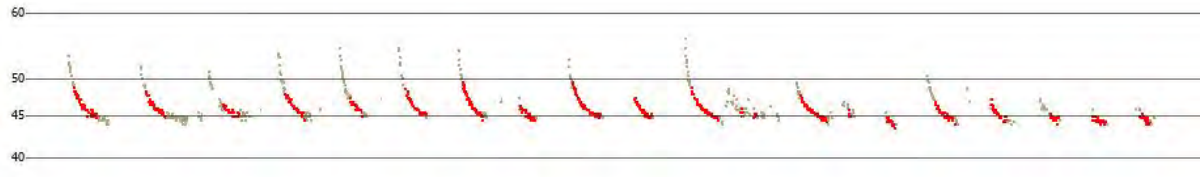


Figure 5 – *Miniopterus orianae oceanensis* probable call

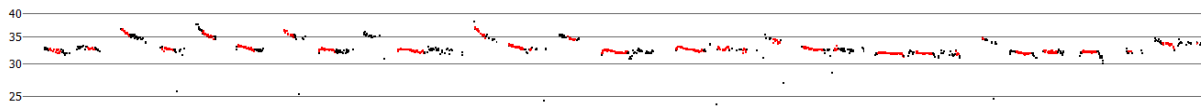


Figure 6 – *Micronomus norfolkensis* definite call

Figure 7 – *Ozimops planiceps* probable call

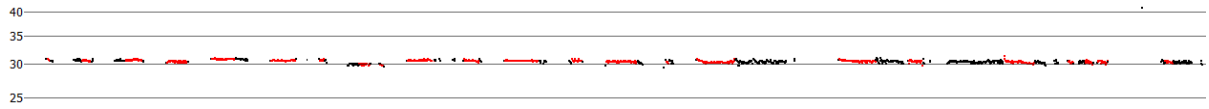


Figure 8 – *Ozimops ridei* definite call

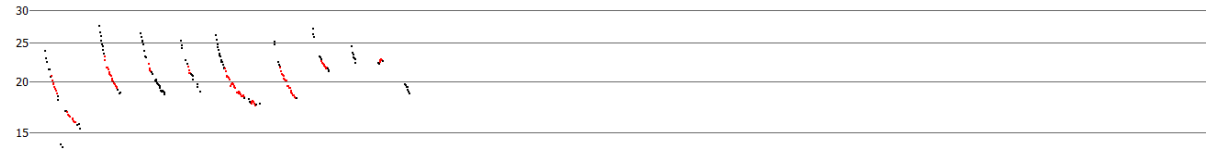


Figure 9 – *Saccolaimus flaviventris* definite call

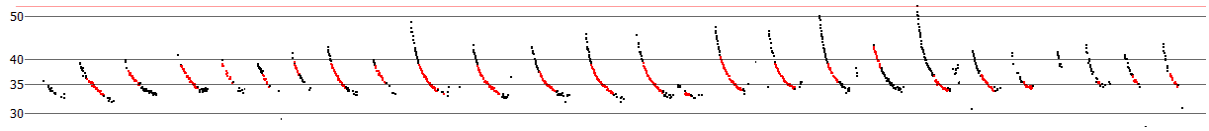


Figure 10 – *Scoteanax rueppellii* definite call

Appendix I – Stormwater Management Report

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Engineering

Working Beyond Expectations

Stormwater Management Plan

Chisholm Residential Subdivision

Property:
Lot 100 DP 847510
523 Raymond Terrace Road, Chisholm

Applicant:
ACG Clovelly Road Pty Ltd

Date:
May 2023

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Draft	02/05/23	S Warburton	ND
B	Issued for DA	08/05/23	S Warburton	ND

Limitations Statement

This report has been prepared in accordance with and for the purposes outlined in the scope of services agreed between ADW Johnson Pty Ltd and the Client. It has been prepared based on the information supplied by the Client, as well as investigation undertaken by ADW Johnson and the sub-consultants engaged by the Client for the project.

Unless otherwise specified in this report, information and advice received from external parties during the course of this project was not independently verified. However, any such information was, in our opinion, deemed to be current and relevant prior to its use. Whilst all reasonable skill, diligence and care have been taken to provide accurate information and appropriate recommendations, it is not warranted or guaranteed and no responsibility or liability for any information, opinion or commentary contained herein or for any consequences of its use will be accepted by ADW Johnson or by any person involved in the preparation of this assessment and report.

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The Client should be aware that this report does not guarantee the approval of any application by any Council, Government agency or any other regulatory authority.

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1.0 Introduction

ADW Johnson has been engaged by the ACG Clovelly Road (*ACG*) to prepare a Stormwater Management Plan (SWMP) for the proposed 108 lot subdivision, located within Lot 100 DP 847510, Raymond Terrace Road, Chisholm (the site). The preparation of this management plan has been undertaken to accompany a Development Application required for the proposed subdivision.

This report documents the means of stormwater treatment and disposal from the proposed 108 lot subdivision in accordance with Maitland City Council (MCC) requirements current at the time of this report.

This report documents the proposed stormwater system required to capture and convey the stormwater from the proposed development and upstream catchments efficiently and effectively, ensuring that there are no adverse effects from the proposed development on water quality to the receiving waters or flooding of downstream properties or infrastructure.

2.0 Site Description

The subject site is identified as Lot 100 DP 847510, 523 Raymond Terrace Road, Chisholm.

The site, as depicted in **Figure 1**, is approximately 10.2 ha and is currently zoned as R1 General Residential.

The existing site is bound to the south by Raymond Terrace Road, to the east by DA approved residential subdivision, to the north and west by rural land currently seeking DA approval for residential subdivision.

Figure 1 - Existing Site
(Source: https://maps.six.nsw.gov.au/)

2.1 TOPOGRAPGHY AND EXISTING INFRASTRUCTURE

The site as shown in **Exhibit A,** is currently occupied by one (1) dwelling, and associated minor structures including sheds, driveways, and services. Overall, the site is relative clear with maintained grasslands and scattered trees across the site.

There are two remnant dams from previous farming activities in the southern section of the site and a large basin/ dam in the northern section of the site. The Raymond Terrace Road frontage has an existing table drain grading in an easterly direction.

The site contains a ridgeline which runs west to east through the southern third of the site. A defined gully exists in the same direction in the northern third of the site. The existing gully contains the large dam/ basin that connects a series of basins from adjacent properties.

This topography divides the site into two (2) overall catchments.

The northern catchment is approximately 7.8ha and grades towards the existing gully at grades between 2% and 10%. Runoff from the northern catchment drains to the existing large dam/ basin. The basin contains a low flow outlet pipe and high-level embankment weir that conveys flows downstream to the next basin in the drainage line.

The southern catchment is approximately 2.5ha and grades to the south east towards Raymond Terrace Road at grades between 2% and 7%. Runoff from the southern catchment drains to the existing table drain in the northern verge of Raymond Terrace Road. There is an existing inlet headwall and DN 600 stormwater pipe that crosses Raymond Terrace Road and discharges flows to the existing stormwater infrastructure on the southern side of Raymond Terrace Road.

A review of the site and surrounding area has determined that runoff from upstream properties will contribute to flows in both the northern and southern catchments. The upstream catchments will be catered for in terms of drainage through the site but will not be assessed for water quality or quantity requirements as the adjoining development will need to consider their own measures.

The soil profile is expected to be generally residual silty and sandy clays overlying weathered sedimentary rock as outlined in '*Report on Geotechnical Investigation*' prepared by Cardno dated February 2016.

2.2 PROPOSED DEVELOPMENT

The proposed development will comprise of 108 residential lots. Typical urban residential elements such as roads, drainage infrastructure, services and landscaping will also be incorporated. **Exhibit B** illustrates the proposed development.

The stormwater from the proposed development and upstream catchments will be captured by a pit and pipe network and conveyed to the discharge locations.

It is proposed to remove the large dam/ basin from the existing drainage line and reconstruct a drainage channel and riparian corridor to convey upstream flows through the site to the downstream receiving waters.

The northern catchment will be conveyed to the reconstructed channel and riparian corridor via stabilised headwalls.

The southern catchment will be conveyed to a detention/ biofiltration basin to limit the peak flows leaving the site to predeveloped flows before discharging to the existing table drain in the northern verge of Raymond Terrace Road via a stabilised headwall.

2.3 BACKGROUND DOCUMENTATION

The subject site is part of the larger Thornton North Urban Release Area (TNURA) Eastern Precinct. The TNURA is a large rezoned area of residential land under fragmented ownership. As such several catchment wide studies have been completed over the area to deal with servicing, traffic, and stormwater.

An approved Stormwater Management strategy was completed by ADW Johnson for the initial subdivision of the TNURA tilted Stormwater Management Plan – Chisholm Residential Subdivision dated September 2016. Since then, a number of addendums have been submitted and approved by Council including:

- Addendum 1 – Stormwater Management Plan #1 by ADWJ dated October 2016;
- Addendum 2 – TNURA Stormwater Management Plan by ADWJ dated July 2019;
- Addendum 3 – Stormwater Management Plan Addendum #3 by ADWJ dated April 2020; and
- Addendum 4 – Stormwater Management Plan Addendum #4 by ADWJ dated November 2022.

The most recent addendum "Thornton North URA Eastern Precinct Stormwater Management Plan Addendum 5" is in the process of being lodged with Council.

This addendum has been prepared to consolidate the number of detention and water quality basins within the drainage corridor running through the northern portion of the subject site. Outcomes of the investigation show that a single additional basin on the downstream "Munro" site will be sufficient to cater for the detention and water quality needs of the proposed developments in the upstream contributing catchments.

As a result of this investigation, it was determined that the subject site does not require detention or water quality facilities for the northern catchment allowing the large dam/ basin to be removed and the corridor be reconstructed into a drainage channel and riparian corridor.

The southern catchment within the subject site has not been catered for and as such will require an investigation into detention and water quality measures.

The catchment area included within the Addendum 5 investigation is shown in **Figure 2** and the report in its entirety is included in **Appendix A**.

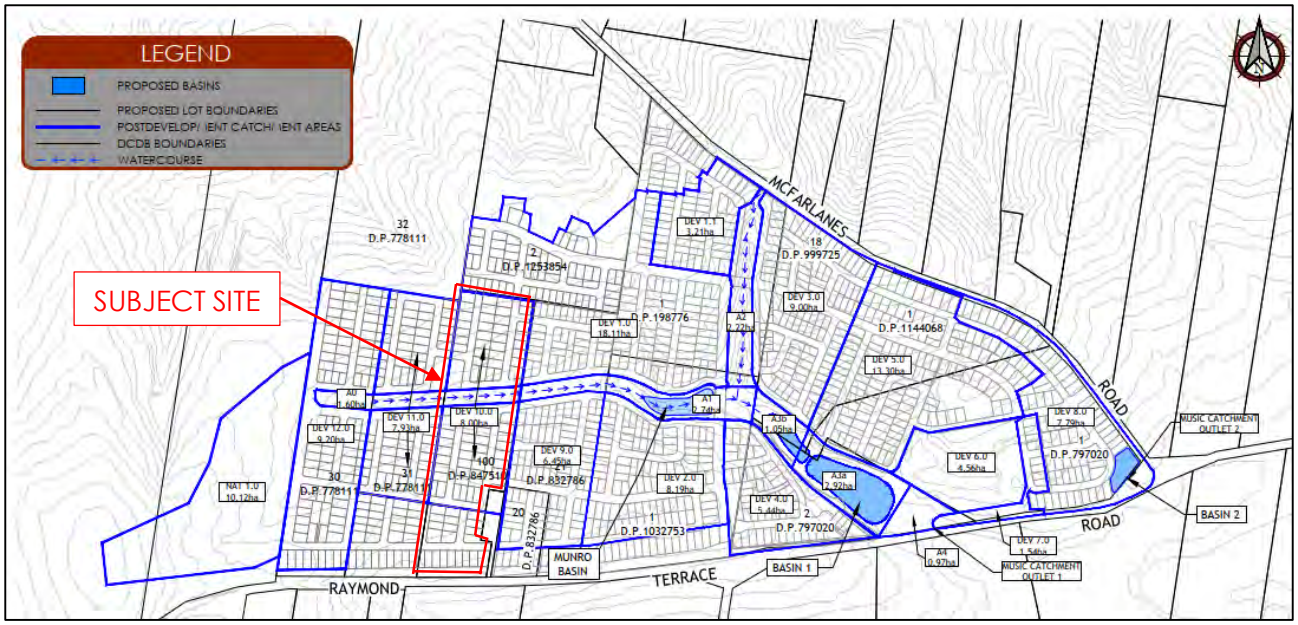

Figure 2 – Catchment Area of TNURA Study
(Source: Thornton North URA Eastern Precinct Stormwater Management Plan Addendum 5)

3.0 Council Requirements

Council outlines the engineering requirements for stormwater management within their *'Manual of Engineering Standards'* (MOES), Section DC.3 of the Maitland Development Control Plan (Part C), and Section F7 of the Maitland Development Control Plan – Thornton North Urban Release Area. DCP Compliance tables have been provided in ***Section 8.2.***

3.1 CONCEPT STORMWATER DESIGN

Maitland DCP requires new developments to provide concept plans as part of the development application.

A concept stormwater design is required to demonstrate that stormwater runoff can be effectively and efficiently conveyed from the proposed subdivision to the existing receiving waters.

