

71 Fig Hill Lane, Dunmore

Biodiversity Development Assessment Report

Nordon Jago Architects

10 October 2019

Final



Report No. 17231RP3

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Approved by:	
Position:	Director
Signed:	
Date:	10 October, 2019

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Glossary

AOBV	Area of Outstanding Biodiversity Value
Assessment area	Area of land within a 1500 m buffer around the outer boundary of the subject land
BAM	Biodiversity Assessment Method
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
Coastal Management SEPP	State Environmental Planning Policy (Coastal Management) 2018
DoEE	Commonwealth Department of the Environment and Energy
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
NSW	New South Wales
MNES	Matters of National Environmental Significance
PCT	Plant Community Type
the Project	The proposed construction of an eco-tourism development, landscaping and associated APZ
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
Subject land	The land proposed as a development site (see Figure 1)
Subject property	The lot within which the development is proposed to occur, known as 71 Fig Hill Lane, Dunmore and Lot 3 DP 717776 (see Figure 1)
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community

Executive Summary

S1 Introduction

Cumberland Ecology was commissioned by Nordon Jago Architects, on behalf of Contract Properties Pty Ltd & The Trustee for Peterson Family Trust (the 'client'), to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed development at 71 Fig Hill Lane, Dunmore New South Wales (NSW) (the 'Project'). The Project involves the demolition of an existing derelict building and construction of an eco-tourism development.

This BDAR will form part of the required documentation to support an application for Local Development Consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Under the NSW *Biodiversity Conservation Act 2016* (BC Act), all development that requires development consent under Part 4 of the EP&A Act that exceeds the Biodiversity Offset Scheme (BOS) thresholds, as set out in Section 7.2 and 7.3 of the NSW *Biodiversity Conservation Regulation 2017*, or is triggered by a 'test of significance' must be assessed using the Biodiversity Assessment Method (BAM) with the results presented in a BDAR. Due to the location of the proposed development and the proximity to a Coastal Wetland (downslope from the proposed development), mapped under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP), the Project has been determined to have the potential to have a significant impact on the nearby Coastal Wetland and associated Threatened Ecological Communities (TECs), if indirect impacts of the Project are not appropriately managed. As a result, a BDAR has been prepared on a precautionary basis.

The purpose of this BDAR is to document the findings of an assessment undertaken for the Project in accordance with requirements for Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM.

S2 Background

The Project is located in the north-western corner of Lot 3 DP 717776, also known as 71 Fig Hill Lane, Dunmore NSW (the 'subject property'), covering an area of approximately 2.6 ha (hereafter referred to as the 'subject land'). The subject land is generally bounded by residential properties and grassland to the north and west, and by existing native woody vegetation to the south and east. Most of the subject land is mapped as RU2 – Rural Landscape, with the south-eastern parts of the site mapped as E3 – Environmental Management, under the Shellharbour Local Environment Plan (LEP) 2013.

The wider subject property stretches out to the east and south of the subject land. The subject property is mostly comprised of a Coastal Wetland mapped under the Coastal Management SEPP. It is bounded by the Minnamurra River to the south, south-west, and east. A large portion of the subject property is also mapped as part of the Minnamurra River Estuary.

The Project involves the construction of an eco-tourism resort that will include the creation of one central building, which occupies the footprint of the existing dwelling, and three attached 'satellite clifftop lodges' that radiate out from the main building and will be linked via footpath. The Project also includes establishment of associated Asset Protection Zones (APZs) for bushfire protection and landscaping to improve aesthetic values around the proposed built landscape. In summary, the Project will include the following components:

- Approval for demolition of the existing derelict building;
- Construction of four buildings (one central building and three clifftop lodges);
- Establishment of landscape elements surrounding the resort including turfed areas, boundary plantings, and garden beds; and
- Establishment of associated APZs.

S3 Landscape Features

As the Project is being assessed as a site-based project, the assessment area comprised the area of land within a 1,500 m buffer around the outer boundary of the subject land. A summary of the landscape features identified within the assessment area are detailed below:

- Native vegetation covers approximately 41% of the assessment area;
- Category 1-6 streams have been identified within the assessment area, including the Minnamurra River. No streams occur within the subject land;
- The Minnamurra Estuary, which is a Nationally Important Wetland as well as a Coastal Wetland mapped under the Coastal Management SEPP, occurs downslope to the south of the subject land;
- The most eastern portion of the subject land is mapped as being part of the Illawarra Regional Biodiversity Corridor;
- No karsts, caves, crevices, cliffs or areas of geological significance were identified within the assessment area; and
- No Areas of Outstanding Biodiversity Value were identified within the assessment area.

S4 Native Vegetation

The subject land has been subject to detailed surveys by Cumberland Ecology for the purpose of this BDAR. Vegetation surveys included vegetation mapping, identification of Plant Community Types (PCTs), completion of four BAM plots, targeted threatened flora searches, targeted threatened bird surveys, as well as assessment of vegetation patches against the Final Determinations for Threatened Ecological Communities (TECs) with potential to occur.

Native vegetation occupies approximately 17% of the subject land, and includes two PCTs:

- PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion; and
- PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion.

The remaining subject land comprises exotic grassland, exotic vegetation and cleared land associated with the previous development.

PCT 838 occurs in the subject land in two broad condition states, referred to here as Illawarra Lowlands Grassy Woodland and Acacia Regrowth. Only the Illawarra Lowlands Grassy Woodland conforms to a TEC under the

BC Act, namely the Endangered Ecological Community (EEC) Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion. PCT 1300 occurs in one broad condition state and is considered to conform to the TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion, which is listed as an EEC under the BC Act.

S5 Threatened Species

The BAM Calculator generates a list of threatened species requiring assessment by utilising a number of variables. The predicted ecosystem credit species for the three vegetation zones within the subject land produced a list of 31 ecosystem credit species and 35 species credit species. No ecosystem credit species were removed from further assessment. Of the 35 species credit species identified by the BAM Calculator, 26 were removed from further assessment as they were considered unlikely to occur. Targeted surveys were undertaken for all remaining species credit species, except the Southern Myotis, due to the timing of the Project not aligning with the suitable survey months for this species.

No threatened flora or fauna were recorded during targeted field surveys. Nevertheless, as surveys could not be undertaken for the Southern Myotis, the species was assumed to be present within a small part of the subject land due to potential suitable forest habitat occurring within the southwestern portion of the site. A species polygon was subsequently created for the Southern Myotis.

S6 Prescribed Impacts

The Project is considered to have the potential to result in the following prescribed impacts:

- Impacts of the development on habitat associated with human-made structures;
- Impacts of the development on habitat associated with non-native vegetation;
- Impacts of the development on the connectivity of different areas of habitat that facilitates movement across a species' range;
- Impacts of the development on movement of threatened species that maintains their life cycle; and
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and

S7 Avoid and Minimise Impacts

A number of measures to avoid and minimise the potential impacts of the development have been applied during the design process. The development footprint is positioned over an area within the subject property containing the lowest biodiversity values, consisting predominantly of the existing derelict dwelling, cleared areas, exotic grassland/weedy areas and areas comprising scattered *Acacia* regrowth. In doing so, the Project entails consideration of the biodiversity values of the vegetation within the subject property and has demonstrated reasonable steps to avoid and minimise impacts based up on the Project location within the relatively cleared and modified habitats of the subject land.

The Project design has been developed to avoid and minimise clearing of native vegetation and habitats by minimising the clearing footprint to include only the operational footprint and the APZ, which contains the entire construction footprint. All ancillary works for stormwater and wastewater management will be contained within the subject land.

Furthermore, the Project will include as an additional design component the retention of the remaining native vegetation and habitat within most of the remainder of the subject property. The retained vegetation will be managed and protected under a Biodiversity Stewardship Agreement, whilst offering opportunities for walking tracks to be incorporated as part of the eco-tourism Project.

Direct impacts to the mapped Coastal Wetland in the subject property have been completely avoided.

S8 Impact Assessment

S8.1 Direct Impacts

The proposed development will result in the removal of small areas of Illawarra Lowlands Grassy Woodland and Illawarra Subtropical Rainforest TECs, as well as areas of Acacia regrowth, for the construction of the eco-tourism resort, APZ and ancillary works. More extensive and higher quality examples of these TECs occur in the land proposed for conservation under the Stewardship Agreement.

Approximately 0.28 ha of the 0.80 ha of PCT 838 in the subject property, and 0.17 ha of the 1.46 ha of PCT 1300, will be removed under the proposed development. All other native vegetation within the subject property will be retained.

Only one hollow-bearing tree occur within the subject land; an exotic fig tree located adjacent to the existing driveway on the western boundary of the site. All other existing potential habitat features within the subject land is comprised of cracks and ceiling gaps within human-made structures, and wooden rubbish piles in association with the derelict building.

The Project will result in the loss of all habitat features within the subject land apart from the exotic fig tree with hollows, which will be retained as part of the design. Overall, the removal of these habitat features is considered to have only minor implications for fauna species due to the modified and degraded ecological context they are within and the high mobility of the species likely to utilise these habitats.

S8.2 Indirect Impacts

The following indirect impacts to native vegetation and habitat may occur as a result of the Project:

- Inadvertent impacts on adjacent habitat or vegetation;
- Reduced viability of adjacent habitat due to edge effects;
- Reduced viability of adjacent habitat due to noise, dust or light spill;
- Increased sedimentation and erosion; and
- Inadvertent impacts associated with wastewater disposal.

S9 Mitigation Measures

The following measures will be undertaken to mitigate impacts to native vegetation and habitat prior to and during construction, and during the lifetime of the Project:

- Construction Mitigation Measures, including:
 - Delineation of clearing areas;

- Pre-clearance surveys;
- Weed management; and
- Stormwater run-off, sediment and erosion control.
- Wastewater Management System.

S10 Offset Liability

As the Project includes the removal of some areas of native vegetation, offsets are required in the form of ecosystem credits. This assessment indicates that the removal of the native vegetation within the subject land requires a total of 3 ecosystem credits, comprising of PCT 838 and PCT 1300. These credits are available from within the balance of the property, which contains high quality remnants of the TECs to be offset.

In the absence of fauna surveys for the Southern Myotis, the species have been assumed present in accordance with the BAM, due to the presence of potential habitat, and will therefore need to be offset with species credits. This assessment indicates that the potential impacts on the Southern Myotis requires a total of 2 species credits.

S11 Conclusion

With the implementation of the proposed mitigation measures and the offsetting of biodiversity credits, it is considered that the impacts of this Project on biodiversity, in particular on TECs and threatened fauna habitat, will be minimal and can be appropriately managed.

Furthermore, it is proposed that most of the remainder of the subject property including the Coastal Wetland will be conserved and managed in perpetuity under a Biodiversity Stewardship Agreement.

1. Introduction

Cumberland Ecology was commissioned by Nordon Jago Architects, on behalf of Contract Properties Pty Ltd & The Trustee for Peterson Family Trust (the 'client'), to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed development at 71 Fig Hill Lane, Dunmore New South Wales (NSW) (the 'Project'). The Project involves the demolition of an existing derelict building and construction of an eco-tourism development. This BDAR will form part of the required documentation to support an application for Local Development Consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1. Requirement for BDAR

Under the NSW *Biodiversity Conservation Act 2016* (BC Act), all development that requires development consent under Part 4 of the EP&A Act that exceeds the Biodiversity Offset Scheme (BOS) thresholds, as set out in Section 7.2 and 7.3 of the NSW *Biodiversity Conservation Regulation 2017*, or is triggered by a 'test of significance' must be assessed using the Biodiversity Assessment Method (BAM) with the results presented in a BDAR.

The proposed development does not exceed either of the two BOS thresholds. Nevertheless, due to the location of the proposed development and the proximity to a Coastal Wetland (downslope from the proposed development), mapped under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP), the Project has been determined to have the potential to have a significant impact on the Coastal Wetland and associated Threatened Ecological Communities (TECs), if indirect impacts of the Project are not appropriately managed. As a result, a BDAR has been prepared as a precautionary approach.

Nevertheless, it should be noted that the Project is not a designated development under Clause 10 of the Coastal Management SEPP, as no clearing of native vegetation, harm of marine vegetation, or activities listed in point 1 (c) will be undertaken on land identified as a Coastal Wetland.

1.2. Purpose

The purpose of this BDAR is to document the findings of an assessment undertaken for the Project in accordance with the requirements of Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM. Specifically, the objectives of this BDAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;
- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;

- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts; and
- Identify the thresholds for the assessment and offsetting of impacts, including:
 - Impact assessment of potential entities of serious and irreversible impacts (SAII);
 - Impacts for which an offset is required;
 - Impacts for which no further assessment is required;
 - Describe the application of the no net loss standard, including the calculation of the offset requirement.

1.3. Project Description

1.3.1. Location

The Project is located at 71 Fig Hill Lane, Dunmore, NSW, approximately 6 km south of Shellharbour City Centre, within the Shellharbour Local Government Area (LGA).

The Project is situated in the north-western corner of Lot 3 DP 717776 (the 'subject property'), covering an area of approximately 2.6 ha (hereafter referred to as the 'subject land') (see **Figure 1**).

The subject land is generally bounded by residential properties and grassland to the north and west, and by existing native woody vegetation to the south and east. Most of the subject land is mapped as RU2 – Rural Landscape, with the south-eastern parts of the site mapped as E3 – Environmental Management, under the Shellharbour Local Environment Plan (LEP) 2013.