3.2 STORMWATER QUANTITY

Council's DCP requires that onsite detention is required to protect downstream properties and infrastructure from increased stormwater flows due to new developments. Council requires that the proposed development does not exceed predeveloped runoff for all storm events up to the 100-year storm.

The pit and pipe network needs to cater for the minor storm event (10yr ARI) without any surcharging within the system and minimising flow widths and ponding. The overland flow paths need to cater for the major storm event (100yr ARI) with freeboard to adjacent habitable floor levels.

The purpose of this study is to limit post-development critical peak flows to less than or equal to existing flows for all design storms up to the 1% design storm event leaving the site.

3.3 STORMWATER QUALITY / WATER SENSITIVE URBAN DESIGN

The stormwater drainage system must effectively remove the nutrients and gross pollutants from the site prior to the runoff entering the existing downstream waterways.

The proposed development will include water quality treatment devices within the catchment to reduce pollutant loads to the downstream watercourse. Council's stormwater quality targets are shown in ***Table 3.1***.

Table 3.1 - Water Quality Targets (Maitland City Council, 2014)

Pollutant	Targets
Total Suspended Solids (TSS)	80% of average annual load
Total Phosphorus (TP)	45% of average annual load
Total Nitrogen (TN)	45% of average annual load
Gross Pollutants (GP) (>5mm)	70% of average annual load
Litter (>50mm)	Retention up to the 3 month ARI peak flow
Oil and Grease	90% of average annual load

3.4 SOIL & WATER MANAGEMENT

Soil and Water Management (SWM) is to be undertaken according to Landcom's *Blue Book* (2004) and Council's Manual of Engineering Standards, specifically Appendix B. The intent of this requirement is to mitigate erosion and prevent sediment-laden run-off from leaving the site during site preparation and construction.

3.5 PRE DA MEETING

A pre-DA meeting was held with Council on 23rd March 2023. Below is a list of the stormwater requirements raised by Council in the pre-DA meeting minutes:

- Stormwater Management – Detention (southern catchment): Council can confirm that the stormwater detention basin constructed on the southern side of Raymond Terrace Road does not cater for the proposed development site. Detention for the southern catchment will need to be provided prior to discharge to Raymond Terrace Road.
- Stormwater Management – Detention (Main Catchment): Part F of the DCP 2011 identifies a stormwater management basin being provided within this site. Any proposal to delete this basin would need to be supported by appropriate details being submitted for assessment at DA stage.

4.0 Concept Stormwater Design

4.1 OVERALL STRATEGY

A stormwater drainage concept plan has been prepared to demonstrate how the stormwater runoff for the proposed development and the upstream catchments is captured and transported to the receiving waters. Refer to **Exhibit C** for the stormwater management plan.

The stormwater system contains a combination of conventional pit and pipe networks and WSUD elements to effectively convey stormwater runoff to the downstream waterways.

Roof runoff is proposed to be captured via the use of rainwater tanks. The rainwater tanks will allow the reuse of stormwater for indoor and outdoor uses. Overflow from the tanks will be conveyed to the stormwater system via an overflow pipe. It is expected that each tank will consist of a first flush system to further improve stormwater runoff quality prior to discharge.

A pit and pipe stormwater system has been designed to convey the stormwater runoff from the developed catchments to two discharge locations. This network has been designed to cater for the minor storm (10yr ARI) without surcharging within the system and minimizing flow widths and ponding. The road network has been designed to cater for the major storm (100yr ARI).

Inter-allotment drainage has been provided in the lots that cannot drain to the street to allow runoff to be captured and conveyed to the discharge locations.

4.2 UPSTREAM CATCHMENTS

There are upstream properties that contribute to flows in both the northern and southern catchments. Where flows would logically connect from upstream catchments within the road network the proposed road drainage has been extended to the boundary to allow for future connection.

The drainage channel has been designed to tie in with the proposed reconstructed channel on both the western and eastern boundaries to allow continuous flow without impediment.

4.3 NORTHERN CATCHMENT

The northern catchment collects and conveys runoff via a pit and pipe network before discharging to the reconstructed drainage channel via stabilized headwall outlets where possible.

Some of the catchment drains to the stormwater network in the proposed development downstream of the site before discharging to the proposed basin in the Munro site.

The stormwater network will be sized to cater for the developed flow from upstream catchments as the detention requirements are proposed to be catered for downstream in the Munro site.

4.4 SOUTHERN CATCHMENT

The southern catchment collects and conveys runoff via a pit and pipe network before discharging to a proposed detention/ biofiltration basin in the south east corner of the development.

The stormwater systems will split into a high flow and low flow system. The low flow system will convey stormwater flows up to and including the three (3) month ARI storm event through a GPT and into a temporary detention/biofiltration basin. The high flows will bypass the GPT and be discharged directly into the temporary detention/biofiltration basins.

Discharge from the basin will be conveyed to the existing table drain in the northern verge of Raymond Terrace Road via a stabilized headwall.

The stormwater network will be sized to cater for the predeveloped flow from upstream catchments as it is assumed that upstream developments will need to cater for their own detention and water quality requirements.

5.0 Stormwater Quantity

As discussed in **Section 2.3** the northern catchment has been included in the "Thornton North URA Eastern Precinct Stormwater Management Plan Addendum 5" stormwater assessment and has been catered for within the proposed basin in the Munro site. Therefore, only the southern catchment will be assessed in this section.

The proposed stormwater system has been designed to protect downstream properties and infrastructure from increased stormwater flows as a result of the development. To ensure there are no adverse impacts on the downstream properties and infrastructure, the stormwater system has to be designed to ensure that the post-development peak flows leaving the site are less than the pre-development peak flows for all storm events up to the 100yr ARI event.

As the development of the site will result in an increased impervious area, on-site detention will be required to reduce the peak median flows back to existing conditions.

The proposed stormwater system, as detailed in **Section 4**, uses a combination of pit and pipe networks and WSUD elements to capture and convey stormwater runoff from the site.

The subject site is subdivided into a series of sub-catchments for the post development scenarios. Parameters of sub-catchment areas, imperviousness, and times of concentration are used to simulate the catchment response to storm events to generate hydrographs and estimate the peak median discharge flows.

5.1 MODELLING PARAMETERS

XP-RAFTS modelling was used to demonstrate that the on-site stormwater detention reduces post-development peak flows back to or less than pre-development peak flows for various design storms.

The model diagram and parameters used for the modelling can be found in the subsequent sections and within **Appendix B.**

5.1.1 Rainfall Intensity

The Rainfall Intensity Frequency Duration (IFD) data adopted was sourced from the Bureau of Meteorology website (IFD AR&R87 application). This was then checked against the IFD data contained in Appendix C of Council's *'Manual of Engineering Standards'.*

5.1.2 XPRAFTS Parameters

The key parameters utilised within the XPRAFTS model are summarised in ***Table 5.1*** below.

Table 5.1 - XPRAFTS Modelling Parameters

Parameter	Pervious Area	Impervious Area
Manning's 'n'	0.05 – Natural	0.015
	0.035 - Developed	
Initial Loss (IL)	5.0mm	1.0mm
Continuing Loss (CL)	2.5mm/hr	0mm/hr

The parameters outlined in ***Table 5.1*** were sourced from both Council's '*Manual of Engineering Standards'* and Australian Rainfall and Runoff (Edition 3 – 1987) *'A Guide to Flood Estimation'* (Pilgrim, 1987).

5.2 CATCHMENT DATA

Subcatchments were delineated by analysis of the field survey undertaken as well as (Lidar) topographical survey information and then confirmed by ground truthing inspection. It was decided to investigate the catchment upstream of the existing DN600 stormwater crossing of Raymond Terrace Road downstream of the subject site.

5.2.1 Predeveloped Catchment

The predeveloped catchments, as shown in **Exhibit A**, were modelled as 5% impervious to account for the existing structures and accesses on site.

A summary of the subcatchment parameters used are shown in ***Table 5.2.***

Table 5.2 - Pre-Developed Catchment Parameters

Subcatchment	Total Area (ha)	% Impervious
Subject Site	2.19	5
Upstream Catchment	1.60	5
Downstream Catchment	1.35	5
TOTAL	**5.14**	

5.2.2 Developed Catchment

Developed catchments were delineated utilising the proposed site grading plan and concept stormwater layout. The catchment areas external to the subject site were modelled in their existing state as it is assumed that they will need to cater for their own detention requirements or not be developed.

Maitland City Council's Manual of Engineering Standards includes standard impervious fractions for different land uses as shown in ***Table 5.3.***

Table 5.3 - Fraction Impervious Rates for Land Uses

Land Use	Fraction Impervious
Residential Lot Size < 1000 m^2	0.6
Road Reserve	0.7
Public Recreation Areas (mowed and with improvements)	0.5
Parkland, Natural Public Reserve	0.1

A summary of the developed catchment parameters is shown in **Table 5.4.**

Table 5.4 - Post Developed Catchment Parameters

Subcatchment	Total Area (ha)	% Impervious	Area (ha) Impervious	Area (ha) Pervious
Subject Site	2.02	60	1.22	0.80
Upstream Catchment	1.6	5	0.08	1.52
Downstream Catchment	1.35	5	0.07	1.28
TOTAL	**4.97**		**1.37**	**3.61**

From **Table 5.4** it can be seen that the post developed catchment is smaller than the pre developed catchment. This is due to some of the catchment being taken to the north to reflect the proposed road grading.

5.3 PROPOSED DETENTION BASIN

The proposed development requires a detention basin to meet Council's requirements for the southern catchment. The basin will be utilised for stormwater quality in addition to stormwater detention so will have a biofiltration component.

The proposed detention basin will be accessible from the adjoining road for maintenance purposes.

The onsite detention basin has been sized and a concept outlet configuration has been prepared to enable modelling of the site and demonstrate that the basin reduces post-development peak flows back to or less than pre-developed peak flows.

General arrangements of the stormwater controls within the ACG site can be found in ***Exhibit D.***

The basin design details are summarised in ***Table 5.5.***

Table 5.5 - The basin

Basin Parameter	Detail
Levels	21.7m AHD – Invert Level
	22.0m AHD – Extended Detention Level
	23.5m AHD – Crest Level
Basin Area	Extended Detention Surface Area 199m^2
Batters	1:4 internal batters
	1:4 external batters
Outlet Controls	0.3m high x 0.6m wide cut out at RL22.0 0.6m high x 0.6m wide cut out at RL22.35
	Weir (Spillway) – 4m length, 1:4 sides – IL 23.2m AHD
Total Storage at 100yr Stage (above the permanent water level)	400.43 m^3

Appendix B contains the storage table for this basin.

5.4 STORMWATER DETENTION RESULTS

In accordance with Council's requirements, modelling was undertaken to demonstrate compliance of post development flows being less than or equal to the pre development flows prior to discharge of stormwater into the downstream waterways.

The results of the modelling are shown in **Table 5.6.**

Table 5.6 - Catchment of The basin Modelling Results

Storm Event (ARI)	Peak Runoff (m^3/s)		
	Pre Developed	Post Developed (w/o detention)	Post Developed (with detention)
1yr	0.38	0.484	0.357
10yr	1.185	1.355	1.057
20yr	1.437	1.617	1.278
50yr	1.662	1.834	1.476
100yr	1.911	2.093	1.687

As shown in ***Table 5.6***, Council's requirement to reduce the post developed runoff to equal or less than the predeveloped runoff was successfully.

The basin top water level and storage for each AEP event are shown in ***Table 5.7*** for the detention basin.

Table 5.7: Basin Top Water Level and Storage

ARI	Basin Stage (m)	Basin Storage (m^3)
1yr	0.392	106.87
10yr	0.882	264.56
20yr	0.941	312.20
50yr	1.039	356.19
100yr	1.133	400.43

6.0 Stormwater Quality

The proposed stormwater system, as detailed in **Section 4**, uses a combination of pit and pipe networks and water sensitive urban design elements to convey stormwater runoff from the site. It is intended to use a combination of treatment devices within the drainage system to remove nutrients and sediments from the stormwater prior to the runoff leaving the site.

6.1 TREATMENT DEVICES

The stormwater design for the proposed subdivision proposes to use a combination of at source, conveyance, and end of line controls to treat the stormwater runoff from the site. The treatment train will be modelled for demonstration of compliance with MCC – key performance objectives.

At Source

Half of the roof runoff for each of the future dwellings will be captured by rainwater tanks where the stormwater will receive at source treatment via a first flush system and a portion of the stormwater will be used for reuse.

Conveyance

The low flows will be conveyed through a GPT which will be the conveyance control used to treat the stormwater. The GPT is the primary pollution control device in the treatment train after the stormwater is conveyed via the pit and pipe network. The GPT will primarily remove litter, large debris and the nutrients attached to particles.

The **Ecosol In-Line GPT** was modelled as the GPTs treatment device. The treatment node was sourced from the Ecosol website. (Ecosol Pty Ltd, 2018). It is proposed that at construction certificate stage, gross pollutant traps will be positioned throughout the development to intercept the majority of stormwater discharging from the development, ensuring that the GPTs are serviceable and remain efficient during smaller duration storm events.

The removal efficiency of the GPT is summarised in **Table 6.1**.