The wider subject property stretches out to the east and south of the subject land. The subject property is mostly comprised of a mapped Coastal Wetland under the Coastal Management SEPP and is generally bounded by the Minnamurra River to the south, south-west, and east. A large portion of the subject property is also mapped as part of the Minnamurra River Estuary.

A site map and location map have been prepared in accordance with the BAM and are presented in **Figure 2** and **Figure 3**, respectively.

1.3.2. Project Overview

The Project involves the construction of an eco-tourism resort that will include the creation of one central building, which occupies the footprint of the existing dwelling, and three attached 'satellite clifftop lodge's that radiate out from the main building and will be attached via footpath. The Project also includes establishment of associated Asset Protection Zones (APZs) and landscaping. In summary, the Project will include the following components:

- Approval for demolition of the existing derelict building;
- Construction of four buildings (one central building and three clifftop lodges);

- Establishment of landscape elements surrounding the resort including turfed areas, boundary plantings, and garden beds; and
- Establishment of associated APZs.

1.3.3. Identification of the Development Site Footprint

The layout of the Project is shown in **Figure 4**. The development site footprint comprises the area of land directly impacted by the Project including the building footprints, landscaped areas and APZ. Due to the large area included within the APZ that will act as a buffer around the construction activities of the building envelopes, no additional construction buffer is required and the operational and construction footprint for the Project are therefore considered to be the same. The overall development site footprint is hereafter referred to as the “subject land”.

1.3.4. General Description of the Subject Land

1.3.4.1. Historical and Present Land Use

The subject land has been subject to a previous unfinished residential development that has since been abandoned. The existing development included extensive landfilling and clearing of vegetation. As a result, the small extent of remaining native vegetation within the southern and south-eastern parts of the site have undergone substantial modification resulting in areas that are heavily infested by weeds. Many of the surrounding properties have historically been modified for agriculture and rural residential development uses.

The historical use of the land has resulted in a site that is substantially modified and ecologically degraded.

1.3.4.2. Topography and Soils

The subject land is situated in an elevated corner of the subject property, overlooking low-lying flat land mostly comprised of a wetland that forms part of the western banks of the Minnamurra River. The subject land and the lower sections of the subject property are separated by a steep slope, with grades between approximately 30-50 %, as a result from previous landfilling carried out across the site, most likely for site levelling purposes. The site elevation ranges between approximately 44 m Australian Height Datum (AHD) in the northern parts of the subject land and 36 m AHD in the southern parts (Martens Consulting Engineers. 2019c).

According to the mapping of soil landscapes (Martens Consulting Engineers. 2019c), the subject land occurs within the Bombo soil landscape (9028bo), which is typically characterised by rolling low hills with benched slopes and sea cliffs formed by Bombo Latite. Expected soils are generally comprised of shallow Structured Loams on crests, moderately deep Krasnozems on upper slopes, with Brown or Red Podzolic Soils occurring on mid and lower slopes (Martens Consulting Engineers. 2019c)

The actual underlying soils of the subject land, according to the Geotechnical Assessment (Martens Consulting Engineers. 2019c), are most likely comprised of three units:

- Fill comprising poorly to moderately compacted gravelly clay/ silty clay/ sand (unit A),
- A thin layer of residual assumed stiff to very stiff silty gravelly clay (unit B), and

- Weathered and inferred low strength latite (unit C).

1.3.4.3. Hydrology

The subject land lies within the north-eastern extent of the Minnamurra River catchment area, which stretches from the Illawarra escarpment in the west to the Tasman Sea on the east.

There are no mapped or un-mapped drainage lines within the subject land, however the Minnamurra River occurs to the east of the subject land, along the eastern and southern boundary of the subject property (see **Figure 1**).

The Minnamurra River Estuary is mapped adjacent to the subject land and includes most of the subject property outside of the extent of the subject land. The Minnamurra River Estuary includes the Minnamurra River and its adjacent wetland areas, including the large wetland area directly south of the subject land, and is classified as a Nationally Important Wetland (DoEE 2019).

Other waterways that occur within the assessment area (the area of land within a 1,500 m buffer around the outer boundary of the subject land (see **Section 3.1.1**)) include Rocklow Creek, which drains into the Minnamurra River north-east of the subject land, and various 1st and 2nd order tributaries associated with the Minnamurra River and Rocklow Creek.

1.3.4.4. Vegetation

The vegetation of Dunmore and the surrounding rural landscapes have been heavily modified since the first European settlement in NSW. Large areas of the pre-existing vegetation have been historically cleared for agriculture and residential development purposes, however substantial tracts of native vegetation remain in small pockets scattered throughout the landscape and in surrounding national parks in neighbouring localities inland, approximately 10 km west of the subject land, including the Budderoo National Park and Barren Grounds Nature Reserve.

Remnant vegetation within the western adjacent property has mostly been identified as Illawarra Gully Wet Forest, Coastal Sand Forest, and Floodplain Swamp Forest under the Compilation of Biometric Vegetation Mapping project for the South East Local Land Services (Eco Logical Australia. 2015). Two of these communities - the Coastal Sand Forest and Floodplain Swamp Forest - can conform to the TECs 'Bangalay Sand Forest in the Sydney Basin and South East Corner Bioregion's and 'Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions'; both of which are listed under the BC Act with the latter also being listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPCB Act).

The small sections of remnant vegetation within the subject land are contiguous with vegetation extending in a southerly and easterly direction, comprising vegetation that is likely to conform to a number of BC Act and EPBC Act listed TECs including 'Illawarra Lowlands Grassy Woodland ', 'Illawarra Subtropical Rainforest in the Sydney Basin Bioregion', 'Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions', and 'Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions', as well as large areas covered by Mangrove Forests.

Most of the vegetation within the subject land has been significantly altered through clearing for a previous residential development, which included removal of trees and extensive landfilling of the site. As such, the remaining woody vegetation is mostly comprised of native regrowth over exotic grasslands and remnant vegetation that has been highly infested by weeds.

1.4. Information Sources

1.4.1. Databases

A number of databases were utilised during the preparation of this BDAR, including:

- DPIE BioNet Atlas;
- DPIE Threatened Biodiversity Data Collection;
- DPIE BioNet Vegetation Classification database;
- DPIE eSPADE;
- DPIE Planning Portal – ePlanning Spatial Viewer;
- NSW Government Water Management (General) Regulation 2018 hydroline spatial data 1.0;
- Commonwealth Department of the Environment and Energy (DoEE) Species Profile and Threat Database;
- DoEE Protected Matters Search Tool (PMST); and
- DoEE Directory of Important Wetlands in Australia.

1.4.2. Literature

This BDAR has utilised the results and/or spatial data from the following documents:

- Biometric Vegetation Compilation. Prepared for South East Local Land Services (Eco Logical Australia. 2015).

1.4.3. Aerial Photography

The aerial imagery utilised in this BDAR is sourced from NearMap and is dated 29 March 2019.

1.5. Authorship and Personnel

This document has been authorised by Dr David Robertson (BAM Accredited Assessor No: BAAS17027). This document and associated field surveys and Geographic Information Systems (GIS) mapping, were prepared with the assistance of additional personnel as outlined in **Table 1**. Notwithstanding the assistance of the additional personnel, the assessment presented within this document is Dr Robertson's.

Table 1. Personnel

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
Dr David Robertson	Document review, document preparation	Doctor of Philosophy. Ecology, University of Melbourne, 1986 Bachelor of Science (Honours) in Ecology, University of Melbourne, 1980 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS17027
Dr Trevor Meers	Document review	Doctor of Philosophy, Restoration Ecology. University of Melbourne, 2007 Bachelor of Applied Science (Honours) in Natural Resource Management. Deakin University, 2002 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18119
Cecilia Eriksson Pinatacan	Document preparation, GIS mapping, field surveys,	Bachelor of Science (Honours) in Marine Biology. University of Technology Sydney, 2008 Master of Science (Major in Marine Science and Management). University of Technology Sydney, 2013 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS19052
Bryan Furchert	Field surveys, document preparation	Bachelor of Biodiversity and Conservation. Macquarie University, 2012 Diploma of Conservation and Land Management. TAFE NSW, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18095
Dr Rohan Mellick	Field surveys	Doctor of Philosophy, Evolutionary Ecology. The University of Adelaide, 2012 Bachelor of Applied Science (Honours) in Natural Resource Management, Southern Cross University, 2000. BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18075
Sally Dupont	Field surveys	Bachelor of Science from Western Sydney University, 2012 Master of Research (Marine Biology) from Macquarie University, 2016 BAM Accredited Assessor Training. Muddy Boots, 2019	-

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
Matthew Freeman	Field surveys	Bachelor of Natural Science (Nature Conservation). University of Western Sydney, 2012 BAM Accredited Assessor Training. Muddy Boots, 2018	BAAS19019
Heather Gosper	Field surveys	Bachelor of Environmental Science and Management. The University of Newcastle, 2013 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS19028

2. Methodology

2.1. Review of Existing Data

Existing information on biodiversity values within the assessment area were reviewed, which includes:

- Survey data that is held in DPIE databases, including:
 - Threatened Biodiversity Data Collection (TBDC); and
 - BioNet Vegetation Classification.
- Existing vegetation mapping, being:
 - Biometric Vegetation Compilation – Prepared for South East Local Land Services (Eco Logical Australia. 2015).

This existing information was considered and included, where appropriate, in the survey design, vegetation mapping and reporting.

The subject property has previously been surveyed by Cumberland Ecology in late 2018, which included vegetation mapping of the entire subject property as part of preliminary investigations for a proposed Biodiversity Stewardship Site. The results of this assessments have been utilised in the preparation of this BDAR.

2.2. Flora Survey

2.2.1. Vegetation Mapping

Detailed vegetation mapping of the subject land was undertaken by random meander searches throughout each patch of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these.

2.2.2. Vegetation Integrity Assessment

Vegetation integrity assessments were undertaken in the subject land in accordance with the BAM. Surveys included establishment of a 20 x 50 m plot within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of 'High Threat Exotic' weed species;
- Assessment of function attributes within a 20 m x 50 m plot, including:
 - Count of number of large trees;
 - Tree stem size classes measured as 'diameter at breast height over bark' (DBH);
 - Regeneration based on the presence of living trees with stems <5 cm DBH;

- The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

Four BAM plots were sampled for the vegetation within the subject land and their location is shown in **Figure 5**. **Table 2** summarises the plot requirements based on the size and number of vegetation zones in the subject land. The vegetation in the subject land has been mapped as comprising three separate vegetation zones, and the minimum number of plots have been completed for each of these zones.

It should be noted that due to the small area of two of the vegetation zones (zone 1 and 2), the BAM plots associated with the relevant vegetation zones were undertaken outside of the subject land but within the same patch of the relevant vegetation zone, within the wider subject property. Furthermore, the locations and orientation of the BAM plots were also somewhat restricted by the steep slope of the northern part of the subject property.

Table 2. Minimum Plot Survey Requirements

Vegetation Zone	PCT	Condition	Approximate Area (ha)	Minimum Number of Plots Required	Number of Plots Completed
1	1300	Moderate	0.17	1	1
2	838	Moderate	0.01	1	1
3	838	Acacia	0.27	1	1

2.2.3. Threatened Flora Species Survey

Targeted threatened flora surveys were undertaken for species credit species that have the potential to occur within the subject land as determined by the BAM Calculator. All targeted surveys were conducted using parallel field traverses in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016). Targeted threatened flora surveys were undertaken by Bryan Furchert, Dr Rohan Mellick and Sally Dupont from Cumberland Ecology on 24 May 2019 and 26 July 2019, for the following species:

- *Cynanchum elegans* (White-flowered Wax Plant);
- *Daphnandra johnsonii* (Illawarra Socketwood);
- *Gossia acmenoides* – endangered population (*Gossia acmenoides* population in the Sydney Basin Bioregion south of the Georges River);
- *Rhodamnia rubescens* (Scrub Turpentine);
- *Senna acclinis* (Rainforest Cassia); and
- *Zieria granuala* (Illawarra Zieria).

2.2.4. Flora Survey Effort

Table 3 below shows the flora survey effort, including dates and staff members.

Table 3. Flora survey effort

Survey Detail	Date	Effort	Personnel
Vegetation Mapping	24 May 2019	4 person hours	Bryan Furchert, Cecilia Eriksson Pinatacan
BAM Plots	24 May 2019 and 26 July 2019	4 x BAM Plots	Bryan Furchert, Cecilia Eriksson Pinatacan, Rohan Mellick, Sally Dupont, Heather Gosper
Targeted Threatened Flora Surveys	24 May 2019 and 26 July 2019	5 person hours, plus observations throughout surveys	Bryan Furchert, Rohan Mellick, Sally Dupont

2.3. Fauna Survey

2.3.1. Threatened Fauna Species Survey

The following threatened fauna species were considered for targeted surveys during the field work:

- *Calyptorhynchus lathami* (Glossy Black-cockatoo); and
- *Myotis macropus* (Southern Myotis).

Due to the survey period for the Project not aligning with the suitable survey period for the Southern Myotis, as outlined within the TBDC, surveys were subsequently not undertaken for this species.

2.3.2. Fauna Survey Methods

2.3.2.1. Habitat Assessment

Habitat assessments were carried out throughout the entirety of the subject land on 24 May 2019 and 30 July 2019. This survey identified any potential habitat features such as significant rocky outcrops, caves, bush rock, fallen logs, culverts, water bodies, decorticating bark, nests and hollow-bearing trees. Particular effort was made to determine any evidence of potential microbat habitats and trees with hollows suitable for threatened owl species.

Survey guidelines utilised: *Threatened Biodiversity Survey and Assessment: Guidelines for Activities and Developments* (DEC (NSW) 2004).

2.3.2.2. Bird Surveys

Bird surveys were undertaken within the subject land using the area search method that involves walking within a 2 ha area and recording all avian species observed or heard calling. These were conducted at one site within

the subject land for a minimum of 30 minutes (see **Figure 5**). The bird surveys occurred over two days on 26 and 30 July 2019.

A visual observation of all trees within the site was completed throughout the survey period and any nests present recorded.

Survey guidelines utilised: Threatened Biodiversity Survey and Assessment: Guidelines for Activities and Developments (DEC (NSW) 2004).

This survey targeted Glossy Black-Cockatoo.

2.3.3. Fauna Survey Effort

All surveys are undertaken during periods specified in the Threatened Biodiversity Data Collection (OEH 2018a) for each species and according to relevant survey guidelines. **Table 4** below shows the fauna survey effort, including dates and staff members.

Table 4. Fauna survey effort

Survey Method	Date	Effort	Personnel
Habitat assessment	24 May 2019 and 30 July 2019	Throughout survey period (approx. 12 person hours)	Cecilia Eriksson Pinatacan, Heather Gosper, Matthew Freeman, Sally Dupont
Incidental observations	24 May 2019, 26 and 30 July 2019	Throughout survey period (approx. 12 person hours)	Bryan Furchert, Cecilia Eriksson Pinatacan, Heather Gosper, Rohan Mellick, Sally Dupont, Matthew Freeman
Bird survey	26 and 30 July 2019	2 person hours	Matthew Freeman, Sally Dupont, Rohan Mellick

2.4. Weather Conditions

Weather conditions during flora and fauna surveys were generally appropriate for detection of a variety of flora and fauna. Surveys were undertaken in late autumn to mid-winter (May 2019 and July 2019). A summary of weather conditions in the wider locality of the subject land (Kiama weather station 068242) during the flora and fauna survey periods is provided in **Table 5** below.

Table 5 Weather conditions during surveys

Date	Temperature Min (°C)	Temperature Max (°C)	Rainfall (mm)
24/05/2019	13.8	24.9	0
26/07/2019	9.7	19.8	0
30/07/2019	11.7	14.9	0.4

3. Landscape Features

3.1. Site Context

3.1.1. Assessment Area

As the Project is being assessed as a site-based project, the assessment area comprises the area within a 1,500 m buffer around the outer boundary of the subject land. The location of the assessment area is shown in **Figure 3**.

3.1.2. Native Vegetation Cover

The native vegetation extent was determined using a Geographic Information System (GIS). To map native vegetation cover within the subject land and assessment area, this assessment utilised the detailed vegetation mapping prepared by Cumberland Ecology in conjunction with broadscale Biometric Vegetation mapping by ELA (2015). The native vegetation cover within the assessment area is shown in **Figure 3**. It occupies approximately 336 ha, which represents 41% of the assessment area. Therefore, the native vegetation cover value is assigned to the cover class of >30-70%.

3.2. Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 2** and the extent within the assessment area is shown in **Figure 3**.

3.2.1. IBRA Bioregions and IBRA Subregions

The subject land and assessment area occur within the Sydney Basin Bioregion and within the Illawarra Subregion.

3.2.2. Rivers, Streams and Estuaries

The subject land and assessment area occur within the Minnamurra River catchment. No mapped or unmapped waterways occur within the subject land. However the Minnamurra River is located approximately 160 m east of the subject land, along the eastern and southern boundary of the subject property.

In the wider assessment area, various named and unnamed Category 1-6 order streams have been identified to occur. Rocklow Creek occurs as a 4th and later 5th order watercourse to the north of the subject land, with a number of associated unnamed tributaries. In the southern extent of the assessment area, the Minnamurra River occurs as a 5th order stream until Rocklow Creek converges into the Minnamurra River to the east of the subject land, where the Minnamurra River continues as a 6th order watercourse.

The Minnamurra River Estuary, which is as a Nationally Important Wetland, includes the majority of the wider subject property south of the subject land.

3.2.3. Important and Local Wetlands

One important wetland, as listed within the Directory of Important Wetlands Australia (DoEE 2019), occurs within the assessment area but not within the subject land, namely the Minnamurra River Estuary. The mentioned wetland is also mapped as a Coastal Wetland under the Coastal Management SEPP and is located

directly south of the subject land, occupying a large portion of the eastern and southern extent of the assessment area.

Local wetlands are scattered throughout the western portion of the assessment area, the closest being approximately 350 m north-west of the subject land.

3.2.4. Habitat Connectivity

The most eastern portion of the subject land is mapped as being part of the Illawarra Regional Biodiversity Corridor (see **Figure 6**), which is a corridor that is identified among other regional corridors under the Illawarra Biodiversity Strategy (NSW Government 2011) on the basis that it is comprising areas that are large, biologically diverse, and contain a diversity of threatened species habitats and vegetation communities of significance. In the wider assessment area, the Illawarra Regional Biodiversity Corridor is mapped as covering approximately 60% of the extent of the assessment area, including the remainder of the subject property.

Furthermore, the south-eastern portion of the subject land includes areas mapped as 'Environmentally Sensitive Land' under Council's Terrestrial Biodiversity Mapping (Shellharbour City Council. 2013) (see **Figure 6**).

There is local connectivity between the native vegetation within the subject land and other vegetated areas in adjoining properties in a south-west to north-easterly direction through the assessment area, and despite the many cleared areas surrounding the subject land, the vegetation has established connectivity such that it is within a large patch of native vegetation that is greater than 100 ha in patch size.

There are also riparian buffers surrounding the Category 1-6 waterways, estuary and wetlands that occur within the assessment area, which provide some habitat connectivity throughout the landscape.

3.2.5. Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the assessment area.

3.2.6. Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value (AOBV) have been mapped as occurring within the assessment area.

3.2.7. Bionet NSW Landscapes

The subject land occurs within two different Bionet NSW Landscapes, namely 'Kiama Coastal Slopes' and the 'Lake Illawarra Alluvial Plains' landscapes. However, the majority of the subject land occurs within the Kiama Coastal Slopes landscape, excluding a small section in the southern part of the subject land, hence this landscape was entered into the BAM calculator.

3.2.8. Soil Hazard Features

No soil hazard features have been identified within the subject land. Although the DPIE's eSPADE database (OEH 2019a) identifies the subject land as having a high probability for Acid Sulphate Soil, detailed

investigations as part of the Acid Sulfate Soil Assessment for the site (Martens Consulting Engineers. 2019b) concluded that the fill/rock profile of the subject land is not associated with Acid Sulphate Soil.

4. Native Vegetation

4.1. Native Vegetation Extent

The subject land has been subject to detailed surveys by Cumberland Ecology for the purpose of this BDAR. The native vegetation extent within the subject land was determined through aerial photograph interpretation and field surveys. The native vegetation extent within the subject land is shown in **Figure 7**. It occupies approximately 0.44 ha, which represents 17% of the subject land. The native vegetation extent within the subject land includes two small areas that conform to native vegetation communities, and a patch of Acacia regrowth.

The remaining land within the subject land comprises cleared land, including an existing building and associated driveway, as well as exotic grassland and weed infested areas. In accordance with Section 5.1.1.5 of the BAM, the areas of cleared land do not require further assessment, unless they are proposed for restoration as part of an offset, or provide habitat for species credit species.

To provide context to the location of the subject land, vegetation mapping by Cumberland Ecology (undertaken in late 2018 for the purposes of a preliminary investigation for a proposed Biodiversity Stewardship Site) of the entire subject property is shown in **Figure 8** and further discussed in **Section 4.2.3**.

4.2. Plant Community Types

Identification of the PCTs occurring within the subject land was guided by the results of the Cumberland Ecology surveys. The data collected during surveys of the subject land and surrounds was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification database. Consideration was given to the following:

- Occurrence within the Illawarra IBRA subregion;
- Vegetation formation;
- Alignment with TECs;
- Landscape position; and
- Upper, mid and ground strata species.

The analysis determined that the native vegetation within the subject land aligned with two PCTs held within the BioNet Vegetation Classification database. **Table 6** provides a summary of the PCTs identified within the subject land. The distribution of these PCTs within the subject land is shown in **Figure 9**. Detailed descriptions of these PCTs and the justification for PCT selection is provided in the sections below.

Table 6 Plant community types

PCT #	PCT Name	Approximate Area (ha)
838	Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	0.28

PCT #	PCT Name	Approximate Area (ha)
1300	Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	0.17

4.2.1. PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

Approximate Area: 0.28 ha

Percent Cleared Value: 85%

TEC Status: Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion – EEC (BC Act)

4.2.1.1. General Description

Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (PCT 838) occurs in two condition states within the subject land, as described in subsequent sections.

i. Forest Red Gum dominated form

This community occurs as a small area in the east of the subject land. The occurrence of this community in the subject land and wider subject property is extremely degraded with a native shrub and ground layer mostly absent. The canopy is dominated by *Eucalyptus tereticornis* (Forest Red Gum). The sub-canopy is dominated by *Acacia maidenii* (Maiden's Wattle) and *Acacia mearnsii* (Black Wattle), and younger individuals of these species occur in the shrub layer along with isolated individuals of *Breynia oblongifolia* (Coffee Bush) and juvenile *Streblus brunonianus* (Whale Bone Tree). The shrub layer is dominated, however, by dense thickets of the exotic *Lantana camara* (Lantana), estimated at up to 95% coverage at some locations. The exotic shrub *Solanum mauritianum* (Wild Tobacco Bush) is also present scattered within the layer.

The ground layer is sparse due to dense shading from *Lantana camara*, and fallen leaves of this species cover the majority of the surface area of the ground. There are sporadic occurrences of the native grass *Oplismenus aemulus* (Basket Grass), the only native species recorded in the layer, and the exotic *Tradescantia fluminensis* (Wandering Trad) is present in the layer in scattered, but dense patches.

A small number of twiners are present, generally scattered in the community and growing on *Lantana camara* shrubs. Species include the natives *Geitonoplesium cymosum* (Scrambling Lily) and *Cayratia clematidea* (Native Grape), and the exotic *Delairea odorata* (Cape Ivy).

An example of this form of the PCT is shown in **Photograph 1**.

Photograph 1. Forest Red Gum dominated form of PCT 838 with shrub layer dominated by the exotic *Lantana camara*



ii. Acacia Regrowth form

This community occurs as a strip along most of the eastern and southern boundaries of the subject land. It is a highly degraded form of PCT 838 and predominately consists of scattered *Acacia* spp. regrowth, mostly of a shrub height, growing over exotic grasses and forbs. *Acacia* species include *Acacia binervata* (Two-veined Hickory) and *Acacia melanoxylon* (Australian Blackwood). Exotic shrubs are present, though not dominant and species include *Lantana camara*, *Chrysanthemoides monilifera* subsp. *monilifera* (Boneseed), and *Gomphocarpus fruticosus* (Narrow-leaved Cotton-bush).

The ground layer is heavily dominated by the exotic grass *Cenchrus clandestinus* (Kikuyu), and other exotic grasses are present and include *Chloris gayana* (Rhodes Grass), *Dactylis glomerata* (Orchard Grass), and *Paspalum dilatatum* (Paspalum). Exotic forbs are common with species present including *Bidens pilosa* (Cobbler's Pegs), *Foeniculum vulgare* (Fennel), *Ageratina adenophora* (Crofton Weed), and *Asparagus aethiopicus* (Ground Asparagus).

A few native species are scattered and uncommon in the ground layer. Species include the grass *Oplismenus aemulus* (Basket Grass), the twiner *Glycine tabacina*, and the forbs *Dichondra repens* (Kidney Weed) and *Centella asiatica* (Indian Pennywort).

An example of this form of the PCT is shown in **Photograph 2**.

Photograph 2. Acacia Regrowth form of PCT 838 on the slope along the southern boundary of the subject land



4.2.1.2. Justification of PCT Selection

i. Forest Red Gum dominated form

PCTs were initially filtered for the NSW Sydney Basin IBRA region, the vegetation formation Grassy Woodland, and the dominant canopy species *Eucalyptus tereticornis*, which provided eight candidate PCTs. These candidate PCTs were then filtered further for the distribution within the Illawarra IBRA subregion and for the TEC name and status. The final two candidate PCTs were then assessed for their similarity to subject land details and the floristic data collected for the PCT during the field survey, including:

- PCT Name;
- Upper/mid/lower stratum species;
- Diagnostic species;
- Landform elements; and
- PCT classification confidence level.

Based on the detailed review of these items, PCT 838 was chosen as the best fit PCT. A summary of the PCT selection process is provided in **Table 7**.