Table 6.1 - GPT Removal Efficiencies

Pollutant	% Removal Efficiency *
Total Suspended Solids	61
Total Phosphorus	29
Total Nitrogen	1
Gross Pollutants	98
Total Petroleum/Hydrocarbon	99

* (Ecosol Pty Ltd, 2018)

The high flow bypass for the modelled GPTs has been set to the calculated 3 month flow (approx. ½ of 1 year ARI) from each subcatchment.

End of Line

Low flows are conveyed from the GPT's to the end of line controls being a detention/biofiltration basin. The detention/biofiltration basin promotes sedimentation of particles larger than 125 µm and promote filtration of the stormwater through a filter media. The detention/biofiltration basin will be planted with vegetation that provides some biological uptake.

The basin details are provided in **Table 6.2**.

Table 6.2 - The basin Parameters

Parameter	Bio retention Basin
Surface Area (m^2)	199
Extended Detention Depth (m)	0.3
Exfiltration Rate (mm/hr)	0
Filter Area (m^2)	65.5
Filter Depth (m)	0.4
Saturated Hydraulic Conductivity	150
Base Lined	yes
Vegetated with Nutrient Removal Plants	yes
Underdrain Present	yes
Submerged Zone	no

The bio filtration component of the basin has been sized to achieve the required treatment targets and is not required over the entire footprint of the basin.

6.2 MUSIC MODELLING PARAMETERS

The software used for the water quality modelling is MUSIC. This program is well regarded as industry best practice for analysis of the effectiveness of treatment mechanisms on the quality of stormwater runoff from a development site of this size.

The model diagram and parameters used for the modelling can be found in the subsequent sections and within **Appendix B.**

6.2.1 Rainfall and Evapotranspiration

The rainfall data from Tocal, Paterson weather station was input into the MUSIC model. Six (6) minute rainfall information for the year 1989 was analysed and deemed to be a reasonable representation of the average yearly rainfall and rainfall event distribution.

The rainfall data file was reviewed and it was noted that the rainfall for 1989 (904.6mm) was comparable to the annual average for the 47 year period from 1967 to 2015 being 930.4mm. During 1989 there were 89 days of rainfall which is equivalent to the long term average of 89.9.

The annual rainfall and evapo-transpiration time series graph for 1989 is shown in ***Figure3 .***

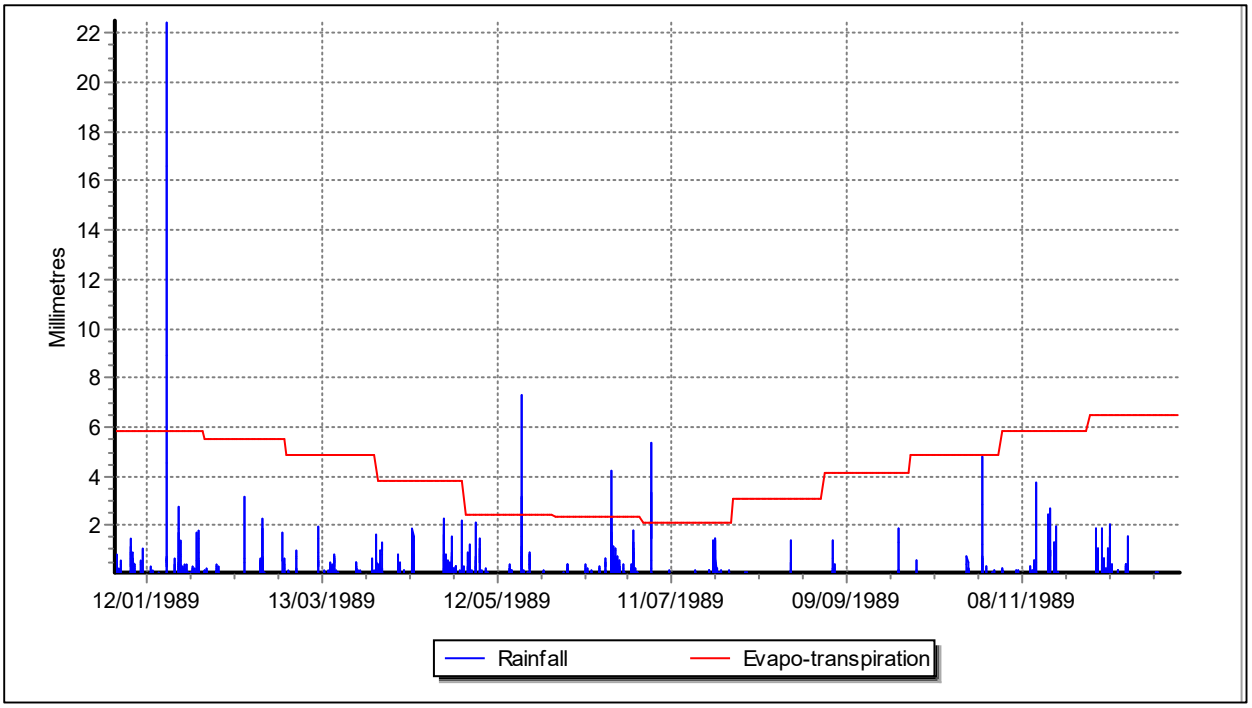

Figure 3 - Rainfall and Evapo-transpiration Graph

6.2.2 Time Step

A time step of six (6) minutes was specified prior to any modelling. This is recommended by the software to increase reliability and output sensitivity.

6.2.3 Catchments

The sub-catchments used in ***Section 5.2.1*** have been adopted for the MUSIC modelling.

6.2.4 Land Use

The MUSIC model defined the following land uses:

- Roof (Urban) – This land use defines the impervious roof area of each lot, it has been assumed to be 100% impervious and accounts for:
  - 60% of the total lot area;
- Lots (Urban) – This land use defines the lot area after the removal of the roof area, it has been assumed to be:
  - 5% impervious of 40% of the remaining lot area;
- Road (Urban) – This land use defines the road reserve area, it has been assumed to be 70% impervious accounting for pervious road verge;
- Basin Area (Urban) – This land use defines the basin area, it has been assumed to be 100% impervious;
- Landscaping (Urban) – This land use defines parklands and general open space, it has been assumed to be 10% impervious; and
- Upstream Natural (Urban) – This land use defines the upstream natural catchments and it has been assumed to be 0% impervious.

Total lot area equates to 62% impervious area.

Table 6.3 summarises the land use areas for each subcatchment.

Table 6.3 - Subcatchment Land Use Areas

SUBCATCHMENT	LAND USE	TOTAL AREA (ha)	% IMPERVIOUS	IMPERVIOUS AREA (ha)	PERVIOUS AREA (ha)
Subject Site	ROADS	0.554	70%	0.388	0.166
	ROOF	0.46	100%	0.460	0.000
	LOTS	0.916	40%	0.366	0.549
	OPEN SPACE	0.091	5%	0.005	0.087
SUB TOTAL		**2.021**		**1.219**	**0.802**
Upstream Catchment	RURAL	1.6	5%	0.080	1.520
Downstream Catchment	RURAL	1.35	5%	0.068	1.283
TOTAL		**4.971**		**1.366**	**3.605**

6.2.5 Rainfall-Runoff Parameters

Pollutant source inputs were obtained from the *'Draft NSW MUSIC Modelling Guidelines'* (BMT WBM, 2010). The parameters adopted for the varying land uses were implemented in accordance with Table 3-2 and 3-7 of the above stated document assuming a CLAY soil description.

The parameters used within the MUSIC model are presented in ***Table 6.4.***

Table 6.4 - MUSIC Rainfall-Runoff Parameters

Parameter	Roof	Lot	Road	Basin	Open Space
Areas - Impervious (%)	100	5	70	100	10
Rainfall Threshold (mm/day)	0.3	1	1.5	1	1
Soil Storage Capacity (mm)	93				
Initial Storage (% of Capacity)	30				
Field Capacity (mm)	68				
Infiltration Capacity Coefficient	135				
Infiltration Capacity Exponent	4				
Initial Depth (mm)	10				
Daily Recharge Rate (%)	10				
Daily Baseflow Rate (%)	10				
Daily Deep Seepage Rate (%)	0				

6.3 WATER QUALITY RESULTS

To show compliance with Council's requirements, the following modelling results are to be compared against Council's pollution reduction targets outlined in ***Table 3.1***.

The petroleum/hydrocarbon target reductions required by Council's are to be achieved through the use of GPTs. GPTs are not specifically designed to capture hydrocarbons, though they may do so during emergency spill events. The petroleum/hydrocarbon pollutant reduction of 99% for the GPT as outlined in ***Section 6.1*** exceeds Council's requirements and therefore shows qualitative compliance provided maintenance is undertaken immediately after an emergency spill event. Simulations of these pollutants are beyond the functionality of the MUSIC program and therefore no quantitative results can be provided.

The average annual pollutant loads downstream of catchments is summarised in ***Table 6.5.***

Table 6.5 - Treatment Train Effectiveness

Catchment	Pollutant	Developed Untreated Load (kg/yr)	Developed Treated		Council Target Reduction (%)
			Load (kg/yr)	Reduction (%)	
D	TSS (kg/yr))	2000	221	**89**	**80**
	TP (kg/yr)	3.88	1.24	**68**	**45**
	TN (kg/yr)	25.6	12.6	**50.9**	**45**
	GP (kg/yr)	389	1.98	**99.5**	**70**

From ***Table 6.5***, it can be seen that the treatment train successfully reduced the pollutant loading from the development.

7.0 Erosion and Sediment Control

Erosion and sedimentation control measures need to be implemented during any construction on the proposed subdivision to minimize the risk of erosion to disturbed areas and limit the transport of sediments from the construction site to downstream waterways. A preliminary Erosion and Sediment Control Plan is presented as **Exhibit D.** Typical erosion and sediment control details and notes are shown in **Exhibit E**.

The attached Erosion and Sediment Control Plan is only an indicative plan as another Erosion and Sediment Control Plan will be provided as part of the construction certificate drawings and a further plan will be provided by the contractor before construction takes place.

During the construction period, it is recommended that the detention portion of the basins are constructed early and used as a temporary sediment basin. It is also recommended that an appropriate Erosion and Sedimentation Control Plan is implemented throughout the entire construction period to minimize the quantity of sediments being conveyed to the temporary sediment basin.

8.0 Key Compliances

8.1 PRE DA MEETING

Below is a list of the stormwater requirements raised by Council in a pre DA meeting. Following the requirements are the responses and actions that have been taken to meet these requirements.

- Stormwater Management – Detention (southern catchment): Council can confirm that the stormwater detention basin constructed on the southern side of Raymond Terrace Road does not cater for the proposed development site. Detention for the southern catchment will need to be provided prior to discharge to Raymond Terrace Road.

A detention basin has been sized to provide adequate detention for the southern catchment.

- Stormwater Management – Detention (main catchment): Part F of the DCP 2011 identifies a stormwater management basin being provided within this site. Any proposal to delete this basin would need to be supported by appropriate details being submitted for assessment at DA stage.

Thornton North URA Eastern Precinct Stormwater Management Plan Addendum 5 caters for the northern catchment. This report is included in **Appendix A**.

8.2 DCP REQUIREMENTS

Section DC.3 of the Maitland Development Control Plan (Part C) relates to drainage, water quality and soil erosion controls. ***Table 8.1*** details each DCP requirement with commentary relating to the subject development.

Table 8.1 - Maitland DCP Controls

No.	Control	Response
DC.3.1	Existing topography and natural drainage lines should be incorporated into drainage designs for larger proposals, and enhanced through provision of additional landscaping, detention areas, artificial wetlands and the like.	The developed conditions of the site will largely be in line with the existing topography to reduce the cut/fill balance. Therefore, the basin will be built at the natural pre-developed drainage point of southern catchment.
DC.3.2	Drainage from proposed lots should be consistent with the pre-development stormwater patterns. An analysis of the downstream drainage system, to the receiving area or waters, may be required.	Hydrologic modelling has been undertaken to compare peak site discharges under existing and developed conditions. Modelling has confirmed that the development will not intensify peak flows at either point of discharge, and that peak flows are well correlated to predeveloped magnitudes.

No.	Control	Response
DC.3.3	Best management practices should be implemented to control runoff and soil erosion and to trap sediment on the subject land to ensure there is no net impact on downstream water quality. The quality of runoff water from the subject land should be the same or better than the quality of water prior to the subdivision taking place.	A stormwater quality treatment train has been developed comprising of Gross Pollutant Traps and bioretention basin. MUSIC modelling has confirmed that the proposed treatment train meets Council's load-based objectives in relation to runoff quality improvement.
DC.3.4	Where possible, design multiple use drainage and treatment systems incorporating gross pollutant traps, constructed wetlands and detention basins.	While the footprint of the basin is mostly required to handle pre to post development flow rates, the basin is also designed to work in conjunction with GPTs to meet Council water quality targets.
DC.3.5	The subdivision should be designed so as to minimise disturbance of the subject land especially in circumstances where there are topographical constraints.	The site levels are as close as practical to the natural surface level, in order to reduce the amount of earthworks required, and to keep as much vegetation as possible during construction.
DC.3.6	Adequate provision should be made for implementation of measures during subdivision construction to ensure that the landform is stabilised and erosion controlled.	Conceptual Soil and Water Management Plans are provided within the concept engineering plans. To ensure downstream waters and adjacent properties are protected, appropriate erosion and sediment controls are to be undertaken during construction. Controls are to be implemented and monitored in accordance with Landcom's 'Blue Book' and Council's engineering guidelines.
DC.3.7	All trunk drainage is to be located in publicly owned land, (reserves), in open space land or in an appropriate easement.	The basin is to be dedicated as public drainage reserve.
DC.3.8	Where the drainage impacts of the subdivision proposal cannot be limited to pre-development stormwater levels by retention or other approved methods, drainage easements will be required over all necessary properties and watercourses. In such circumstances, the easement must be the subject of a signed agreement prior to issue of development consent. Such easements shall be created with, or prior to issue of the Subdivision Certificate.	Hydraulic modelling has confirmed that the proposed basin will be sufficient to detain the peak flows to be in line with, or less than, the predeveloped conditions.