Table 7. PCT Selection Justification - PCT 838 (Forest Red Gum dominated form)

PCT Filtering Criteria Used	PCTs Considered	Selected PCT	Selected PCT Name	Species Used for Identification
1. IBRA Region (Sydney Basin), dominate canopy species (<i>Eucalyptus tereticornis</i>), formation (Grassy Woodland)	622, 762, 830, 838, 849, 850, 1326, 1401	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Upper stratum species: <i>Eucalyptus tereticornis</i>
2. Distribution (Illawarra IBRA subregion)	838, 1326			Mid-stratum species: <i>Breynia oblongifolia</i> , <i>Geitonoplesium cymosum</i>
3. TEC name and status	838, 1326			Ground-stratum species: <i>Oplismenus imbecillis</i>

ii. Acacia Regrowth form

As the vegetation referred to as 'Acacia Regrowth' predominantly consists of scattered *Acacia* spp. regrowth (mostly of a shrub height) growing over mostly exotic grasses and forbs, it is not considered to conform to a vegetation community and hence does not conform to a PCT. Nevertheless, recent advice provided by DPIE regarding how to assess native vegetation that is not generally considered to conform to a vegetation community, is to still nominate a PCT based on the native species present. Therefore, for the purpose of this BDAR, the area of Acacia Regrowth has been assigned to what is considered to be the best-fit PCT, as explained below.

Identification of the best-fit PCT was initially based on review of the directly adjacent vegetation mapping and associated PCTs, presence of *Acacia* spp. and review of the final determinations for the TECs mapped in directly adjacent areas. As the PCT descriptions are generally quite broad and only have very few diagnostic species to rely on, the final determinations for the TECs mapped in adjacent areas were subsequently utilised for the final PCT selection for the Acacia Regrowth form. Based on the presence of *Acacia* spp. within the final determination for the TEC Illawarra Lowlands Grassy Woodland (NSW Scientific Committee 2011) occurring in adjacent areas to the east, PCT 838 was selected as the best-fit PCT. The final determination for the Illawarra Dry Subtropical Rainforest, also mapped in adjacent areas to the south-west and east, does not include *Acacia* spp. (NSW Scientific Committee. 2011) and as such this PCT was not selected.

4.2.1.3. Alignment with Threatened Ecological Communities

The Forest Red Gum dominated form of PCT 838 mapped on the subject land conforms to the TEC Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion, which is listed as an EEC under the BC Act. However, although this TEC is listed as a CEEC under the EPBC Act, the occurrence of the PCT that exist within the subject land does not conform to the EPBC listing, due to the patch of the community being smaller than 0.5 ha, as per the Conservation Advice of the TEC (TSSC 2016).

The Acacia Regrowth form of the community does not conform to a TEC, as described within the final determination, as it lacks an over-storey layer. There is no derived native grassland form of the Illawarra Lowlands Grassy Woodland TEC, according to the description in the final determination (NSW Scientific Committee 2011). Furthermore, as described in **Section 4.2.1.2 (ii)**, although the occurrence of Acacia Regrowth mapped within the subject land does not conform to a PCT, a best-fit PCT was still assigned to the community in accordance with advice from the DPIE, for the purpose of undertaking BAM calculations. Nevertheless, the occurrence of Acacia Regrowth does not constitute the vegetation community Illawarra Lowlands Grassy Woodland, and does not conform to the TEC.

4.2.2. PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

Vegetation Formation: Rainforests

Vegetation Class: Dry Rainforests

Approximate Area: 0.17 ha

Percent Cleared Value: 50%

TEC Status: Illawarra Subtropical Rainforest in the Sydney Basin Bioregion – EEC (BC Act)

4.2.2.1. General Description

This community occurs as a small area in the east of the subject land. It exists predominately as tall regrowth of *Acacia mearnsii*, with scattered *Acacia maidenii*, and scattered occurrences of rainforest species indicating, along with the fertile soils that the community is a derived form of PCT 1300. Rainforest species present include the tree species *Alphitonia excelsa* (Red Ash), *Streblus brunonianus*, *Dendrocnide excelsa* (Giant Stinging Tree), and the climbing shrub *Maclura cochinchinensis* (Cockspur Thorn). The exotic shrub *Lantana camara* dominates the shrub layer and was estimated at 85 percent coverage (see **Photograph 3**).

The ground layer is relatively sparse, due to dense shading from *Lantana camara*. The exotic forb *Tradescantia fluminensis* is the dominant species, and the exotic vines *Passiflora subpeltata* (White Passion Flower), *Delairea odorata* and *Araujia sericifera* (Moth Vine) are common. Natives occur sporadically in the ground layer, with species recorded including the forbs *Pseuderanthemum variabile* (Pastel Flower) and *Dichondra repens*, the grass *Oplismenus aemulus*, and the climbers *Geitonoplesium cymosum* and *Cayratia clematidea*.

Photograph 3. Degraded form of PCT 1300 with a shrub layer dominated by the exotic *Lantana camara*



4.2.2.2. Justification of PCT Selection

PCTs were initially filtered for the NSW Sydney Basin IBRA region, the vegetation formation Rainforests, and the presence of either of the dominant canopy species *Streblus brunonianus* and *Alphitonia excelsa*, which provided eleven candidate PCTs. These candidate PCTs were then filtered further for the distribution within the Illawarra IBRA subregion and for the TEC name and status. The final two candidate PCTs were then assessed for their similarity to subject land details and the floristic data collected for the PCT during the field survey, including:

- PCT Name;
- Upper/mid/lower stratum species;
- Diagnostic species;
- Landform elements; and
- PCT classification confidence level.

Based on the detailed review of these items, PCT 1300 was chosen as the best fit PCT. A summary of the PCT selection process is provided in **Table 8**.

Table 8. PCT Selection Justification - PCT 1300

PCT Filtering Criteria Used	PCTs Considered	Selected PCT	Selected PCT Name	Species Used for Identification
1. IBRA Region (Sydney Basin), dominant canopy species (<i>Streblus brunonianus</i> , <i>Alphitonia excelsa</i>), formation (Rainforests)	616, 845, 906, 1300, 1525, 1528, 1534, 1537, 1541, 1545, 1832	1300	Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Upper stratum species: <i>Streblus brunonianus</i> , <i>Alphitonia excelsa</i> , <i>Acacia maidenii</i>
2. Distribution (Illawarra IBRA subregion)	906, 907, 1300			Mid-stratum species: <i>Geitonoplesium cymosum</i> , <i>Maclura cochinchinensis</i> , <i>Notolaea venosa</i>
3. TEC name and status	906, 1300			Ground-stratum species: <i>Pseudenranthemum variabile</i>

4.2.2.3. Alignment with Threatened Ecological Communities

The entirety of the area of PCT 1300 mapped within the subject land conforms to the TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion, which is listed as an EEC under the BC Act. However, although this TEC is listed as a CEEC under the EPBC Act, the occurrence of the PCT within the subject land does not conform to the EPBC listing, as the community does not meet the condition criteria for overstorey cover of at least 30%, as per the Conservation Advice of the TEC (TSSC 2019).

4.2.3. PCTs in the Subject Property

The vegetation mapping of PCTs in the wider subject property is shown in **Figure 8** and includes four TECs listed under the BC Act and/or EPBC Act:

- Dry Subtropical Rainforest (BC Act: EEC, EPBC Act: Critically Endangered)
- Coastal Saltmarsh (BC Act: EEC, EPBC Act: Vulnerable);
- Swamp Oak Floodplain Forest (BC Act: EEC, EPBC Act: EEC); and
- Littoral Rainforest (BC Act: EEC, EPBC Act: Critically Endangered).

In addition to the TECs listed above, Mangrove Forests, which are protected habitats under the NSW *Fisheries Management Act 1994*, were found to cover large areas of the site.

The extent of the mapped PCTs within the subject property and the subject land is shown in **Table 9** below.

Table 9. PCTs in the Subject Property and Subject Land

PCT ID	PCT Name	Approximate Area (ha) - Subject Property	Approximate Area (ha) - Subject Land
838	Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	0.53	0.01
838	Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (Acacia Regrowth)	0.27	0.27
910	Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion	9.93	0
920	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	20.40	0
1126	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	11.55	0
1234	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	11.03	0
1300	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	0.23	0
1300	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (degraded)	1.23	0.17
N/A	Exotic Vegetation	0.04	0.01
N/A	Exotic Grassland	2.98	1.57
N/A	Cleared	0.59	0.59
N/A	Water	0.41	0
Total		59.20	2.62

4.3. Threatened Ecological Communities

Two PCTs identified within the subject land have been assessed as being associated with TECs. **Table 10** summarises the TECs identified within the subject land and their distribution is shown in **Figure 10**.

Table 10 Threatened ecological communities

TEC Name	BC Act Status	Associated PCTs	Approximate Area (ha)
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	EEC	838	0.01
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	EEC	1300	0.17

4.4. Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to vegetation zones based on PCTs and broad condition states. Patch sizes were subsequently assigned for each vegetation zone. The extent of vegetation zones and patch size classes within the subject land are shown in **Figure 11**.

Each vegetation zone was assessed using survey plots/transects (see **Section 2.2**) to determine the vegetation integrity score. Plot/transect data utilised within the BAM Calculator to determine the vegetation integrity score is provided in **Appendix A**. Field data sheets and electronic copies of raw data are provided separately to this document.

Vegetation zones, patch sizes and vegetation integrity scores for the subject land are summarised in **Table 11**.

Table 11. Vegetation Zones within the Subject Land

Vegetation Zone	PCT #	PCT Name	Condition Name	Approximate Area (ha)	Patch Size Class	Composition Score	Structure Score	Function Score	Vegetation Integrity Score
1	1300	Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Mod	0.17	>100 ha	23.0	17.1	45.0	26.1
2	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Mod	0.01	>100 ha	15.0	43.1	45.0	30.8
3	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Acacia	0.27	>100 ha	6.5	7.7	43.7	12.9

5. Threatened Species

5.1. Threatened Species for Assessment

The BAM Calculator generates a list of threatened species requiring assessment utilising a number of variables. The following criteria have been utilised to predict the threatened species requiring further assessment:

- IBRA subregion: Illawarra
- Geographic limitations and habitat constraints that were selected as present:
 - Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest);
 - Subject land located within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels;
 - Shellharbour and Wollongong LGAs;
 - Subject land located within 1 km of wet area/swamps/waterbodies;
 - Hollow-bearing trees;
 - Subject land located within 200 m of riparian zone;
 - Bridges, caves or artificial structures within 200 m of riparian zone;
 - North of Gerringong;
 - Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines; and
 - Subject land located within 5 km of coast.
- Associated PCTs: 838 and 1300;
- Percent native vegetation cover in the assessment area: 41%;
- Patch size: PCT 838: >101 ha and PCT 1300>101 ha; and
- Credit type: Ecosystem and/or species.

Based on the above variables, the BAM Calculator generated a list of 31 ecosystem credit species and 35 species credit species.

5.2. Ecosystem Credit Species

Table 12 lists the predicted ecosystem credit species for the vegetation zones within the subject land and the associated PCT. No ecosystem species were removed from consideration. The highest sensitivity class of these species is "High Sensitivity to Potential Gain", which has subsequently been utilised by the BAM Calculator for ecosystem credits.

Table 12. Predicted ecosystem credit species

Scientific Name	Common Name	PCT#	Removed from Consideration
<i>Anthochaera phrygia</i>	Regent Honeyeater (foraging)	838	No
<i>Artamus cyanopterus</i>	Dusky Woodswallow	838, 1300	No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)	838, 1300	No
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (foraging)	838	No
<i>Circus assimilis</i>	Spotted Harrier	838	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	838, 1300	No
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	838, 1300	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	838, 1300	No
<i>Glossopsitta pusilla</i>	Little Lorikeet	838, 1300	No
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	838	No
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)	838, 1300	No
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake (foraging)	1300	No
<i>Kerivoula papuensis</i>	Golden-tipped Bat	1300	No
<i>Lathamus discolor</i>	Swift Parrot (foraging)	838	No
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	838	No
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	1300	No
<i>Miniopterus schreibersii oceanensis</i>	Large Bent-winged Bat (foraging)	1300	No
<i>Mormopterus norfolkensis</i>	Eastern Coastal Freetail-bat	838, 1300	No
<i>Neophema pulchella</i>	Turquoise Parrot	838	No
<i>Ninox connivens</i>	Barking Owl (foraging)	838, 1300	No
<i>Ninox strenua</i>	Powerful Owl (foraging)	1300	No
<i>Petroica boodang</i>	Scarlet Robin	838	No
<i>Petroica phoenicea</i>	Flame Robin	838	No
<i>Phascolarctos cinereus</i>	Koala (foraging)	838	No
<i>Potorous tridactylus</i>	Long-nosed Potoroo	1300	No

<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	838, 1300	No
<i>Ptilinopus regina</i>	Rose-crowned Dove	1300	No
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	1300	No
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	838, 1300	No
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	838, 1300	No
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)	838, 1300	No

5.3. Species Credit Species

5.3.1. Assessment of Habitat Constraints and Microhabitats

Table 13 lists the species credit species predicted by the BAM Calculator, based on the selection of the criteria outlined in **Section 5.1**, and details whether the species have been further assessed based on the presence or absence of habitat constraints within the subject land. Under Section 6.4.1.13 of the BAM. Further species credit species can be excluded from further assessment if an assessment of habitat constraints and microhabitats determines that the habitat within the subject land is substantially degraded, such that the species credit species is unlikely to occur.