No.	Control	Response
DC.3.9	Where site topography in new residential subdivisions prevents discharge of storm water directly to the street gutter or a Council controlled pipe system, inter allotment drainage should be provided to accept run off from all existing or future parcels of land. The design and construction of the inter allotment drainage system should be in accordance with the requirements of Council's Manual of Engineering Standards.	The concept engineering plans show inter-allotment drainage and appropriate easements on all rear-draining lots.
DC.3.10	Where inter-allotment drainage is required, easements having a general minimum width of 1.5m are to be identified on plans submitted.	The concept engineering plans show inter-allotment drainage and appropriate easements on all rear-draining lots.
DC.3.11	A soil and water management plan (SWMP) should be prepared by a properly qualified practitioner with the aim of minimising erosion and maximising the quality of any water leaving the site. Applicants should refer to Council's Manual of Engineering Standards.	Conceptual Soil and Water Management Plans are provided within the concept engineering plans. To ensure downstream waters and adjacent properties are protected, appropriate erosion and sediment controls are to be undertaken during construction. Controls are to be implemented and monitored in accordance with Landcom's 'Blue Book' and Council's engineering guidelines.

From ***Table 8.1*** it is seen that Council's DCP requirements are met.

In addition to the general Maitland Council requirements, the site is located in the Thornton North Urban Release Area (*URA*), and as such has additional requirements

Table 8.2 - Thornton North DCP Controls

No.	Control	Response
1.5.1	The stormwater and water quality management controls shall be consistent with the Thornton North Structure Plan in the use of Water Sensitive Urban Design (WSUD).	A WSUD treatment train has been developed which meets Council's pollutant reduction targets.
1.5.2	The number and location of WSUD elements should be determined by modelling to develop the WSUD strategy for the site, and be integrated with the overall design.	MUSIC modelling has been undertaken to affirm the suitability of the proposed WSUD strategy.
1.5.3	Parking areas can be located adjacent to WSUD elements where they are designed to prevent damage by vehicles.	No WSUD elements have been designed to be under a location viable to vehicular access.

No.	Control	Response
1.5.4	Bollards or castellated kerbs are required to allow distributed flow to WSUD elements.	Road cross sections are designed to have water drain into the kerb and gutter network as access into the pit and pipe network.
1.5.5	Parking areas may be interspersed between WSUD elements.	Not Applicable
1.5.6	Long-term maintenance costs are to be identified in the design of the WSUD elements and are to be submitted to Council for consideration prior to acceptance of the WSUD strategy.	The proposed treatment train is typical of Council's existing assets, the number of basins and GPTs has been minimised to reduce long-term maintenance costs.
1.5.7	Swales may be acceptable where it can be demonstrated that they will meet Council's performance and maintenance objectives and facilitate safe and effective movement of pedestrians and vehicles.	No new swales have been proposed to service the development's internal road network. A swale is being cut into the drainage corridor to replace the existing dam, however this has been accommodated in the Sophia Waters report.
1.5.8	No change to the minimum width of roads on account of WSUD is permissible.	Road widths do not deviate from Council's norms.
1.5.9	Flow control measures shall be used where grades in swales exceed 4%.	No swales on site are graded at more than 3.0%.
1.5.10	Where practical, WSUD elements may be incorporated in a centre depressed median of dual carriage roads.	There are no dual carriageway roads proposed for this site.
1.5.11	Wherever possible, existing natural drainage gullies should form part of a stormwater and runoff drainage management system incorporating detention basins and/ or wetlands to alleviate stormwater peaks and retain pollutants.	The existing watercourse is being reshaped and embellished to create a riparian corridor through the site. The dam is being removed and water quality and detention is being provided downstream to cater for the developed catchment.
1.5.12	Wetlands should be well-designed creating an attractive and safe amenity, and be highly visible for both the adjoining residents and passers-by.	No wetlands are proposed by the subject development.
1.5.13	Walking paths should have frequent contact adjacent to the wetland edge.	Both sides of the drainage corridor have full length walking paths.
1.5.14	Vegetation should be designed such that generous unobstructed view of the wetland is available.	Refer to landscape plans for detail.
1.5.15	Emergent macrophytes should be minimal and manageable.	Permanent waterbodies will be discouraged to minimise macrophyte growth.

No.	Control	Response
1.5.16	Slopes surrounding wetlands should be gentle and offer convenient tractor-mowing access.	No wetlands are proposed by the subject development. However, all batters are not steeper than 1V:4H and therefore considered mowable by a tractor.
1.5.17	Flat grassed areas that potentially may be water-logged should be avoided.	This should not be an issue, due to the site having generally a 4% slope.
1.5.18	Gullies intended to be left in their natural state should be assessed, and if necessary enhanced to offset the need for maintenance.	The drainage corridor is to be reshaped and revegetated.
1.5.19	In general, grassed areas must be kept to a minimum for maintenance purposes, and wetland and gullies should offer a sense of ownership to the public.	Grassed areas have been kept to a minimum. No wetlands are proposed. Footpaths will front the drainage corridor to create a sense of public ownership.

As seen in ***Table 8.2***, the Thornton North URA requirements have been met.

9.0 Conclusion

The stormwater system has been designed to safely convey the minor and major flows from within the development and upstream catchments to the receiving waters without adversely impacting downstream properties and infrastructure.

The northern catchment drains to the existing drainage corridor that is being catered for by proposed downstream infrastructure.

The stormwater detention provided by the proposed OSD basin in the southern catchment will allow the limiting of the post-development critical peak discharges leaving the site to less than that of pre-development for all design storm events up to the 1% AEP storm event; thereby not increasing the risk of flood inundation to existing downstream development and not increasing the demand on the downstream stormwater infrastructure.

The treatment train process of rainwater tanks, GPTs, and a detention/ bioretention basin have been designed to effectively reduce the nutrients and gross pollutants from stormwater runoff from the proposed development.

Hydrological and hydraulic modelling has shown that the stormwater measures proposed meet or exceed the water quantity and quality objectives set by MCC.

An Erosion and Sedimentation Control Plan has also been prepared for construction of the proposed development also complying with Council's requirements.

10.0References

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ADW Johnson. (2023) Thornton North URA Eastern Precinct Stormwater Management Plan Addendum 5.

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Maitland City Council. (2014). *Manual of Engineering Standards.* Maitland.

Exhibits

Appendix A

THORNTON NORTH URA EASTERN PRECINCT STORMWATER MANAGEMENT PLAN ADDENDUM 5

Appendix B

WATER QUANTITY

FIGURE B-1 – RAFTS LAYOUT

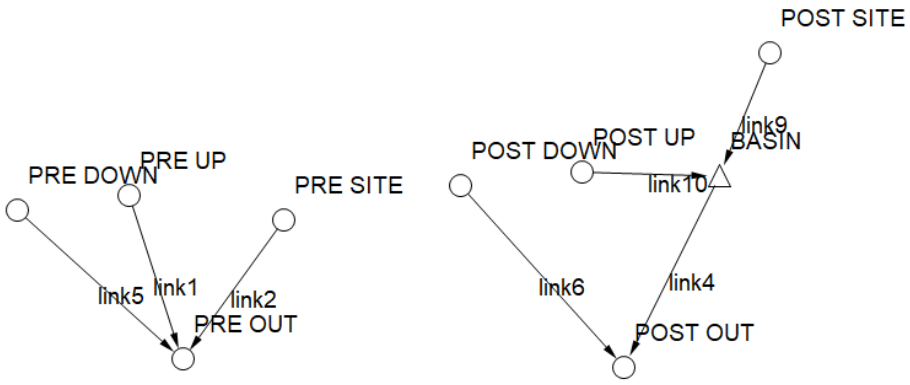


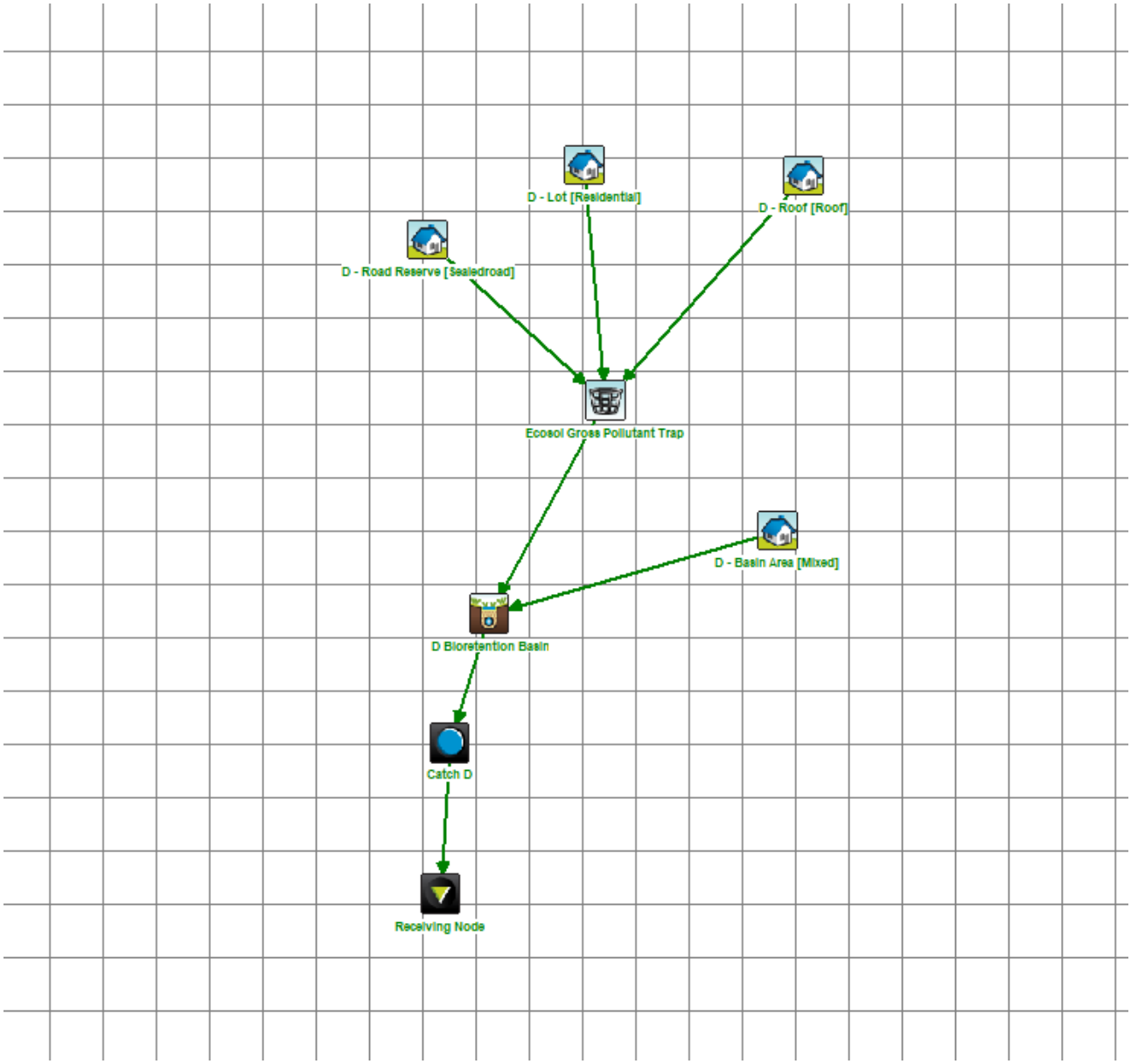
Table B1- BASIN VOLUMES

RL (AHD)	DEPTH (m)	VOLUME (m3)
21.7	0	0
21.8	0.1	24.378
21.9	0.2	50.696
22	0.3	79.008
22.1	0.4	109.376
22.2	0.5	141.862
22.3	0.6	176.521
22.4	0.7	213.408
22.5	0.8	252.578
22.6	0.9	294.085
22.7	1	337.986
22.8	1.1	384.334
22.9	1.2	433.186
23	1.3	484.596
23.1	1.4	538.618
23.2	1.5	595.309
23.3	1.6	654.659
23.4	1.7	716.642
23.5	1.8	781.271

Appendix C

STORMWATER QUALITY

FIGURE C-1 – MUSIC LAYOUT



Appendix J– BDAR Checklist

BAM Reference	Information	BDAR Section	Completed
Report			
Introduction - Chapters 2 and 3	Introduction to the biodiversity assessment including: ● brief description of the proposal ● identification of subject land boundary, including: - operational footprint (if BDAR) - construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR) - land proposed for biodiversity certification (if BCAR) ● general description of the subject land ● sources of information used in the assessment, including reports and spatial data	1.1 Introduction 1.1.1 Biodiversity Offset Scheme Threshold Trigger 1.1.2 Assessment Scope 1.1.3 The Proposal 1.1.4 General Description of the Subject Site 1.1.5 Site Particulars 1.1.6 Geology and Soils 1.1.7 Information Sources Figure 1 Site Map Figure 2 Location Map Appendix A Development Plan Appendix G Other Legislation	Completed
Landscape - Section 3.1, 3.2 and Appendix E	Identification of site context components and landscape features, including; General description of subject land topographic and hydrological setting, geology and soils	1.2 Landscape Features 1.2.1 Regional Landscapes 1.2.2 Identified Landscape Features Figure 2 Location Map	Completed
	Percent native vegetation cover in the assessment area (as described in BAM Subsection 3.2).	1.2.2 Identified Landscape Features 1.3.2 Landscape Native Vegetation Cover	Completed
	IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	1.2.1 Regional Landscapes	Completed
	Rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E)	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	
	Wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.))	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	
	Connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	

BAM Reference	Information	BDAR Section	Completed
	Karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.)	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	
	Areas of geological significance and soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(8-9.))	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	
	Any additional landscape features identified in any SEARs for the proposal	1.2.2 Identified Landscape Features Table 2 – Landscape Feature Assessment	
	NSW (Mitchell) landscape on which the subject land occurs	1.2.1 Regional Landscapes	Completed
Native vegetation, Chapter 4, Appendix A and Appendix H	Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1)	1.4 Native Vegetation 1.4.1 Regional Mapping Figure 3 – Regional Vegetation Mapping Figure 4 – Ground-truthed Vegetation Map Appendix F Site Photographs	Completed
	Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2)	1.4 Native Vegetation 1.4.3 PCT Selection Justification Figure 3 – Regional Vegetation Mapping Table 3 – Regional Vegetation Mapping Results	Completed
	Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1)	1.4.1 Regional Mapping Figure 3 – Regional Vegetation Mapping	Completed
	Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2	1.4.2 Plot Based Floristics Surveys 1.6 Survey Effort Figure 4 – Ground-truthed Vegetation Map Figure 6 – AEP Survey Effort Flora Figure 7 – AEP Survey Effort Fauna 1.4.5 Vegetation Integrity Assessment 1.4.5.1 Patch Size 1.4.6 Vegetation Integrity Score	Completed

BAM Reference	Information	BDAR Section	Completed
		Table 14 – Vegetation Integrity Score for PCT 1600 – Canopy only degraded and Moderate condition Table 15 - Vegetation Integrity Score for PCT 1598 and PCT 1736 – Moderate Condition and Poor Condition Appendix D BAM Plot Data Appendix F Site Photographs	
	Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A)	N/A	
	For each PCT within the subject land, describe: ● vegetation class ● extent (ha) within subject land ● evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) ● plant species relied upon for identification of the PCT and relative abundance of each species ● if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) ● estimate of percent cleared value of PCT (BAM Subsection 4.2.1(5.))	1.4 Native Vegetation 1.4.3 PCT Selection Justification Table 4 – Species Data for Potential PCT Determination Table 6 – Determination of PCT 1600 Table 9 – Determination of PCT 1598 Table 11 – Determination of PCT 1736	Completed
	Describe the vegetation integrity assessment of the subject land, including: ● identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) ● assessment of patch size (as described in BAM Subsection 4.3.2) ● survey effort (i.e., number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.)	1.3.1 Method 1.4.5 Vegetation Integrity Assessment 1.4.5.1 Patch Size 1.4.6 Vegetation Integrity Score Table 13 – Summary of Vegetation Zones Areas Table 14 – Vegetation Integrity Score for PCT 1600 – Canopy only degraded and Moderate condition	Completed

BAM Reference	Information	BDAR Section	Completed
	• use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.))	Table 15 - Vegetation Integrity Score for PCT 1598 and PCT 1736 – Moderate Condition and Poor Condition 1.4.2 Plot Based Floristics Surveys Figure 4 – Ground-truthed Vegetation Map Figure 6 – AEP Survey Effort Flora Figure 7 – AEP Survey Effort Fauna	
	Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): • identify the PCT or vegetation class for which local benchmark data will be applied • identify published sources of local benchmark data (if benchmarks obtained from published sources) • describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) • provide justification for use of local data rather than BioNet Vegetation Classification benchmark values • provide written confirmation from the decision-maker that they support the use of local benchmark data	Figure 3 – Regional Vegetation Mapping Figure 4 – Ground-truthed Vegetation Figure 6 – AEP Survey Effort Flora Figure 7 – AEP Survey Effort Fauna 1.6.1 Survey Effort Results 1.6.1.1 Habitat Trees Table 20 – Habitat Tree Detail 1.5.3 Field Survey Methods Appendix D BAM Plot Data	Completed
Threatened Species, Chapter 5	Identify ecosystem credit species likely to occur on the subject land, including: • list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.)) • justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) • justification for addition of any ecosystem credit species to the list	1.5 Threatened Species 1.5.1 Ecosystem Credit Species Table 16 – Predicted Ecosystem Credit Species Table 18 – Potential Credit Species Excluded and Removed from BAM - C Figure 5 – NSW BioNet Atlas Records Appendix E – Biodiversity Credit Report	Completed
	Identify species credit species likely to occur on the subject land, including:	1.5 Threatened Species 1.5.2 Species Credit Species Figure 5 – NSW BioNet Atlas Records	Completed

BAM Reference	Information	BDAR Section	Completed
	• list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1) • justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) • justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2) • justification for addition of any species credit species to the list	Table 17 – Potential Species Credit Species and SAII Species Table 18 – Potential Credit Species Excluded and Removed from BAM - C 1.5.3 Field Survey Methods Appendix C Fauna Species List	
	From the list of candidate species credit species, identify: • species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2. a.)) • species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2. d.)) • species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4(2. b.)) • species for which an expert report is to be used to determine species presence (Subsection 5.2.4(2. c.))	Table 6, 9, 11 – PCT Determination Tables Table 16 Predicted Ecosystem Credit Species Table 17 Potential Species Credit and SAII Species Table 21 Species Credit Species Appendix G – Other Legislation	Completed
	Present the outcomes of species credit species assessments from: • threatened species survey (as described in BAM Section 5.2.4) • expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Section 5.2.4 and 5.3, Box 3)	Table 17 – Potential Species Credit Species Figures 6, 7 Survey Effort Appendix B Flora Species List Appendix C Fauna Species List Appendix E Biodiversity Credit Report Appendix F Site Photographs	Completed
	Where survey has been undertaken include detailed information on: • survey method and effort, (as described in BAM Section 5.3) • justification of survey method and effort (e.g., citation of peer-reviewed literature) if approach differs from the Department's taxa-specific survey guides or where no relevant guideline has been published • timing of survey in relation to requirements in the TBDC or the Department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys	1.5.3 Field Survey Methods 1.6 Survey Effort 1.6.1 Survey Effort Results 1.6.2 Species Credit Species Survey Results Table 21 – Species Credit Species Figures 6 & 7 Flora and Fauna Survey Effort Appendix D – BAM Plot Data Appendix I CVs	Completed

BAM Reference	Information	BDAR Section	Completed
	● survey personnel and relevant experience ● describe any limitations to surveys and how these were addressed/overcome		
	Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: ● justification of the use of an expert report ● identify the expert, provide evidence of their expert credentials and Departmental approval of expert status ● all requirements of Box 3 have been addressed in the expert report	N/A	
	Where use of local data is proposed (BAM Subsection 1.4.2): ● identify relevant species ● identify data to be amended ● identify source of information for local data, e.g., published literature, additional survey data, etc. ● justify use of local data in preference to VIS Classification or TBDC data ● provide written confirmation from the decision-maker that they support the use of local data	N/A	
	Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that: ● the unit of measure for each species is documented for species assessed by area: ● the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5) ● a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied for species assessed by counts of individuals: ● the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.))	Figure 9 Table 17 – Potential Species Credit Species	Completed

BAM Reference	Information	BDAR Section	Completed
	● the method used to derive this number (i.e., threatened species survey or expert report) and evidence-based justification for the approach taken ● the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4)		
Prescribed impacts - Chapter 6	Identify potential prescribed biodiversity impacts on threatened entities, including: ● karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) ● occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) ● corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) ● water bodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4) ● protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5) ● where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6)	1.2.2 Identified Landscape Features 2.1 Avoid and Minimise Summary Table 23 – Prescribed Impact Avoidance and Minimisation Table 24 Direct Impact Assessment Table 25 Prescribed Impact Assessment Table 26 Indirect Impact Assessment Table 27 Residual Impact Assessment	Completed
	Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts	Table 17 – Potential Species Credit Species	Completed
	Describe the importance of habitat features to the species including, where relevant, impacts on life-cycle or movement patterns (e.g., Subsection 6.1.3)	1.2 Landscape Features 1.6.1.1 Habitat Trees Table 17 Potential Species Credit and SAII Species Table 20 – Habitat Tree Detail Table 23 & 24 Impact Avoidance and Minimisation	Completed

BAM Reference	Information	BDAR Section	Completed
	Where the proposed development is for a wind farm: ● identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5) ● provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.) ● predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.))	N/A	
Maps			
Introduction – Chapters 2 and 3	Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR)	Figure 1 Site Location Figure 2 Location Map Appendix A - Development Plan	Completed
Landscape - Section 3.1, 3.2 and Appendix E	Site Map ● Boundary of subject land ● Cadastre of subject land ● Landscape features identified in BAM Subsection 3.1.3	Figure 1 Site Location Figure 2 Location Map	Completed
	Location Map ● Digital aerial photography at 1:1,000 scale or finer ● Boundary of subject land ● Assessment area (i.e., the subject land and either 1500 m buffer area or 500 m buffer for linear development) ● Landscape features identified in BAM Subsection 3.1.3 ● Additional detail (e.g., local government area boundaries) relevant at this scale	Figure 1 Site Location Figure 2 Location Map	Completed
	Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or r Location map include: ● IBRA bioregions and subregions ● rivers, streams and estuaries	Figure 1 Site Location Figure 2 Location Map	Completed

BAM Reference	Information	BDAR Section	Completed
	• wetlands and important wetlands • connectivity of different areas of habitat • karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features • areas of outstanding biodiversity value occurring on the subject land and assessment area • any additional landscape features identified in any SEARs for the proposal • NSW (Mitchell) landscape on which the subject land occurs		
Native vegetation, Chapter 4, Appendix A and Appendix H	Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2)	Figure 1 Site Location Figure 2 Subject Site Figure 3 Regional Vegetation	Completed
	Map of PCTs within the subject land (as described in BAM Section 4.2(1.))	Figure 3 Regional Vegetation Figure 4 Ground-truthed Vegetation	Completed
	Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries	Figure 3 Regional Vegetation Figure 4 Ground-truthed Vegetation Figure 6 & 7 – AEP Survey Effort 1 & 2	Completed
	Map of TEC distribution on the subject land and table of TEC listing, status and area (ha)	Figure 3 Regional Vegetation Figure 4 Ground-truthed Vegetation	Completed
	Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2)	Figure 2 Location Map Table 6, 9, 11 – PCT Determination Tables Table 13 – Summary of Vegetation Zones Areas	Completed
Prescribed impacts Chapter 6	Map showing location of any prescribed impact features (i.e., karst, caves, crevices, cliffs, rocks, human-made structures, etc.)	N/A	
	Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)	N/A	
Tables			

BAM Reference	Information	BDAR Section	Completed
Native vegetation, Chapter 4, Appendix A and Appendix H	Table of current vegetation integrity scores for each vegetation zone within the site and including: ● composition condition score ● structure condition score ● function condition score ● presence of hollow bearing trees	Table 3 Regional Vegetation Mapping Results Table 13 Summary of Vegetation Zones Areas Table 14 and 15 Vegetation Integrity Score Tables Table 20 Habitat Tree Detail	Completed
Threatened Species, Chapter 5	Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying: ● the ecosystem credit species removed from the list ● the sensitivity to gain class of each species	Table 16 Predicted Ecosystem Credit Species Table 17 Potential Species Credit Species Table 21 Species Credit Species Table 24 Direct Impact Assessment Table 27 Residual Impact Assessment Table 30 – 49 Credit Requirements	Completed
	Table detailing species credit species in accordance with BAM section 5.2 and identifying: ● the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present ● the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map	Table 17 Potential Species Credit Species Table 22 Avoid and Minimise Impacts on Biodiversity Values Table 23 Prescribed Impact Avoidance and Minimisation	Completed
	Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)	Table 16 Predicted Ecosystem Credit Species Table 21 Species Credit Species Table 30 – 49 Credit Requirements	Completed
Prescribed impacts Chapter 6	No table	Table 25 – Prescribed Impact Assessment	Completed
Data			

BAM Reference	Information	BDAR Section	Completed
Landscape - Section 3.1, 3.2 and Appendix E	All report maps as separate jpeg files / Individual digital shape files of: ● subject land boundary ● assessment area ((i.e., subject land and 1500 m buffer area) boundary ● cadastral boundary of subject land ● areas of native vegetation cover ● landscape features	Attached files	Completed
Native vegetation, Chapter 4, Appendix A and Appendix H	All report maps as separate jpeg files ● Plot field data (MS Excel format) ● Plot field data sheets		
	Digital shape files of: ● PCT boundaries within subject land ● TEC boundaries within subject land ● vegetation zone boundaries within subject land ● floristic vegetation survey and vegetation integrity plot locations		Completed
Threatened Species, Chapter 5	Digital shape files of suitable habitat identified for survey for each candidate species credit species		Completed
	Survey locations including GPS coordinates of any plots, transects, grids		Completed
	Digital shape files of each species polygon including GPS coordinates of located individuals		Completed
	Species polygon map in jpeg format		Completed
	Expert reports and any supporting data used to support conclusions of the expert report		N/A
	Field data sheets detailing survey information including prevailing conditions, date, time, equipment used, etc		Completed

BAM Reference	Information	BDAR Section	Completed
Prescribed impacts **Chapter 6**	• Digital shape files of prescribed impact feature locations • Prescribed impact features map in jpeg format		N/A

Appendix K– CVs

Alana Guest

Curriculum Vitae

Alana works with AEP in the role of Ecologist. She graduated with a Bachelor of Science majoring in Biology and a Bachelor of Arts, majoring in History and minoring in Ancient History. She has worked in various roles unrelated to the science field over the past 5 years. Alana has worked at AEP since October 2022, and in addition to this has, experience in a variety of environmental work, from her university degree in, flora and fauna field surveys, reporting, and data management.