Detailed habitat assessments of the site were undertaken as described in **Section 2.3.2**. The habitat assessments focussed on habitat features relevant to species credit species predicted to occur. This included determining the presence/absence of the habitat constraints identified for the predicted threatened species and the condition of these habitat constraints and other microhabitats.

The Regent Honeyeater and Swift Parrot have been excluded from further assessment after confirmation from DPIE that no important habitat occurs within the subject land for either species. Breeding habitat for both species is limited to specific areas that are not associated with, or in the vicinity of, the subject land, therefore since the species credit species component for both species is associated with breeding habitat only, both the Regent Honeyeater and Swift Parrot were excluded from further assessment.

The initial habitat assessment survey completed in May 2019 focussed on determining if habitat for any potential species credit species (or relevant breeding component for dual credit species) was substantially degraded such that the species is unlikely to utilise the subject land or specific vegetation zone in accordance with the requirements of Step 3 (a) of Section 6.4 of the BAM. Further, more detailed habitat assessment was undertaken in July 2019 to confirm presence/absence of various habitat components for several species.

Most of the subject land has previously been cleared, in association with the construction of the existing derelict buildings, and now comprises a mix of exotic grassland and shrubby exotic vegetation. Limited habitat is present along the southern and eastern boundary of the site, in the form of scattered occurrences of Acacia regrowth over exotic grassland, as well as small areas of degraded Dry Subtropical Rainforest and Illawarra Lowlands Grassy Woodland with a dense understorey dominated by the High Threat Weed species *Lantana*

camara. Only one hollow-bearing tree is present, which is an exotic fig tree located at the entry of the subject land on the western boundary that contains several small hollows. Other potential habitat is contained within the existing buildings in the form of potential roosting habitat for microbat species within ceiling and wall cracks and gaps, as well as potential nest sites for birds.

Based on habitat features present within the subject land, species-specific information, and valid database records of species, several candidate species credit species were excluded from requiring further assessment, as outlined in detail in **Table 13**. References utilised in the aforementioned table includes habitat constraints outlined in the following resources:

- DPIE Threatened Biodiversity Data Collection (TBDC); and
- DPIE Threatened Biodiversity Profile (DPIE 2019); and
- PlantNet – NSW Flora Online (Botanic Gardens Trust 2019).

A few species credit fauna species had the potential to be excluded from further assessment based on the lack of (or degradation of) habitat. However due to the alignment of the survey period for these species within the timeframe for the field surveys; they were not removed from consideration and were surveyed as a precautionary measure.

Table 13. Consideration of Species Credit Species

Scientific Name	Common Name	Habitat/ Geographic Constraints	Removed from Consideration	Reason for Inclusion or Removal
Flora				
<i>Chorizema parviflorum</i> - endangered population	<i>Chorizema parviflorum</i> Benth. in the Wollongong and Shellharbour Local Government Areas	None	Yes	The subject land is not considered to contain potential habitat for the species, as the subject land occurs outside of the species known distribution. The species is known to occur between Austinmer and Albion Park in the Wollongong and Shellharbour LGAs. There are no records of the species since 1980 within a 5 km radius of the subject land. Furthermore, the species is known to occupy woodland or forest dominated by <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus longifolia</i> . Although potential habitat could be present within the areas of Illawarra Lowlands Grassy Woodland, the areas of this TEC within the subject land are highly degraded with a dense understorey dominated by <i>Lantana camara</i> .
<i>Cynanchum elegans</i>	White-flowered Wax Plant	None	No	The subject land may contain potential habitat for the species.
<i>Daphnandra johnsonii</i>	Illawarra Socketwood	None	No	The subject land may contain potential habitat for the species.

<i>Gossia acmenoides</i> endangered population	-	<i>Gossia acmenoides</i> population in the Sydney Basin Bioregion south of the Georges River	None	No	The subject land may contain potential habitat for the species.
<i>Pimelea curviflora</i>	var.	<i>Pimelea curviflora</i>	var. None	Yes	The subject land is not considered to contain potential habitat for the species, as the subject land does not occur in close proximity to a location of a known population. The closest population is located in Albion Park approximately 6.5 km north of the subject land. Furthermore, the habitat present within the subject land is considered to be highly degraded, with a dense understorey of <i>Lantana camara</i> .
<i>Pimelea spicata</i>		Spiked Rice-flower	None	No	The subject land is not considered to contain potential habitat for the species. In the coastal Illawarra, the species generally occurs in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites. The Illawarra populations usually occur in one of two communities - a woodland or a coastal grassland, with groundcover dominated by kangaroo grass. As the woodland habitat within the subject land is highly degraded with an understorey dominated by dense layer of <i>Lantana</i>

				<i>camara</i> , the species is not considered likely to occur. However, surveys for the species were undertaken as the survey period aligns with the Project timing.
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	None	Yes	The subject land is not considered to contain potential habitat for the species, as it does not occur in close proximity to any of the two known populations within the Illawarra IBRA subregion (Albion Park and Yallah). Furthermore, although the species is known to favour open forest or woodland dominated by <i>Eucalyptus tereticornis</i> (among other canopy species), the Illawarra Lowlands Grassy Woodland habitat that occur within the subject land is highly degraded with a dense understorey of <i>Lantana camara</i> .
<i>Rhodamnia rubescens</i>	Scrub Turpentine	None	No	The subject land may contain potential habitat for the species.
<i>Senna acclinis</i>	Rainforest Cassia	None	No	Although there are no records of the species since 1980 within a 10km radius of the subject land, the subject land may contain potential habitat for the species.

<i>Solanum celatum</i>	<i>Solanum celatum</i>	None	Yes	The subject land is not considered to contain potential habitat for the species, due to the degraded nature of the habitat. The species usually grows on hills and slopes in Eucalypt woodland. However, the small area of Eucalypt woodland present within the subject land (less than 0.01 ha) is heavily degraded, with a dense understorey of <i>Lantana camara</i> . The closest record of the species occurs approximately 3.5 km from the subject land.	
<i>Zieria granulata</i>	Illawarra Zieria	None	No	The subject land may contain potential habitat for the species.	
Fauna					
<i>Anthochaera phrygia</i>	Regent (breeding)	Honeyeater	As per mapped areas	Yes	The subject land does not contain areas of important mapped habitat according to DPIE.
<i>Burhinus grallariu</i>	Bush Stone-curlew	Fallen/standing dead timber including logs	Yes	The subject land is not considered to contain potential habitat for the species. The species is known to inhabit open forests and woodlands with a sparse grassy ground layer and fallen timber. Most of the subject land comprise cleared land with exotic grassland, and the small occurrence of Illawarra Lowlands Grassy Woodland within the subject land is heavily degraded with a thick understorey of mainly <i>Lantana camara</i> . Furthermore, the species is only common still in northern Australia and considered rare or extinct throughout the remainder of its	

former range. Only one previous record of the species has been recorded within a 10km radius, approximately 1 km from the subject land, and was recorded in 2003, hence more than 15 years ago.

<i>Callocephalon fimbriatum</i>	Gang-gang (breeding)	Cockatoo	Eucalypt tree species with hollows greater than 9 cm diameter	Yes	The subject land is not considered to contain potential breeding habitat for the species, as there is no eucalypt tree species with hollows. Additionally, there are no records of the species since 1980 within a 10 km radius according to the TBDC.
<i>Calyptrorhynchus lathamii</i>	Glossy (breeding)	Black-Cockatoo	Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground.	No	The subject land is not considered to contain potential breeding habitat for the species, as there are no trees with hollows greater than 15 cm in diameter. Furthermore, there are no records of the species since 1980 within a 5 km radius according to the TBDC. However, surveys for the species were undertaken as the survey period aligns with the Project timing.

<i>Cercartetus nanus</i>	Eastern Pygmy-possum	None	Yes	The subject land is not considered to contain potential habitat for the species, as the majority of the site is cleared whilst the small occurrences of treed habitat are heavily degraded with a dense understorey of <i>Lantana camara</i> . There are only six known localities from which the species has mainly been recorded; the Piliga area, New England Tablelands, Barren Grounds Nature Reserve-Budderoo National Park, Royal and Heathcote National Parks, Kioloa State Forest and the Eden area. Furthermore, there have been no records of the species since 1980 within a 10 km radius of the subject land.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	Yes	The subject land is not considered to contain potential breeding habitat for the species, as there are no occurrences of caves, overhangs, or mines within the site. The species is generally rare with a patchy distribution. Although the subject land occurs within approximately 2 km from cliffs along the coastline, no suitable foraging habitat is considered to be present within the subject land, as the treed vegetation within the site is highly degraded. The species is assumed to prefer to forage in fertile valleys and plains, as well as areas with moderately-tall to taller trees along watercourses. The subject land is not located within proximity

					to any known populations. Furthermore, there are no records since 1980 within a 10km radius of the subject land.
<i>Haliaeetus leucogaster</i>	White-bellied (breeding)	Sea-Eagle	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Yes	The subject land is not considered to contain potential breeding habitat for the species as it typically nests in tall, large living eucalypt trees within remnant patches of vegetation. The subject land is located at the edge of treed habitat, with no large trees present, and therefore the species would be unlikely to utilise these trees as breeding habitat.
<i>Heleioporus australiacus</i>	Giant Burrowing Frog		Hanging swamps on the top of sandstone plateaus and deeply dissected gullies that occur as erosion features in the Sydney Basin	Yes	The subject land is not considered to contain potential habitat for the species as it is known to be heavily reliant on hanging upland swamps which do not occur within the subject land. Additionally, there are no records of the species since 1980 within a 10 km radius according to the TBDC.
<i>Hieraaetus morphnoides</i>	Little Eagle (breeding)		Nest trees - live (occasionally dead) large old trees within vegetation.	Yes	The subject land is not considered to contain potential breeding habitat for the species as it typically nests in tall, large living trees within remnant patches of vegetation. The subject land is located at the edge of treed habitat, with no large trees present, and therefore the species would be unlikely to utilise these trees as breeding habitat.

<i>Hoplocephalus bungaroides</i>	Broad-headed (breeding)	Snake	Including escarpments, outcrops and pogodas within the Sydney Sandstone geologies	Yes	The subject land is not considered to contain potential habitat for the species as it does not occur within the four general areas of occurrence being the Blue Mountains, southern Sydney, north-west of the Cumberland Plan and the Nowra Hinterland. Additionally, there are no records of the species since 1980 within a 10 km radius of the subject land.
<i>Lathamus discolor</i>	Swift Parrot (breeding)		As per mapped areas	Yes	The subject land does not contain areas of important mapped habitat according to DPIE
<i>Litoria aurea</i>	Green and Golden Bell Frog		Within 1 km of wet areas, swamps, and waterbodies	Yes	The subject land is not considered to contain potential habitat for the species, as it does not occur in close proximity to any known existing population. The closest record of the species occurs approximately 2km south-west of the subject land from ponds associated with a quarry. However, this record is over 15 years old. Furthermore, the subject land does not contain any wet areas, such as swamps or other waterbodies.
<i>Lophoictinia isura</i>	Square-tailed Kite (breeding)		Nest trees	Yes	The subject land is not considered to contain potential breeding habitat for the species, as no suitable nest trees were observed during the habitat assessment and no stick nests were found. The subject land is located at the edge of treed habitat, with no large trees present, and therefore the species would be

						unlikely to utilise these trees as breeding habitat. Furthermore, there have been no records of the species since 1980 within a 5 km radius of the subject land.	
<i>Miniopterus australis</i>	Little (breeding)	Bent-winged	Bat	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.	Yes	Although potential roosting habitat exists within the subject land in the existing derelict dwelling, the subject land is not considered to contain potential breeding habitat for the species, as there are no suitable or known maternity caves within the subject land or close proximity to the subject land. The only records since 1980 within the 10km radius locality are from Albion Park, approximately 5 km north of the subject land.	
<i>Miniopterus oceanensis</i>	<i>schreibersii</i>	Large (breeding)	Bent-winged	Bat	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500	Yes	Although potential roosting habitat exists within the subject land in the existing derelict dwelling, the subject land is not considered to contain potential breeding habitat for the species, as there are no suitable or known maternity caves within the subject land or in close proximity to the subject land. .
<i>Mixophyes balbus</i>		Stuttering Frog		None	Yes	The subject land is not considered to contain potential habitat for the species, as it is only known to occur in two locations south of Sydney to Victoria; around Narooma and near Macquarie Pass.	

<i>Myotis macropus</i>	Southern Myotis	Within 200 m of riparian zone; Bridges, caves or artificial structures within 200 m of riparian zone	No	The subject land may contain potential habitat for the species.
<i>Ninox connivens</i>	Barking Owl (breeding)	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	Yes	There is no suitable potential breeding habitat within the subject land, since there are no trees with hollows greater than 20 cm in diameter.
<i>Ninox strenua</i>	Powerful Owl (breeding)	Living or dead trees with hollow greater than 20cm diameter	Yes	There is no suitable potential breeding habitat within the subject land, since there are no trees with hollows greater than 20 cm in diameter.
<i>Petaurus norfolcensis</i>	Squirrel Glider	None	Yes	The subject land is not considered to comprise potential habitat for the species, as the Squirrel Glider typically inhabits Blackbutt-Bloodwood forest with heath understorey in coastal areas and require abundant tree hollows for refuge and nest sites, none of which are present within the subject land. Additionally, there are no records of the species within a 10 km radius of the subject land.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines	Yes	The subject land is not considered to contain any potential habitat, as it does not contain any land within 1 km of rocky escarpments, gorges, boulder piles or rock outcrops. Furthermore, there are no records since 1980 within a 10km radius of the subject land.

<i>Phascolarctos cinereus</i>	Koala (breeding)		Areas identified via survey as important habitat, defined by the density of koalas and quality of habitat determined by on-site survey	Yes	The subject land is not considered to contain potential habitat for the species. Although the small areas of Illawarra Lowlands Grassy Woodland within the subject land contains a koala feed tree species (<i>Eucalyptus tereticornis</i>), as identified within the 'SEPP 44 - Koala Habitat Protection', Shellharbour LGA is not listed within the SEPP, as Koalas are generally not known to occur in these areas. Furthermore, the mapped occurrence of Illawarra Lowlands Grassy Woodland within the subject land is less than 0.01 ha, hence is not considered to constitute important habitat for the species. No records of the species occur within a 5 km radius of the subject land.
<i>Pteropus poliocephalus</i>	Grey-headed (breeding)	Flying-fox	Breeding camps	Yes	There are no known breeding camps within or directly adjacent to the subject land.
<i>Tyto novaehollandiae</i>	Masked Owl (breeding)		Living or dead trees with hollows greater than 20cm diameter.	Yes	There is no suitable potential breeding habitat within the subject land, since there are no trees with hollows greater than 20 cm in diameter.

5.3.2. Candidate Species for Further Assessment

The following species were identified as candidate species credit species for further assessment;

- Flora:
 - *Cynanchum elegans*;
 - *Daphnandra johnsonii*;
 - *Gossia acmenoides* – endangered population;
 - *Pimelea spicata*;
 - *Rhodamnia rubescens*;
 - *Senna acclinis*; and
 - *Zieria granulata*.
- Fauna:
 - Glossy Black-Cockatoo (breeding); and
 - Southern Myotis.

5.3.3. Presence of Candidate Species

5.3.3.1. Surveys

Targeted surveys for the candidate species credit species for further assessment undertaken within the subject land are summarised in **Table 14**. The methodology of these surveys is detailed further in **Section 2.2** and **2.3**.

It should be noted that no surveys were undertaken for the Southern Myotis, due to the timing of the Project not aligning with the suitable survey months for this species.

Table 14. Surveys undertaken for Candidate Species Credits Species

Species	Suitable Survey Months	Surveys Undertaken	Survey Timing
Flora			
<i>Cynanchum elegans</i>	All year	Parallel field traverse threatened flora surveys	May and July 2019
<i>Daphnandra johnsonii</i>	All year	Parallel field traverse threatened flora surveys	May and July 2020
<i>Gossia acmenoides</i>	All year	Parallel field traverse threatened flora surveys	May and July 2021

<i>Pimelea spicata</i>	All year	Parallel field traverse threatened flora surveys	May and July 2022
<i>Rhodamnia rubescens</i>	All year	Parallel field traverse threatened flora surveys	May and July 2023
<i>Senna acclinis</i>	All year	Parallel field traverse threatened flora surveys	May and July 2024
<i>Zieria granulata</i>	All year	Parallel field traverse threatened flora surveys	May and July 2025
Fauna			
Glossy Cockatoo	Black-	March - August	Diurnal bird surveys
			July 2019

5.3.3.2. Species Occurrence

A summary of the species credit species surveyed within the subject land, including whether they were present during surveys is shown in **Table 15**. Further discussion of the survey results is outlined in subsequent sections. A summary lists of fauna species recorded within the subject land is included in **Appendix B**, whilst a flora species list is provided separately to this document.

Table 15. Summary of Species Credit Species surveyed in the subject land

Species	Present	Method of Identification	Associated Habitat Component	Biodiversity Risk Weighting	SAII Entity
Flora					
<i>Cynanchum elegans</i>	No	Survey	N/A	High	No
<i>Daphnanadra johnsonii</i>	No	Survey	N/A	Very High	Yes
<i>Gossia acmenoides</i> - endangered population	No	Survey	N/A	High	No
<i>Pimelea spicata</i>	No	Survey	N/A	High	No
<i>Rhodamnia rubescens</i>	No	Survey	N/A	Very High	Yes
<i>Senna acclinis</i>	No	Survey	N/A	High	No
<i>Zieria granulata</i>	No	Survey	N/A	High	No
Fauna					
Glossy Black-Cockatoo	No	Survey	N/A	High	No
Southern Myotis	Yes	Assumed Present	PCTs on subject land within 200 m of waterbodies	High	No

i. Threatened Flora Species

Despite threatened flora surveys being conducted across the subject land, no threatened plant species listed under either the EPBC Act and/or BC Act have been recorded within the site and none are considered likely to occur.

Accordingly, no further assessment is required for any threatened flora species and no species credits have been calculated.

ii. Threatened Fauna Species

No threatened fauna species were recorded during field surveys undertaken across the subject land, including targeted surveys for threatened birds. Accordingly, no further assessment is required for the Glossy Black-Cockatoo.

Nevertheless, as the timing of the Project did not align with the suitable survey period for the Southern Myotis, the presence of the species and/or potential habitat for the species within the subject land could not be excluded, hence the species was subsequently assumed as being present within the subject land.

5.3.4. Species Polygons

As the Southern Myotis has been assumed present within the subject land, a species polygon has been created for the purposes of calculating the impacts on Southern Myotis in terms of species credits (see **Figure 12**).

The species polygon for the Southern Myotis was created in accordance with the document 'Species credit threatened bats and their habitats' (OEH 2018b) and includes forest PCTs on the subject land that are within 200 m of waterbodies.

Due to the degraded nature of Vegetation Zone 3, which only comprises scattered Acacia regrowth over exotic grassland and lacks trees, this vegetation zone was not included in the species polygon as no roosting habitat is present for the species (OEH 2019b).

6. Identification of Prescribed Impacts

6.1. Identification of Prescribed Impacts

Prescribed impacts are outlined within the NSW *Biodiversity Conservation Regulation 2017*. The Project is considered to have the potential to result in a number of prescribed impacts outlined in **Table 16**.

Table 16. Identification of prescribed impacts in the subject land

Feature	Present	Feature Characteristics and Location	Potential Impact	Threatened Species or Community Using or Dependent on Feature	Section of BDAR Where Addressed
Karst, caves. Crevices, cliffs or other geologically significant feature	No	N/A	Feature not present in subject land	N/A	N/A
Rocks	No	N/A	Feature not present in subject land	N/A	N/A
Human-made structure	Yes	Existing derelict dwelling	Demolition of potential roosting habitat for microbats	Large Bent-winged Bat, Little Bent-winged Bat	Section 8.3.1
Non-native vegetation	Yes	Exotic grassland and exotic shrubby areas	Reduce extent of potential foraging habitat for species	All fauna species	Section 8.3.2
Connectivity of different areas of habitat that facilitates movement across a species' range	Yes	Vegetated corridor along the south and eastern margin of the subject land, as part of the Illawarra Regional Biodiversity Corridor	Reduce connectivity between habitats and accessibility of habitat for species	All fauna species	Section 8.3.3

Movement of threatened species that maintains their lifecycle	Yes	Vegetated corridor along the south and eastern margin of the subject land, as part of the Illawarra Regional Biodiversity Corridor	Reduced area for foraging and fauna movement corridors	All fauna species	Section 8.3.4
Water quality, water bodies and hydrological processes	Yes	Proximity area to Coastal Wetland in the southern part of the subject land	Stormwater or wastewater run-off, or disturbance of ground water, affecting the Coastal Wetland	Coastal Saltmarsh Swamp Floodplain Mangrove forest TEC, Oak TEC,	Section 8.3.5
Wind turbine strikes	No	N/A	No wind farm proposed on site	N/A	N/A
Vehicle strikes	No	N/A	Although traffic is likely to increase during the construction phase, and across the driveway during the operational phase, impacts to biodiversity are unlikely within the subject land.	N/A	N/A
Other	No	N/A	No additional prescribed impacts identified within the subject land	N/A	N/A

7. Avoid and Minimise Impacts

7.1. Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impact on biodiversity values identified within the subject land. Any mentioning of the development footprint within this chapter is synonymous with the subject land.

7.1.1. Avoid and Minimise Direct Impacts

i. Project Location

The Project has been situated within the subject property to allow for the operational requirements of the site while minimising impacts to areas containing the majority of biodiversity values. The development footprint has been positioned within the north-western portion of the subject property to avoid impacts to high quality remnant native vegetation where possible, including the higher quality remnant vegetation in the north eastern and southern portion of the subject property. Direct impacts on the Coastal Wetland, mapped under the Coastal Management SEPP, have been completely avoided, as well as the majority of mapped areas of TECs in the northern section of the subject property, comprising areas of 'Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion' and 'Illawarra Subtropical Rainforest in the Sydney Basin Bioregion'.

The development footprint is positioned over an area within the subject property containing the lowest biodiversity values, consisting predominantly of the existing derelict dwelling, cleared areas, exotic grassland and weedy areas, and areas comprising scattered Acacia regrowth over exotic grassland. In doing so, the Project has considered the biodiversity values of the vegetation within the subject property and has demonstrated reasonable steps to avoid and minimise impacts based up on the Project location within the subject land.

In summary, the proposed development will avoid and minimise direct impacts on clearing of native vegetation and habitat by:

- Locating the Project predominantly in areas where there are low to no biodiversity values (such as in previously cleared, exotic dominated grassland areas);
- Situating the subject land to minimise clearing of native vegetation that is a TEC;
- Locating the Project to minimise clearing of areas mapped as part of the Illawarra Regional Biodiversity Corridor and land mapped as "Environmentally Sensitive Land" on Council's Terrestrial Biodiversity Map; and
- Locating the Project in the north-western corner of the subject property to reduce impacts to waterways (i.e. the Minnamurra River), wetlands, and associated vegetated riparian corridors.

ii. Consideration of Alternative Locations

Alternative development layouts were considered throughout the planning stage, and the current layout has been developed to respond to ecological and hydrological concerns raised by Council in relation to the Project. The extent of the footprint has been significantly reduced in the easterly direction, to both minimise impacts on TECs, regional biodiversity corridors, and vegetated areas associated with the proximity area of the adjoining

Coastal Wetland. The most recent revision (as shown in **Figure 4**), almost entirely avoids clearing of native vegetation that is part of the more intact patch of vegetation in the north-eastern part of the subject property, which also corresponds to areas mapped as being part of the Illawarra Regional Biodiversity Corridor.

iii. Consideration of Project Design

The Project design has been developed to avoid and minimise clearing of native vegetation and habitats by minimising the clearing footprint to include only the operational footprint and the APZ, which contains the entire construction footprint. All ancillary works for stormwater and wastewater management will be contained within the subject land.

Furthermore, the Project will include as an additional design component the retention of the remaining native vegetation and habitat within most of the remainder of the subject property. The retained vegetation will be managed (with a focus on reducing the abundance of the high threat exotic *Lantana camara*) and protected under a Biodiversity Stewardship Agreement, whilst offering opportunities for walking tracks to be incorporated as part of the eco-tourism Project.

Therefore, by retaining all works within the one development site, and in areas of the least biodiversity values practical, the Project will avoid and minimise direct impacts to native vegetation and habitats through:

- Reducing the overall clearing footprint of the Project, by reconfiguring the design and layout of the resort;
- Locating facilities in areas where the native vegetation or threatened species habitat will be least impacted
- Incorporating the only existing hollow-bearing tree in the design to enable retention of this habitat feature;
- Incorporating comprehensive wastewater management measures, including an Effluent Management Area, and locating the wastewater facilities outside of the 'proximity area' (as mapped under the Coastal Management SEPP) to avoid impacts of wastewater disposal on the downslope Coastal Wetland (Martens Consulting Engineers. 2019d); and
- Ensure that indirect impacts to adjoining Coastal Wetlands and native vegetation are managed and contained, through long-term management under a Biodiversity Stewardship Agreement.

7.1.2. Avoid and Minimise Prescribed Impacts

Measures to avoid and minimise prescribed impacts identified in **Chapter 6** are outlined below.

i. Human-made structures

One existing derelict dwelling with a few associated small connected buildings and underground culverts, which are planned to be demolished as part of the Project, could potentially provide roosting habitat for the threatened Large Bent-winged Bat and the Little Bent-winged Bat.

Given the limited area of land within the subject property on which the Project is located, as well as the design requirements for constructing the resort, impacts to these structures are not able to be avoided as part of the development.

Nevertheless, the human made structures planned to be demolished and removed are not considered to be essential for survival for either the Large Bent-winged Bat or the Little Bent-winged Bat, and adequate mitigation measures (as discussed in **Chapter 9**) will be implemented to minimise the impact to fauna (if any) that may utilise the existing human-made structures for roosting.

ii. Non-native vegetation

The location of the Project and the development design have been focused on avoiding areas of native vegetation, with a specific focus on avoiding areas of TECs. As a result, most of the subject land contains non-native vegetation, in the form of exotic grassland and other exotic vegetation mostly comprised of the high threat exotic *Lantana camara*, which will be cleared as part of the development. Hence, impacts to the areas of non-native vegetation are not able to be avoided as part of the Project

No overstorey vegetation was recorded in the areas of non-native vegetation within the subject land (with the exception of two exotic fig trees located at the entry of the site that will be retained) and due to previous clearing associated with the construction of the existing buildings, it is considered to be too degraded to regenerate to any form of woodland or forest in the foreseeable future. For this reason, the non-native vegetation offers very limited habitat for threatened species.