Qualifications

- Bachelor of Science, Biology major and Bachelor of Arts, History major and Ancient History minor – University of Newcastle (2022)

Further Education & Training

- Class C NSW Driver's Licence
- First Aid and CPR

Fields of Competence

- Field assessment including: targeted fauna and flora surveying, Koala Spot Assessment Technique (SAT) surveys, targeted fauna trapping
- High proficiency in written and verbal communication skills
- Gaining skill in botanical surveys
- Growing proficiency in Biodiversity Development Assessment report and Ecological Assessment report writing
- Data management and the use of Excel and Word

Relevant Employment History

2022 – Present **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation

ALEX MCNAMARA

Curriculum Vitae

Alex works with AEP in the role of Ecologist. He is expected to graduate with a Bachelor of Environmental Science and Management, majoring in Ecosystems and Biodiversity in November 2022. Alex has previously worked extensively throughout the renewable infrastructure industry as a leading hand before coming to AEP. His background undertaking large multidisciplinary projects and his growing ecological knowledge and experience is utilised in a diverse array of applications in his current role.

Qualifications

- Currently undertaking a Bachelor of Environmental Science and Management (Sustainability), University of Newcastle; to be completed in June 2023

Further Education & Training

- Class C NSW Driver's Licence
- Working at Heights
- NSW Construction White Card
- First Aid (Provide first aid HLTAID003)

Fields of Competence

- Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys, tree surveys, HBT and nest box inspections.
- Assessment of sites using the Biodiversity Assessment Method (BAM) under the Biodiversity Offsets Scheme, production of Biodiversity Development Assessment Reports and Ecological Assessment Reports
- Experience in fauna handling and trapping
- Growing proficiency in botanical surveys
- Adept experience in operating 4x4 vehicles

Relevant Employment History

October 2020 - Present **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, bushfire, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation.

AEP CV Alissa Rogers
Curriculum Vitae

Alissa works with AEP in the role of Ecologist. She completed a Bachelor of Park Management and holds a Certificate III Conservation and Land Management. She has extensive experience in bush regeneration, including planning, leading field staff, mapping and report writing. Her background in project management and park management combined with her ecological knowledge is utilized in a diverse array of applications in her current role.

EXPERIENCE

Feb 2022 - current	**Ecologist, Anderson Environment and Planning, Newcastle NSW.** Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys and tree surveys Assessment of sites, production of due diligence, Biodiversity Development Assessment Reports and Ecological Assessment Reports. Production of assessments against various legal instruments such as EPBC Act fauna and flora assessments, comprehensive Koala plans of management and SEPP 44 and SEPP Koala Habitat Protection assessments. Bushfire threat analysis and reporting. Competence in GIS mapping software.
Oct 2019 – February 2022	**Land Services Officer (Volunteer Coordinator) PT** **Hunter Local Land Services, Department Regional NSW.** Managing Volunteer program for Hunter region to improve natural resource condition.
Oct 2016- Oct 2019	**Ranger - Site Supervisor, Belmont Wetlands State Park, PT, Belmont NSW.** Leading and supervising paid staff and Volunteers for maintenance and environmental restoration tasks.
April 2009 – June 2011	**Landcare Project Coordinator, Glenelg Hopkins Catchment Management Authority, Warrnambool VIC.** Project managed a 3yr (Caring for Our Country) initiative for cross-property Sustainable Farm Practices-Woodlands Protection.
September 2007-June 2008.	**Department of Conservation New Zealand** **Biodiversity Threats Ranger (Pest Management) Tauranga.** Responsible for pest possum and stoat control program.
November 2003 – August 2008	**Northern Territory Parks and Wildlife Service, various locations.** **Park Ranger (T1,T2 and T3)** Monitoring threatened species, controlling pest plants and animals, undertaking controlled burning and maintaining visitor facilities.
January 2002 – June 2003	**Parks Victoria, various locations.** Seasonal Ranger
January 2001-December 2002.	**Frankston City Council, Mornington Peninsula, Victoria.** Natural Reserves team member

EDUCATION

1999 – 2001	**Bachelor of Park Management, Deakin University, Burwood, Victoria.** Natural resource management plus business management, wildlife ecology, fire ecology, extension marketing, community engagement and communications.
Feb 2021-December 2021	Certificate III Conservation and Land Management Tafe NSW Newcastle campus
	Supplementary training (select summary)
April 2023	Operate and maintain a chainsaw, LGTI, NSW
2004, 2008, 2018, 2020, 2021	Geographic Information Systems ArcGIS, MapInfo, QGIS various providers
May 2016-current	NSW Boat Driver's license Lake Macquarie Marine Rescue Services, Pelican NSW
2003, 2016, 2021	ChemCert Australia Chemical Users certificate

BONNI YARE

Curriculum Vitae

Bonni works with AEP in the role of Ecologist has a Bachelor of Science, majoring in Natural Resource Management. Bonni has experience in a variety of environmental work, in a professional and volunteer capacity, including flora, fauna and aquatic field surveys, reporting, GIS and mapping, habitat restoration and community volunteering.

Qualifications

- Bachelor of Science (Natural Resource Management) University of Newcastle, completed in November, 2020

Further Education & Training

- Bush Regeneration Training
- NSW Driver's Licence: Car (Class "C").
- Chemqual (RTO 70207)
- First Aid (Provide first aid HLTAID003)

Fields of Competence

- Ecological field surveys, covering terrestrial and aquatic flora and fauna
- Growing proficiency at botanical surveys

Relevant Employment History

2019 – Present **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2015 - 2016 **Green Army Participant**
Bush regeneration / supporting local land care groups

Supported local land care groups and reserve areas in weed removal and site restoration, including tree planting, seed collection and nursery work. Bird surveying and koala surveys were also carried out.

Relevant Ecological Experience

2018 - present **Field assistance**

Participated as a volunteer in various PhD and Honours projects with the University of Newcastle and University of Technology Sydney. I have experience with small mammal trapping for squirrel gliders, nest box construction, aquatic surveys, infaunal sampling and mark recapture population surveys for *Litoria aurea* (Green and Golden Bell Frog).

2019 **Undergraduate Research Project associated with NPWS**

Undertook flora and habitat surveys for a locally threatened orchid, *Diuris praecox*, supervised volunteers, data analysis and project write up.

2019 **Volunteer Botanical Training Program**
Australian National Herbarium

Understanding of Herbarium practices, including fieldwork, use of databases, maps and GPS, botanical terminology and up to date taxonomic information, curatorial experience including identification and processing of specimens.

2018 **Stream sampling using macroinvertebrates as bioindicators**
Newcastle Council

Contracted to finish stream sampling for the community program, Waterbug Blitz, which involved water quality testing of Newcastle's urban streams.

BYRON DE JAGER

Curriculum Vitae

Byron works with AEP in the role of Ecologist has a Bachelor of Science, majoring in Natural Resource Management. Byron has experience in a variety of environmental work, in a professional and volunteer capacity, including flora, and field surveys, reporting and mapping, habitat restoration and community volunteering.

Qualifications

- Certificate III Conservation and Land Management, Ryde TAFE 2017
- Bachelor of Science, Sustainable Resource Management (GPA 5.1)

  University of Newcastle

  Relevant courses: Australian Flora, Restoration Ecology, Land Management, Catchment and Water Resource Management, Environmental Legislation. 2011-2015

Further Education & Training

- Certificate II in Public Safety, through State Emergency Service (SES)
- Leadership fundamentals, SES
- Storm and Water Damage Operations, SES
- AQF3 Chemical user Certificate
- Chainsaw use statement of attainment: Feel small trees. Trim and cut felled trees
- First Aid Certificate, SES
- C-class Driver's License
- Cert IV Digital Media
- Cert II Office Applications for the Office TAFE Northern Sydney Institute

Relevant Employment History

October 2022- Present	**Ecologist** Anderson Environmental & Planning, Newcastle
October 2019-present	**Supervisor; Bush Regenerator** Toolijooa Hunter Valley Special Projects Division Supervisor
Mar – May 2014	**Bushcare, Blackwall Mountain Landcare**

Relevant Ecological Experience

Oct- Dec 2015 **Trees in Newcastle, Environmental Sector Placement**

- Researched more water and power efficient irrigation specifically suitable to upgrading the nursery.
- Created a guide to help improve the existing system and installing the most efficient system possible in the new site including budget information
- Wrote a five-page report and presented findings to the Board

Jun – Sept 2014 **Research assistant, Kooragang Island**.

- Assisted PhD Student with collecting data on frogs at night.
- Collected and identified frog species with careful hygiene and consideration to prevent transfer of pathogens
- Marked location using GPS releasing the frogs in the same place after tagging.

Jun- Aug 2016 **Hunter Water; Catchment Management department**

- Database management including data entry, graphing and interpretation
- Imported Data from Lab Data program to Excel
- Explore and interpret data using Excel using graphs tables and formulas
- Updated procedures to latest format and information.
- WH & Safety induction including appropriate PPE, Take 5, incident reporting
- Water sample collecting from various sites around the catchment including drinking water in various locations in the catchment, supply test points and wastewater areas affected by high volumes of stormwater
- Introduction to water supply network including catchments, pumping stations, drinking treatment plants, reservoirs, wastewater treatment plants and recycling or disposal systems
- Learned to navigate and understand GIS data regarding the network

Craig Anderson

Curriculum Vitae

An environmental professional with over 20 years experience providing high level ecological services, advice, strategic direction and management for sectors such as land development, infrastructure, conservation, government, legal, mining & quarrying.

Qualifications

- Bachelor of Applied Science (Environmental Assessment & Management) University of Newcastle, New South Wales (1994).
- Completing a Graduate Diploma in Archaeological Heritage through University of New England (one subject to complete).
- NSW Scientific Investigation Licence SL101313
- NSW Animal Research Authority
- NSW Accredited Biobanking Assessor No. 150
- NSW Biodiversity Accredited Assessor BAAS: 17002

Further Education & Training

- Biobank and Biocertification Assessors Training Course / BAAS Fast-track Accreditation Course
- Animal Ethics Training (University of Newcastle / NSW DPI)
- RFS / PIA NSW Consulting Planners Bushfire Training
- Bush Regeneration Training
- OH&S Induction Training / Green Card
- NSW Driver's Licence: Car (Class "C"). Experienced 4WD operator.
- Occupational Health & Safety Training, including legal compliance requirements of Officers (Standard 11 & S1,S2,S3).
- + various other vocational environmental and computer based training sessions.

Fields of Competence

- Production and peer review of detailed environmental impact assessment documentation. Author and

- / or Manager of hundreds of ecological / environmental / bushfire / historical heritage / archaeological heritage / strategic & statutory planning documents over nearly 25 years of environmental work

- Biobanking & Biodiversity Offset Commissions – initial scoping and feasibility, BAM impact assessments and BDAR reporting, biobank calculations, Stewardship site creation

- Detailed ecological field survey, covering all aspects of terrestrial and aquatic flora and fauna

- Expert witness legal representation

- Ecological Management Planning, ranging from individual species to full ecosystem management

- Project Management and delivery of complex projects, including projects worth more than $100M

- Project Management (including areas outside environmental sphere)

- Environmental Due Diligence processes for both asset procurement and divestment

- Management and co-ordination of teams producing EIA documentation

- Identification of strategic approval pathways and key project risk evaluation and management

- Extensive experience in conflict resolution, impact mediation and outcome negotiation on large scale and contentious projects

- Environmental peer review and ecological compliance auditing

- Project advocacy and representation with all levels of stakeholders

- Detailed knowledge of land and infrastructure development processes

Relevant Employment History

2013 – Present	**Director/Principal Consultant** Anderson Environment & Planning, Newcastle
2012- Present	**Director** Habitat Indoor/ Outdoor Living, Furniture, Homewares & Design, Newcastle.
2010-2012	**General Manager Sustainable Development** Coal Mining Company, Cockatoo Coal PtyLtd, Newcastle/Sydney/ Brisbane

2009 – 2010	**Independent Environmental Expert** Donaldson Conservation Trust
2010	**Principal- Environment** RPS, Development Consultants, Newcastle
2006-2009	**Manager Environment Group** RPS HSO, Development Consultants, Newcastle
2001-2006	**Manager Environment Group/ Director** Harper Somers O'Sullivan, Development Consultants, Newcastle
2000-2001	**Senior Ecologist & NSW Projects Manager** Wildthing Environmental Consultants, Salt Ash.
1996-1999	**Ecologist** Wildthing Environmental Consultants, Salt Ash.
1995-1996	**Ecologist/Environmental Officer** Pulver Cooper & Blackley, Engineers & Surveyors, Newcastle.
1995	**Environmental Officer/ Cadastral Survey Assistant** Kel Nagle Cooper & Associates, Golf Course Design & Construction,Newcastle.

Darcy Kilvert

Curriculum Vitae

Darcy works with AEP in the role of Ecologist. He graduated with a Bachelor of Science majoring in Biology. Darcy has worked as a Bush Regenerator for over 5 years and undertaken numerous volunteering projects in the environmental sector. These experiences have given him experience in flora & fauna identification, surveying, reporting, mapping, and ecological restoration

Qualifications

- Bachelor of Science (Biology), The University of Newcastle, completed in September 2021

Further Education & Training

- Class C NSW Driver's Licence
- NSW Construction White Card
- Working at Heights
- Chemcert and EPA ground applicator licence
- Apply First Aid

Fields of Competence

- Flora & fauna surveying both terrestrial and aquatic
- Growing proficiency in botanical surveys
- Adept experience in operating 4x4 vehicles

Relevant Employment History

2021 – Present — **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation.

2018 - 2021 — **Senior Field Supervisor**
Traditional Aussie Gardens, Newcastle

2015 - 2017 — **Field Worker**
Newcastle City Council, Newcastle

Ian Benson

Curriculum Vitae

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

Qualifications

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

Further Education & Training

- Biodiversity Accredited Assessor System (BAAS 18147)
- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence. Experienced 4WD operator
- Occupational Health & Safety Training
- Remoted Piloted Aircraft Excluded Category Training with Aviassist Pty Ltd
- Rail Industry Worker
- ARTC Safety Induction for Contractors (NSW)
- ARTC Hunter Bulk Terminal Induction

Fields of Competence

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

Relevant Employment History

2022 – Present — **Director & Principal Ecologist**
Anderson Environment & Planning, Newcastle

Ian is a Director of Anderson Environment & Planning whilst continuing in the role of Principal Ecologist overseeing a team of approx. 35 professional ecology staff and all aspects of the business including training and management of field and office staff undertaking ecology and bushfire works to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2019 – 2022 — **Principal Ecologist**
Anderson Environment & Planning, Newcastle

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

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

2012 – 2016 — **Project Manager**
Douglas Partners, Newcastle

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

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

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

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

2017-Current — **Birddata Moderator**
BirdLife Australia

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

Key Project Experience

- Targeted surveys for *Dichanthium setosum* in Glen Innes Region;
- Target surveys for Eucalyptus cannonii, Western Rail Coal Unloader, Pipers Flat;
- White-bellied Sea-Eagle nest locating and monitoring Glenning Valley and Chisholm;
- Powerful Owl nest locating and monitoring: Salamander Bay, Soldiers Point, Anna Bay North, Wallsend, Cameron Park and Edgeworth;
- Accredited Assessor for approved Biodiversity Development Assessment Reports:
    - Berkeley Vale Road, Glenning Valley;
    - Railway Road, Warnervale;
    - Barden Ridge Townhouses;
    - McFarlane's Road, Chisholm;
    - Fairlands Road, Medowie;
    - Rosella Rise, Warnervale;
    - Carr's Road, Neath;
    - Jack Grant Avenue, Warnervale;
    - Minnesota Road, Hamlyn Terrace;
    - Bellbird North;
    - Waterford, Chisholm;
- Ecological Assessment Report for Proposed Modification To Approved Western Rail Coal Unloader At Pipers Flat;
- Spot Analysis Techniques surveys: Nelsons Plains, Wallsend, Anna Bay, Boat Harbour, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Kincumber, Palmdale, Wyee, Charlestown, Chisholm, Gillieston Heights, Mount Vincent, Radford Park, Cessnock
- Infrastructure;
    - Gwandalan Recycled Water Main;
    - Lower Belford Water Main;
    - Raymond Terrace Rising Main;
    - Astra Street Landfill Rehabilitation Assessment;
- Cat Tracker Pilot Program Associated With The Hunter Estuary Wetlands for Hunter Local Land Services;
- Surveys for Squirrel Glider (*Petaurus norfolcensis*) Warnervale Area June 2020

- Biodiversity Stewardship Agreements including:
    - • Bobs Farm (approved);
    - • Cedar Brush Creek (ready for signing);
    - • Girvan (final assessment);
    - • Mardi (under assessment);
    - • Wallsend (report being drafted);
    - • Ellalong (report being drafted);
    - • Blueys Beach (surveys continuing);
    - • South-West Rocks (surveys continuing).

Kelly Drysdale

Curriculum Vitae

Kelly works with AEP in the role of Ecology Project Manager. She has extensive experience in various land management operations in several regions, with both small and large enterprises, in Australia and internationally. Her strong environmental stewardship knowledge, lateral thinking, project and change management, business development, strategic planning and human resource management skills are adding value to the AEP team.

Qualifications

- Certificate IV in Training and Assessment TAE40110, TAFE Hunter Institute, NSW 2016
- Graduate Certificate in Business Administration (with honours), Newcastle University, Newcastle, NSW 2013
- Associate Diploma of Applied Science (VITICULTURE), Charles Sturt University, Wagga Wagga, NSW 1992

Further Education & Training

- Australian Rural Leadership Foundation Program, Fellow 2011
- Class C NSW Drivers Licence Class, Defensive Driving, FL & experienced 4WD operator
- First Aid Certificate inc CPR 2021
- SafeWork NSW Construction White Card CGI1713214SEQ01
- Farm Chemical User Accreditation Certificate III (ChemCert Australia)
- Negotiation skills (Rogen International), Crucial conversations (ME Consulting)
- Media Training (Doyle Media Services)
- Various WHS management training, legislation and compliance courses, EEO, cultural competency and diversity in the workplace
- Workplace Trainer and Workplace Assessor
- Open Water PADI Dive Certificate

Fields of Competence

- Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys, tree surveys, HBT and nest box inspections.
- Assessment of sites using the Biodiversity Assessment Method (BAM) under the Biodiversity Offsets Scheme, production of Biodiversity Development Assessment Reports and Ecological Assessment Reports
- Production of assessments against various legal instruments such as EPBC Act fauna and flora assessments, State Environmental Planning Policy Biodiversity and Conservation) 2021 – Chapter 4 Koala Habitat Protection 2021, State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management, Water Management Act 2000 and the Environment Protection and Biodiversity Conservation Act 1999
- Bushfire threat analysis and reporting
- Liaison with clients/site/company/government representatives

Relevant Employment History

Feb 2021- Current **Ecology Project Manager**- Anderson Environment & Planning, Newcastle, NSW

Assisting in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

Aug 2019 - July 2021 **Business Development Manager** - RLF

Business development and strategic targeting of corporate and larger enterprises leveraging a vast network of contacts in the Australian Wine Industry and Agricultural sector to add value to farming systems with agronomic and fertiliser solutions.

Jul 2015 - Aug 2019 **Viticultural & Trade Resource Manager**- Hope Estate, Pokolbin, NSW

Operational and strategic management of five estate owned vineyards in NSW, WA & VIC. CRM & BDM of wine and beer portfolio of on/off premise sales on >1,800 customer base with PR responsibilities and hosting of events.

Jul 2017 - Aug 2019 **Casual teacher in Viticulture & Wine** - Kurri Kurri Tafe NSW

Revising, formulating and developing resources for and delivering all units of competency in the AHC51516 Diploma of Viticulture and strengthening relationships within the Hunter wine region.

Jul 2014 – July 2015 **Sales Acquisition Agent** – Wine Selectors & Choice, NSW

Wine appraisals, wine sales, developing staff training manuals, exceeding sales targets.

Jan 2004 - May 2010 **Viticultural Manager** – Casella Family Brands, Yenda NSW

Primarily responsible for the effective and efficient viticultural, land management operations and programs reporting to the company directors on 1,800ha with up to 160 staff. Primarily viticulture but also managed a large prune/plum orchard, broad acre cropping-dry and pivot, cattle, biodiversity tree planting program, compost making, winery waste water treatment plant and traded water.

June 2002 - Jan 2004 **Viticulturist** - Brown Brothers**,** Milawa VIC

Grower liaison for 84 growers and 5 diverse company owned vineyards; strategic plan development, asset assessments and evaluations.

June 2001 - June 2002 **One-year overseas travel - study/work tour**

Studied wine and agricultural markets in Asia and London, travelled through Italy, Switzerland and Spain's wine regions and worked vintage periods in Portugal, France and mostly in South Africa- Flagstone Wines, Cape Town, sourcing fruit from 48 vineyards across the Western Cape.

May 2000 - June 2001 **Viticultural Projects Manager** – Nepenthe**,** Adelaide Hills

Viticultural consultancy, contract management, development and management of investment projects, costing systems, reporting and management protocols.

Jan 1998 - May 2000 **General Manager –** Pertaringa Wines, McLaren Vale, SA

Strategic operational and financial planning for company land portfolio and brand development, including contract management for clients and winery liaison with 15 customer wineries.

Dec 1992 - Jan 1998 **Viticulturist** –Southcorp Wines, SA

Grower Liaison in McLaren Vale, Technical Officer in Barossa/Clare/Adelaide Hills and Riverland, Greenfield Vineyard Development in Barooga and Robe, and Vine Propagation Manager for the group successively.

1993 - Vintages **Cellar hand** - Murphy-Goode Estate Winery- Alexander Valley, California USA and Willamette Valley Vineyards- Willamette Valley, Oregon USA and CSUR, Wagga Wagga, NSW

KIERAN GIFFEN

Curriculum Vitae

Qualifications

- Certificate III Mechanical Trade – Hunter Valley Training Company
- Certificate IV Engineering Fluid Power – Hunter Tafe, Newcastle
- Certificate II Conservation and Eco systems expected finish 2022 – Tafe Digital

Further Education & Training

- First Aid and Resuscitation
- NSW SafeWork Certification White Card
- AQF3 Chemical and Pesticide applicator
- Certification of explosion protected Diesel engine system maintenance
- Trained to carry out pre- and post- checks on company fleet, assets and infrastructure

Ecological Field Experience

- Experienced in garden maintenance, planting, weeding, fertilization and pest eradication.
- Trained in safely working with containing and disposing of hazardous materials and chemicals.
- Sustainability minded and passionate about the environment and the effects my work and industry have upon it.
- Proficient in working safely and following OHS policies and procedures.
- Proficient in safety checks, shift reporting, incident reports, risk assessments and pre and post job documentation.

Relevant Employment Experience

Aug 2022 **Ecologist**
Anderson Environment and Planning, Newcastle

2021 – Aug 2022 **Geotechnician**
Coffey Testing Construction materials testing services
Working independently, as a team and alongside contractors in the collection, speciality testing, calculating and evaluating of aggregate, concrete and soil samples and delivering tailored results through documentation to fulfill client's specific requirements.

2016 – 2017 **Landscape Labourer and Machine operator**
Moss Boss Studios Design and Construction

Working independently and as a team to design, create and construct high – end landscapes, gardens and custom interior and exterior spaces. Maintenance of gardens, plant and moss walls as well as fertilization, pest control and weed eradication. Skilled in drainage, retaining walls, and garden edges, concreting, brickwork, pathways, and timber construction as well as planting and mulching. Medium rigid tipper, excavator and posi – track skid steer loader operator.

NAOMI STACKHOUSE

Curriculum Vitae

Naomi works with AEP in the role of Ecologist. She is in the process of completing a Bachelor of Science Advanced, majoring in Ecology, Biodiversity and Conservation Science. Naomi has worked in various roles unrelated to the science field over the past 7 years. She has worked at AEP since November 2021, and in addition to this, she has undertaken numerous volunteering projects in the environmental sector. She has experience with the Australian Wildlife Conservancy, and is a current volunteer at Hunter Wildlife Rescue. These experiences have given her experience in wildlife handling, data management, report writing, ecological surveys, flora & fauna identification, reporting and ecological restoration.

Qualifications

- Bachelor of Science (Advanced), Ecology, Conservation and Biodiversity Major. University of Newcastle, due for completion in June 2023.

Further Education and Training

- Class C NSW Driver's Licence
- Animal Handling and Rescue Certificate (NATF)
- General First Aid + CPR
- Introduction to Temperate Marine Biology (UTAS)

Fields of Competence

- Flora & fauna surveying both terrestrial and aquatic environments
- Growing proficiency in botanical surveys
- High proficiency in written and verbal communication skills
- Wildlife handling experience
- Gaining skill in document control and Environmental legislation at a local and state level.
- Data management and the use of Excel and Word.

Relevant Employment

2021 - Present **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation.

2022 **Wildlife Rescue and Transport**
Hunter Wildlife Rescue

2021 **Volunteer Field Assistant**
Australian Wildlife Conservancy

2020-2021 **Fieldwork Research Assistant**
Newcastle University

Natalie Black

Curriculum Vitae

Natalie works with AEP in the role of Senior Environmental Manager. She has extensive knowledge in environmental management, environmental planning, and report writing and assessment. With a detail understanding of planning, catchment management, coastal management and rehabilitation. Natalie has had a successful career with both state and local government in conservation, planning and field investigation roles. Natalie has also gained extensive communication skills and project management through her previous career in lecturing. Her background and experience in the ecological and planning fields is utilised in a diverse array of application in her current role.