Although the areas consisting of non-native vegetation may be utilised occasionally as foraging habitat, they are unlikely to be favoured over the adjoining woodland, forest and wetland habitats.

iii. Connectivity of different areas of habitat that facilitates movement across a species' range

The Project has been designed to avoid impacts to native vegetation to the highest extent possible, hence the development will only remove a very small area of native vegetation/habitat along the southern and eastern boundary of the subject land. The vegetation to be removed already consists of low-quality vegetation (*Acacia* regrowth) and of relatively isolated fragments, as well as small edge areas of vegetation from a larger patch, surrounded by pastures and cleared land.

As the subject land is located to the north-west of the main corridor of habitat (mapped as part of the Illawarra Regional Biodiversity Corridor), no fragmentation will occur as a result of the Project, and it is not expected that connectivity will be reduced. Threatened birds and bats, and other fauna, may occasionally utilise this area for movement throughout the landscape and between areas of habitat. However, none are likely to rely on the small areas of native vegetation within the subject land.

iv. Movement of threatened species that maintains their lifecycle

Small patches of degraded native vegetation in the south of the subject land, and small edge areas from a larger patch of forest in the eastern part of the subject land, will be removed as part of the Project. These areas may be used to a limited degree for dispersal and foraging by threatened woodland birds; however, it is considered unlikely that any birds (or other fauna) would be solely reliant or regularly utilising the highly degraded and exposed habitat within the subject land, in favour over the adjoining woodland, forest and wetland habitats.

v. Water quality, water bodies and hydrological processes

As discussed above, the location and design of the development footprint have been modified so that it avoids the majority of the most ecologically significant areas within the subject property, namely several TECs and the Coastal Wetland. Nevertheless, without specific design measures in place there is still potential for impacts to the water quality and hydrological processes of the wetland and associated TECs.

Changes to water quality, water bodies and hydrological processes can affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. This is particularly relevant to the subject property because the majority of habitats within the subject property are mangroves and saltmarsh that are reliant on specific hydrological regimes.

Since the Project has been located in the north-western corner of the subject property, the proposed development will not result in the removal of any mangroves or saltmarsh areas. The proposed development has been developed with particular regard to avoiding impacts to the hydrological processes. With the implementation of the proposed stormwater and wastewater regimes (Martens Consulting Engineers. 2019d), it is expected that any potential impacts to the habitat quality in the areas of retained mangroves and saltmarsh will be avoided.

Furthermore, based on the Project location, excavation associated with the proposed development is not expected to reach groundwater, hence any changes to the ground water table as a result of the Project and associated potential impacts on TECs or the Coastal Wetland are considered unlikely to occur (Martens Consulting Engineers. 2019b).

8. Impact Assessment

8.1. Assessment of Direct Impacts

8.1.1. Impacts on Native Vegetation and Habitat

The primary and direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject land.

8.1.1.1. Impacts on Vegetation Communities

The proposed development will result in the removal of very small areas of Illawarra Lowlands Grassy Woodland and Illawarra Subtropical Rainforest TECs, as well as areas of Acacia regrowth, for the construction of the eco-tourism resort, APZ and ancillary works.

Table 17 identifies the areas of vegetation to be cleared within the subject land.

Table 17. Proposed impacts to vegetation within the subject land

PCT	Condition	TEC	Approximate Area to be removed (ha)
838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Moderate	Illawarra Lowlands Grassy Woodland (BC Act - EEC, EPBC Act - not listed)	0.01
838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Acacia regrowth	Not a TEC	0.27
1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Moderate	Illawarra subtropical rainforest in the Sydney Basin Bioregion (BC Act - EEC, EPBC Act - not listed)	0.17
Exotic Vegetation	N/A	N/A	0.01
Exotic Grassland	N/A	N/A	1.57
Cleared	N/A	N/A	0.59
Total			2.62

8.1.1.2. Loss of Specific Habitat Features

Most of the habitat, albeit degraded habitat, for native fauna in the subject land is in the areas of native vegetation in the form of potential foraging habitat. No hollow-bearing trees occur within the subject land, apart from one exotic fig tree located adjacent to the existing driveway on the western boundary of the site, which contains several small hollows.

All other existing potential habitat features within the subject land is comprised of cracks and ceiling gaps within human-made structures, and wooden rubbish piles in association with the derelict building.

These habitat features are displayed in **Figure 13**.

The Project will result in the loss of all habitat features within the subject land apart from the exotic fig tree with hollows, which will be retained as part of the design. Overall, the removal of the limited number of specific habitat features in the subject land is considered to have only minor implications (if any) for native fauna species due to the already modified state of the site. Although the areas of existing habitats within the subject land may be utilised occasionally, they are unlikely to be favoured over the adjoining woodland, forest and wetland habitats.

8.1.2. Change in Vegetation Integrity Score

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in **Table 18** below.

Table 18. Change in Vegetation Integrity Score

Zone	Name	Approximate Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Change in Vegetation Integrity Score
1	1300_Mod	0.17	26.1	0	-26.1
2	838_Mod	0.01	30.8	0	-30.8
3	838_Acacia	0.27	12.9	0	-12.9

8.2. Assessment of Indirect Impacts

The following indirect impacts to native vegetation and habitat may occur as a result of the Project:

- Inadvertent impacts on adjacent habitat or vegetation;
- Reduced viability of adjacent habitat due to edge effects;
- Reduced viability of adjacent habitat due to noise, dust or light spill;
- Increased sedimentation and erosion; and
- Inadvertent impacts associated with wastewater disposal.

8.2.1. Inadvertent Impacts on Adjacent Habitat or Vegetation

i. Nature and Extent

The land within the subject land has previously been heavily modified through the complete removal of original vegetation for the purposes of the construction of the existing derelict dwelling, as well as associated

earthworks and landfilling of the site. Hence, most of the vegetation to be removed has already been modified by the previous development, apart from some small areas that occur on the edge of a larger patch of vegetation along the eastern boundary of the subject land. Therefore; removal of the small areas of native vegetation and construction activities associated with the new development are unlikely to inadvertently impact on the adjacent habitat beyond existing conditions.

ii. Duration

Inadvertent impacts on adjacent habitat or vegetation are already occurring within the subject land and are predicted to be long-term. However, the impacts are predicted to decrease over time following the construction phase and the introduction of management of landscaped areas and weeding within the subject land.

iii. Likely Affected Threatened Entities

There is a potential for the following entities to be marginally affected:

- Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion TEC;
- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion TEC; and
- Foraging habitat for microbats and woodland birds.

iv. Consequences

The construction of the Project will result in removal of approximately 0.28 ha of native vegetation that has some connectivity to adjacent vegetation and habitats, which could be used by threatened species as they traverse throughout the landscape. However, this vegetation is currently highly degraded and is unlikely to be solely relied upon by any threatened species. Therefore, the consequences of the Project on adjacent habitat or vegetation are not expected to increase significantly beyond existing conditions.

8.2.2. Reduced Viability of Adjacent Habitat Due to Edge Effects

i. Nature and Extent

Edge effects are impacts that occur at the interface between natural habitats, especially forests and disturbed or developed land (Yahner 1988). When an edge is created between woodland and a cleared area, changes to ecological processes within the vegetation can extend between 10 m and 100 m from the edge (Yahner 1988). These include microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006). Edge effects can also result from the increase in noise and artificial light from a project.

The land within the subject land has previously been heavily modified through the complete removal of original vegetation for the purposes of the construction of the existing derelict dwelling, as well as associated earthworks and landfilling of the site. Hence, in its current condition, vegetation and habitat throughout this portion of the subject property is currently subject to existing edge effects as a result of historical clearance associated with the previous development. Subsequently, the removal of additional exotic and small areas of native vegetation within the subject land is unlikely to result in significantly greater edge effects beyond current conditions within the subject property.

ii. Duration

Any impact on adjacent habitat or vegetation is likely to be long term, commencing in the construction phase and continuing throughout the operation phase of the Project.

iii. Likely Affected Threatened Entities

There is a potential for the following entities to be marginally affected by increases edge effects:

- Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion TEC;
- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion TEC; and
- Foraging habitat for microbats and woodland birds.

iv. Consequences

The Project will result in the loss of small areas of native vegetation along the southern and eastern boundary of the subject land. Although there is the potential for the directly adjacent retained vegetation in the subject property to be marginally indirectly impacted by increased edge effects, most concentrated throughout the vegetated interface along the transition between the subject land and retained areas, any increase beyond current conditions are considered unlikely to have a significant impact. The areas of vegetation adjacent to the subject land are already heavily weed infested, with an understorey dominated by the high threat exotic *Lantana camara*. Further colonisation of exotic flora within the remainder of the subject property, is considered unlikely.

Furthermore, the building footprint of the resort will be set back from the retained vegetation through the establishment of an APZ. Hence, any potential edge effects from the operational phase are expected to be minor in comparison to existing conditions.

8.2.3. Reduced Viability of Adjacent Habitat Due to Noise, Dust or Light Spill

i. Nature and Extent

Noise, dust and light spill will be exacerbated by construction activities, resulting from truck movements, machinery and lighting (if night work is proposed). Noise and light spill are also expected to be slightly increased, compared to current conditions, during the operational phase.

ii. Duration

The main increases in noise, dust and light are expected to last in the short-term for the duration of the construction activities of the Project. However, an increase in noise and light beyond current conditions are also expected to be long-term for the duration of the operation of the Project.

iii. Likely Affected Threatened Entities

- Woodland birds (ecosystem credit species);
- Microchiropteran bats (foraging); and
- Grey-headed Flying-fox (foraging).

iv. Consequences

The potential increase in noise, dust and light from the proposed development is unlikely to significantly impact any threatened woodland species that may occasionally utilise adjacent habitat. The area of vegetation is already subject to some levels of noise and light from the surrounding agricultural and residential infrastructure. The minor increase in light, noise and dust from the Project, mainly associated with the construction activities, is unlikely to be such that it would reduce the viability of the already degraded adjacent habitats surrounding the subject land.

8.2.4. Increased Sedimentation and Erosion

i. Nature and Extent

One of the potential indirect impacts of the Project is increased sedimentation of waterways and wetlands, as a result of soil disturbance during construction. Increased sediment and eroded material can smother retained vegetation, cause dieback of herbs and shrubs and reduce regeneration of groundcover species. Sedimentation has the potential to reduce water quality in wetland and riverine environments. Sediment and eroded material can also contain weed matter and nutrients. In the absence of appropriate mitigation measures, the proposed development has the potential to result in increased sedimentation of retained wetlands and saltmarsh areas as a result of soil disturbance from construction activities.

ii. Duration

The impacts due to sedimentation and erosion are likely to be short-term, and occur during the construction phase of the Project.

iii. Likely Affected Threatened Entities

There is a potential for the following threatened entities to be affected:

- Coastal Saltmarsh TEC;
- Swamp Oak Floodplain Forest TEC; and
- Mangrove forest.

iv. Consequences

Increased sedimentation and erosion have the potential to result in degradation, and potentially die-back of TECs within the Coastal Wetland, as well as reduced water-quality. The impact is likely to persist in the short-term, during the construction phase of the Project and will be ameliorated through the implementation of stormwater, sediment and erosion control (Martens consulting Engineers. 2019a).

8.2.5. Inadvertent Impacts Associated with Wastewater Disposal

i. Nature and Extent

Impacts associated with wastewater disposal from the operation of the Project include the disposal of wastewater from kitchen, pool and spas, and accommodation/facilities. The wastewater generated from the Project will be primarily of a domestic character (Martens Consulting Engineers. 2019d). The proposed Effluent

Management Area is to be located in the north-western corner of the subject land, within areas currently covered by exotic grassland and outside of the Proximity Area to the Coastal Wetland.

ii. Duration

The impacts associated with wastewater disposal are likely to be long-term and occur during the operational phase for the lifetime of the Project.

iii. Likely Affected Threatened Entities

There is a potential for the following threatened entities to be affected:

- Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion TEC;
- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion TEC;
- Coastal Saltmarsh TEC;
- Swamp Oak Floodplain Forest TEC;
- Mangrove forest; and
- Foraging habitat for microbats and woodland birds.

iv. Consequences

Inadvertent impacts associated with wastewater disposal are likely to persist in the long-term, and have the potential to cause degradation to several TECs within the subject property and reduce the quality of the existing foraging habitat within the site, as well as impacts to the water quality of the Minnamurra River and the Coastal Wetland. Nevertheless, with the implementation of the proposed wastewater management system, developed by Martens Consulting Engineers (Martens Consulting Engineers. 2019d), inadvertent impacts on the mentioned entities as a result of wastewater disposal are considered unlikely to occur.

8.3. Assessment of Prescribed Impacts

The following prescribed impacts are potentially relevant to the proposal:

- Impacts of the development on habitat associated with human-made structures'
- Impacts of the development on habitat associated with non-native vegetation;
- Impacts of the development on the connectivity of different areas of habitat that facilitates movement across a species' range;
- Impacts of the development on movement of threatened species that maintains their life cycle;
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and

These are discussed in detail in subsequent sections.