Qualifications

- B.Sc (Hons), University of Newcastle, 2002 Sustainable Resource Management and Marine Science.
- Master Planning, University of Technology Sydney 2007.
- Certificate IV Training and Assessment at NSW TAFE 2012.
- BAM Assessor; accreditation number: BAAS19076.

Further Education & Training

- Evidence Gathering and Legal Process (Australian Institute of Environmental Health).
- Conflict Resolution Course (LGSA).
- Report Writing Course (LGSA).
- Powerful Presentation (LGSA).
- NSW Rural Fire Services Bush Fire Assessment
- Relocation of Threatened Species (Botanical Gardens Sydney).
- Sustainable Home Assessment Reduction Revolution.
- Flora and Fauna Survey Assessments Niche Environment and Heritage.
- First Aid TAFE.

Fields of Competence

- Environmental Planning
- Environmental Management and rehabilitation of catchments coastal waterways. Statement of Environmental Effects (preparation and assessing).
- Fish Passage
- Marine ecosystems including; mangroves, seagrasses, algae, Fauna and habitat assessment.
- vegetation.
- Communicating with a wide range of stakeholders.
- Development Application.
- Education in both Environmental and Planning industries.
- Koala Plans of Management.
- Policy Development.

Relevant Employment History

2019 – Present	**Senior Environmental Manager**
	Anderson Environment & Planning, Newcastle
2010 - 2019	**Principal Environmental Planner**
	Black Earth
2003-2010	**Natural Resource Manager and**
	Development Assessment Officer
	Lismore City
2002- 2003	**Jervis Bay Indigenous Fishing Strategy**

Samuel V. Rayfield

Curriculum Vitae

Samuel works with AEP in the role of Ecologist. He graduated with a Bachelor of Communication and is working towards completion of a Diploma in Conservation and Ecosystems Management. Samuel has previously worked in ecological restoration and land management before coming to AEP. Samuel has experience in a variety of environmental work, both paid and unpaid, including flora and fauna terrestrial and aquatic field surveys, weed management, reporting, GIS and mapping and habitat restoration. His background in ecological surveying projects and growing flora knowledge and experience is utilised in a diverse array of applications in his current role.

Qualifications

- Working at Heights Certificate
- First Aid & CPR Cert – HLTAID003
- Driver Licence – Class C, unrestricted
- National Police Check
- Working with Children Check

Further Education & Training

2020	**Introduction to Anatomy & Physiology; Individual Determinants of Health** Latrobe University
2017	**Diploma in Conservation and Land Management** Hunter TAFE – partial completion
2012 –2016	**Bachelor of Communication** University of Newcastle

Relevant Employment History

2022 – Present	**Ecologist** Anderson Environment and Planning, Newcastle
2020	**Bush Regenerator** Litoria Ecological Restoration Services
2018 – 2020	**Bush Regenerator** Toolijooa Environmental Restoration
2016 – 2017	**Bush Regenerator** Newcastle City Council

SIMON PURCELL
Curriculum Vitae

Simon works with AEP in the role of Senior Ecologist. Simon has over 7 years of professional experience managing projects in the fields of terrestrial ecology, mining and mine rehabilitation and environmental management.

Qualifications

- Bachelor of Applied Science, Major Wildlife Science, University of Queensland Gatton 2013
- Certificate III in Animal Care and Management, Companion Animal Services (2008)

Further Education & Training

- NSW Class C Driver's Licence

Fields of Competence

- Terrestrial Ecology field survey, covering terrestrial flora and fauna
- Project Management

Relevant Employment History

2020 (November) -present **Senior Ecologist**
Anderson Environment & Planning, Newcastle

- Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2018-2019 **Team Leader / Ecologist**
Ecotone Flora Fauna Consultants, Weipa, QLD

- Conducted client liaison meetings, providing ecological advice and recommendations for flora, fauna and land management, complying with Queensland state and Commonwealth environmental legislation.
- Wrote proposal and executed surveys for Prefeasibility studies and EIS on Western Cape York for multi-national mining company complying with Commonwealth environmental legislation.
- Negotiated increases to budget and survey requirements with the client in relation to ongoing changes and project requirements
- Led high level discussions with the client to provide new services.
- Developed wide scale camera monitoring program to assess presence /absence of EVNT fauna within the survey site.
- Complex logistical planning for remote work
- Co-developed and implemented new safety system within the business

- Mentored project managers through training, and leadership guidance to ensure quality and standards of business were met
- Managed human relation matters within the business
- Digitally transformed infield data collection through roll out of ArcGIS Collector, leading to the reduction in the use of paper in the field.

2014-2018 **Team Leader / Ecologist**
Ecotone Flora Fauna Consultants, Weipa, QLD

- Lead project manager (6 years) for all aspects of mine / drill preclearing environmental surveys across three different mine sites and exploratory sites, including during the construction phase of a new mine in the Weipa region.
- Project managed and participated in numerous annual EVNT projects that led to cultural and process practices changing within a multinational mining company.
- Played a critical role in maintaining client and stakeholder relationships and built stability with onsite leadership to further grow business opportunities.
- Maintained client confidentiality on sensitive and impactful projects.
- Ensured all projects complied with Queensland state and Commonwealth environmental legislation and clients Environmental Authority.
- Assisted in the development of growth and innovation projects such as cloud-based document storage solution to support multi-site users.

2013-2014 **Field Technician / Ecologist**
Ecotone Flora Fauna Consultants, Weipa, QLD

- Pre-clear flora and fauna mining and drilling programs
- Baseline fauna surveys of future mining areas
- Sensitive vegetation ground truthing
- EVNT flora and fauna surveys
- Seed Processing (storing, drying management of inventory)
- Mixing of seed in preparation for annual rehabilitation season

2010-2012 **Mine Operator and Trainer**
Rio Tinto, Weipa, QLD

- Acted as Crew Leader to manage 30 mine operators, production targets and minimising environmental impacts
- Skilled Caterpillar 992G, 993K & Komatsu WA900 Loader and 776D, 777F and 785C Caterpillar haul truck operator
- Crew Trainer/Assessor - completed five certificate IV modules to Training and Assessing.

2009 - 2010 **Parks and Garden Maintainer**
Spotless Group, Weipa, QLD

- Attained six competencies towards Certificate III Forest Growing and Management.
- Maintained local green spaces and houses.

2009-2009 **Vet Nurse**
Tableland Veterinary Service, Weipa, QLD

- Prepared surgery for surgeries including use of autoclave to sterilise implements
- Administered sedation via injections in the muscle and intravenously
- Prepared and monitored animals before, during and after surgeries
- Monitored animal and anaesthetic during surgery focussing on breath rate, colour of gum and pupil movements
- Took blood samples from veins and prepared samples of foreign bodies for analysis
- Successfully directed and carried out on-call emergency cases with vet assistance over the phone

2003 – 2009 **Manager**
The Pet Centre, Sydney, NSW

2001 – 2003 **Sales Assistant**
The Pet Centre, Sydney, NSW

- Implemented standard procedures for staff to follow
- Focussed on achieving a high level of OHS standards within the store
- Responsible for daily takings up to five thousand dollars per day
- Accountable for people management including rosters, recruitment and managing employee issues
- Responsible for management of store inventory
- Developed skills in handling a range of domestic animals
- Maintained animal's health and welfare in store and complied with state laws and regulations
- Analysed store's and customer's aquarium water quality
- Developed sound knowledge of animals including their origin, identification and general requirements

Relevant Volunteer Experience

2012 **Fauna Spotter / Field Assistant**
Humble Bee Films

- Volunteered as a fauna spotter/field assistant with Dr Brad Purcell and Humble Bee Films in a ten day research camp, during the production of the natural history documentary "Dingo".

2012 **Volunteer Ecological Field Assistant**
Rio Tinto, Weipa, QLD

- Participated in an ethno-botanical workshop with Rio Tinto Alcan Land and Rehabilitation team.
- Participated as a field technician during pre-mining survey work. The work included assessing flora and the land formations to identify buffer zones for natural drainage systems and sensitive areas in the Andoom mine site Weipa.

2012 **Fauna Technician**
Brad Purcell PhD,
Greater Blue Mountains World Heritage Area

- Field technician for Brad Purcell during his doctoral research project on dingoes in the Greater Blue Mountains World Heritage Area. Developed skills in use of VHF radio tracking to retrieve collars, triangulation method to determine positioning of dingoes or deployed collars and traversing bushland.

Tim Moulton

Curriculum Vitae

Tim works with AEP in the role of Ecologist. Tim has over 10 years of professional experience managing projects in the fields of ecology, natural area restoration, biodiversity conservation, community education, and construction environmental management. Tim also has 5 years experience working in the field as a bush regenerator.

Qualifications

- Bachelor of Environmental Science University of Newcastle (2001)
- Conservation Land Management Certificate II Tafe (2003)
- Master of Environmental Science Southern Cross University (2008)

Further Education & Training

- Biodiversity Assessment Methodology (BAM) Accredited Assessor (BAAS: 19083)
- NSW Class C Driver's Licence. Experienced 4WD operator.
- OH&S NSW White Card
- Erosion & Sediment Control Training (4 day Blue Book course / CPESC)
- Feral Animal Control training (1080 & Pindone baiting)
- Certificate 3 in Chemical Application (AQF3)

Fields of Competence

- Ecological field survey, covering terrestrial and aquatic flora and fauna
- Highly proficient at botanical surveys and establishing monitoring programs
- Project Management and auditing
- Restoration Science

Relevant Employment History

2019 - present **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2015 - 2018 **Senior Project Officer / Ecologist**
Conservation Volunteers Australia / WetlandCare Australia

- Project managing on-ground restoration works including revegetation, site stabilisation, weed control and bush regeneration.
- Facilitating community engagement events, and supervision of volunteers.

- Undertaking site assessments, ecological surveys, and preparing plans of management.
- Scoping and preparing grant applications, managing all aspects of grant delivery, budgets, and reporting.

2009 - 2015 **Senior Ecologist / Environmental Scientist**
Onsite Environmental Management

- Undertaking and project managing detailed environmental assessments including flora and fauna surveys, threatened species assessments, management plans and monitoring reports.
- Environmental site management, monitoring and compliance auditing on large scale infrastructure projects and extractive industries.

2008 - 2009 **Bush Regenerator / Leading Hand**
Lane Cove Council, Australian Wetlands

- Undertaking bush regeneration activities including removal of environmental/noxious weeds, track construction and maintenance, native seed collection and propagation, fire assisted regeneration, feral animal control and supervision and training of volunteers.
- Supervising bush regeneration and weed management teams.
- Undertaking large scale revegetation works on infrastructure projects involving mass tubestock planting, site stabilisation and maintenance weeding.

2006 - 2007 **Ecologist / Environmental Scientist**
GeoLINK Consulting

- Undertaking and project managing detailed environmental assessments including flora and fauna surveys, threatened species assessments, management plans and monitoring reports.
- Monitoring and analysis of wetland, groundwater, and domestic wastewater systems.

2002 - 2006 **Bush Regenerator / Leading Hand**
Gondwana Bush Restoration, Willoughby City Council

- Undertaking bush regeneration activities including removal of environmental/noxious weeds, track construction and maintenance, native seed collection and propagation, fire assisted regeneration, feral animal control and translocation of vegetation.
- Supervision and training of bush regeneration teams and volunteers.

2001 - 2002 **John Holland Construction**
Environmental Officer

- Environmental site management and monitoring and reporting on large scale infrastructure projects.

Relevant Volunteer Experience

2014 - CurrentBurwood Beach Coastcare - Facilitator (Volunteer)

Supporting and managing volunteers, on-ground works, promotion and funding opportunities on a monthly basis, to undertake conservation and restoration activities within Glenrock State Conservation Area (NPWS estate).

2013 - 2016 Humane Society International – EPBC Act Nomination Support

Preparation of Threatened Ecological Community (TEC) nominations under the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act).

Oscar Anderson

Curriculum Vitae

Oscar works with AEP in the role of Ecologist. He intends to graduate with a Bachelor of Environmental Science and Management, majoring in sustainability. Oscar has previously worked in bush regeneration and arborist work before coming to AEP. His background in ecological surveying projects and growing flora and fauna knowledge and experience is utilised in a diverse array of applications in his current role.

Qualifications

- High School Diploma
- First Aid/CPR

Further Education & Training

- Environmental Science and Management, University of Newcastle
- High School Diploma, Whitefriars College

Fields of Competence

- Flora and fauna surveys;
- Habitat assessment fieldwork;
- Targets threatened species surveys;
- Ecological restoration undertaking vegetation and habitat improvement works;
- Fauna spotting, catching ad release during vegetation clearance works;
- Plant identification;
- Data review and management;
- Writing of reports within the scope of ecological and bushfire assessment, council condition compliance letters;
- Ecological monitoring equipment installation and maintenance;
- General upkeep of field and safety equipment;
- Operation of all-terrain vehicle;
- General admin including report writing and email communication;
- First Aid/CPR
- Environmental Remediation
- Impact assessments
- Ground Maintenance

Relevant Employment History

2022 – Present	**Ecologist** Anderson Environment & Planning, Newcastle
2021-Present	**Affordable Tree Works** Tree Service Groundsman Newcastle, NSW