8.3.1. Human-made Structures

As mentioned in **Section 7.1.2**, the existing derelict dwelling may contain potential roosting habitat for the threatened Large Bent-winged Bat and the Little Bent-winged Bat. Given the limited area of land on which the development occurs, as well as the consideration to avoid impacts to native vegetation to the greatest extent possible, impacts to these structures are not able to be avoided as part of the Project.

Nevertheless, the human made structures to be removed for the proposed development are not considered to form significant roosting habitat for this species and therefore not considered to be dependent on for survival for the Large Bent-winged Bat or Little Bent-winged Bat. Hence, no significant impacts to these species are expected from the removal of the human made structures on the subject land.

8.3.2. Non-native Vegetation

As the development design have been focused on avoiding areas of native vegetation and locating the development within areas cleared or existing of non-native/ exotic vegetation, the majority of areas of non-native vegetation will be cleared as a result of the Project. Although considered as areas of low ecological integrity, the clearing of non-native vegetation has the potential to reduce foraging habitat for some fauna species.

Although the areas consisting of non-native vegetation may be utilised occasionally as foraging habitat, they are unlikely to be favoured over the adjoining woodland, forest and wetland habitats. Hence, no significant impacts on threatened fauna species are expected from the removal of non-native vegetation within the subject land.

8.3.3. Connectivity of Different Areas of Habitat that Facilitates Movement

As the Project has been designed and located in areas that are predominately cleared, only minor areas of native vegetation on the edge of larger patches will be removed, as well as small areas of already modified vegetation comprising Acacia regrowth. Impacts to the Illawarra Regional Biodiversity Corridor, which runs through the subject property from south-west to north-east, are almost entirely avoided. Therefore, the Project is not considered likely to impact on the connectivity of different areas of habitat that may facilitate movement within the landscape, or to fragment patches of vegetation beyond current conditions.

8.3.4. Movement of Threatened Species that Maintains their Lifecycle

The Project design has aimed to reduce the development footprint where feasible and the current layout will allow for the retention of the majority of high condition native vegetation within the wider subject property, which includes the Coastal Wetland and several TECs. These retained areas will provide for any movement of threatened species required to maintain their lifecycle and will continue to contribute to the larger corridor of habitat mapped across the southern and eastern extent of the subject property (Illawarra Regional Biodiversity Corridor). Hence, no significant impacts on the movement of threatened species that maintains their lifecycle is likely to result from the Project.

8.3.5. Water quality, water bodies and hydrological processes

Changes to areas adjacent to wetlands has the potential to affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. This is particularly relevant to the subject property because the most important habitats are mangroves and saltmarsh that are reliant on specific hydrological regimes. The proposed development will not result in the removal of any areas of wetland habitats. The proposed development has been developed with particular regard to maintaining the hydrological regime in the subject property. With the implementation of the proposed hydrological regimes, including a stormwater design and wastewater management system, it is expected that habitat quality in the Coastal Wetland will not be negatively impacted by the Project (Martens Consulting Engineers. 2019d).

Furthermore, the proposed development is not expected to have any impacts on the groundwater, hence changes to the ground water table as a result of the Project and associated potential impacts on TECs or the Coastal Wetland are considered unlikely to occur (Martens Consulting Engineers. 2019b)

8.4. Assessment of Impacts to Coastal Wetlands

8.4.1. Mapped Coastal Wetlands

Land mapped as Coastal Wetlands under the Coastal Management SEPP occurs in the subject property, as shown in **Figure 2**; however, none occurs in the subject land. Additional areas of Coastal Wetlands occur outside the subject land and subject property along the Minnamurra River to the north and north-west.

No area of SEPP Coastal Wetland will be removed by the Project, and none is located within the subject land. There is the potential for some indirect impacts to occur to the Coastal Wetland within the subject property, through erosion and sedimentation caused by construction works or runoff of stormwater and inappropriate disposal of waste water, however these potential impacts will be managed through the implementation of appropriate mitigation measures, such as erosion and sedimentation control measures, a detailed stormwater design, and a comprehensive wastewater management system (Martens Consulting Engineers. 2019d, a). These measures are described in more detail in the Wastewater Management Plan (Martens Consulting Engineers. 2019d) and the Concept Stormwater Management Plan (Martens consulting Engineers. 2019a), and discussed further in **Chapter 9** of this BDAR. With the implementation of these measures, negative impacts on the nearby areas of Coastal Wetlands are unlikely to occur.

8.4.2. Mapped Proximity Area to Coastal Wetlands

The subject land includes land mapped as 'Proximity Area' to the Coastal Wetlands, which acts effectively as a buffer area to the Coastal Wetland. The majority of the proposed development is contained outside of the Proximity Area, although parts of the APZ and one of the ancillary buildings for the resort are contained in the Proximity Area, in the southern portion of the subject land.

Under the Coastal Management SEPP, development can be carried out in areas mapped "proximity area for coastal wetlands" if the consent authority is satisfied that the proposed development will not significantly impact on the biophysical, hydrological and ecological integrity of the coastal wetland or the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

The clearing of vegetation within the proximity areas in the subject land is not expected to significantly impact the ecological integrity of the Coastal Wetland beyond current conditions, as these areas have previously been heavily modified during the construction of the existing dwelling. Furthermore, the majority of the Proximity Area within the subject land will comprise the APZ, hence these areas will be managed to the standard of an Inner Protection Zone in accordance with the Bushfire Assessment Report (ABPP 2019), and comprise the establishment of managed landscaped gardens with terraced pedestrian walkways (ABPP 2019).

The quality of water entering the wetlands is expected to be equal or improved beyond current conditions, due to the improved active management of stormwater run-off and wastewater management proposed as part of the Project (Martens consulting Engineers. 2019a, d). This will ensure that although some works are proposed in the Proximity Area, including APZ management and one of the ancillary buildings, indirect impacts on Coastal Wetlands will not be exacerbated. As a result, no significant impact on the hydrological integrity is expected on the Coastal Wetland (Martens Consulting Engineers. 2019d).

Furthermore, the proposed development is not expected to have any impacts on the groundwater, hence changes to the ground water table or the quantity and quality of groundwater, as a result of the Project, and associated potential impacts on the Coastal Wetland, are considered unlikely to occur (Martens Consulting Engineers. 2019b).

9. Mitigation

9.1. Mitigation Measures for Impacts to Native Vegetation and Habitat

A range of mitigation measures has been developed for this Project to mitigate the impacts that are unable to be avoided using the measures outlined previously. These include a range of measures to be undertaken before and during construction to limit the impact of construction, enhance the retained vegetation in the subject property and measures to manage weed control, as well as measures to be undertaken for the lifetime of the Project. These measures are discussed in more detail below.

A summary table outlining techniques, timing, frequency, responsibility, risk of failure and the risks and consequences of residual impacts for all proposed mitigation measures are detailed in **Table 19**.

9.1.1. Construction Mitigation Measures

9.1.1.1. Delineation of Clearing Areas

Areas that require clearance will be flagged and clearly delineated by temporary fencing to ensure that no retained areas of vegetation in the subject property will be inadvertently cleared during the construction process. No machinery will be parked on areas beyond the temporary fencing and no access will be allowed during construction. Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

9.1.1.2. Pre-clearance Surveys

In order to avoid impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas that are required to be cleared. Pre-clearing surveys will be undertaken ahead of clearing, to limit fauna injury and mortality and to identify habitat features to be relocated. Pre-clearance surveys will be conducted by suitably qualified ecologists and all fauna found during these surveys will be encouraged to move on or relocated by the ecologists in areas of similar habitat nearby that will not be impacted.

Pre-clearing protocols will include:

- Preparation of an inventory of trees to be removed and relocated, prior to clearing;
- Checking trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling; and
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands.

9.1.1.3. Clearing Supervision

An ecologist will be present while clearing and demolition of the buildings to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All staff working on the vegetation clearing/ building demolition will be briefed about the possible fauna present and should avoid injuring any present;

- Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

Provision of a report following the completion of clearing works will be provided detailing the total number and species of individuals recorded and details of their release/health.

9.1.1.4. Weed Management

In order to minimise the spread of weeds throughout the subject land and spread of weeds present in the subject land to areas outside of it, appropriate weed control activities will be undertaken in accordance with all state, regional and local weed management plans. The subject land lies within the South East Local Land Services Area and is subject to the South East Regional Strategic Weed Management Plan 2017 – 2022 (NSW Local Land Services) and management of Weeds of National Significance (WoNS).

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high-risk activities, as provided in the Appendices of the South East Regional Strategic Weed Management Plan.

The objectives of the management plan (2017) are:

- Prevention: preventing the entry of new risks into NSW;
- Eradication: quickly finding, identifying and eradicating threats where possible;
- Containment: quickly finding, identifying and containing threats; and
- Minimisation: effectively minimising the impacts of those pests, diseases and weeds that cannot be eradicated.
- In order to comply with the objectives of the South East Regional Strategic Weed Management Plan, it is recommended the following measures be implemented for the subject land.

i. Prevention

Appropriate site hygiene measures will be implemented to prevent entry of new weeds to the area, such as the use of wash bays.

ii. Eradication

Initial weed management will be carried out over the subject land according to best-practice methods under the direction of a suitably qualified bush regenerator. The targeted species will be those listed under Appendices 1 and 2 of the South East Regional Strategic Weed Management Plan. Initial weed treatment will include eliminating woody species and targeting large dominant infestations of exotic herbs. This may be achieved via a combination of manual weed removal and herbicide use.

iii. Containment

Follow-up monitoring and maintenance should be undertaken in areas of the subject land that have received past primary weeding treatments in the following months, to contain any re-emergence of weed species.

iv. Minimisation

Minimisation of weed species that cannot be effectively controlled on the site, such as exotic grasses, will be prevented from further spread through construction and operational phase site hygiene procedures.

9.1.1.5. Stormwater, Sediment and Erosion Control

Stormwater run-off, sedimentation and erosion is proposed to be managed through the implementation of sediment fencing, shaker pads, geo-textile inlet filters, and earth banks, in addition to management and appropriate location of stockpiles. The Concept Stormwater Management Plan (Martens consulting Engineers. 2019a) for the Project will ensure that adequate sediment and erosion control measures are applied prior to and throughout construction. Additionally, site run-off will be managed throughout the operational stage by a stormwater design comprising stormwater pipelines, surface inlet pits, infiltration trenches and rainwater tanks, to use rainwater for irrigation and discharge stormwater into ground and spread overflows as per existing conditions (Martens consulting Engineers. 2019a).

9.1.2. Wastewater Management Measures

In order to mitigate any potential impacts arising from the disposal of wastewater associated with the Project, a comprehensive wastewater management system have been developed as outlined in detail with the Wastewater Management Plan (Martens Consulting Engineers. 2019d). The wastewater management system will involve the establishment of an Effluent Management Area, which will be located in the north-eastern corner of the subject land, outside the Proximity Area to the Coastal Wetland. Wastewater management measures will be undertaken during the operational phase for the lifetime of the Project.

9.2. Mitigation Measures for Prescribed Impacts

9.2.1. Human-made Structures

As mentioned within **Section 9.1.1.2**, pre-clearance surveys are proposed to be implemented in order to avoid impacts to fauna species during construction. The pre-clearance surveys will also extend to the existing human-made structures, to identify habitat features or fauna needed to be relocated.

Pre-clearance surveys will be conducted by suitably qualified ecologists ahead of the demolishing of the buildings, and all fauna found during these surveys will be encouraged to move on or relocated by the ecologists in areas of similar habitat nearby that will not be impacted.

9.2.2. Non-native Vegetation

Although the areas consisting of non-native vegetation may be utilised occasionally as foraging habitat, they are unlikely to be favoured over the adjoining woodland, forest and wetland habitats. Hence, no fauna species or habitat features are expected to be present in these areas. Nevertheless, the pre-clearance surveys will be extended to include areas of non-native vegetation, where considered appropriate, and will be conducted in accordance with the information outlined in **Section 9.1.1.2**.

9.2.3. Connectivity of Different Areas of Habitat that Facilitates Movement

As previously stated, the vegetation to be removed already consists of modified vegetation or trees on the edge of larger patches, hence no significant impacts to the connectivity of different areas are expected. Nevertheless, to ensure that the connectivity provided by the Illawarra Regional Biodiversity Corridor remains in the subject property, the majority of the remainder of the vegetation in the subject property is proposed to be conserved and managed under a Biodiversity Stewardship Agreement in perpetuity.

9.2.4. Movement of Threatened Species that Maintains their Lifecycle

The Project design has aimed to reduce the development footprint where feasible and the current layout will allow for the retention of the majority of high condition native vegetation within the wider subject property, which includes the Coastal Wetland and several TECs. These retained areas will continue to provide for any movement of threatened species required to maintain their lifecycle and will continue to contribute to the larger corridor of habitat mapped across the southern and eastern extent of the subject property (Illawarra Regional Biodiversity Corridor). Furthermore, to ensure that the connectivity provided by the Illawarra Regional Biodiversity Corridor remains in the subject property, the majority of the remainder of the subject property is proposed to be conserved and managed under a Biodiversity Stewardship Agreement in perpetuity.

9.2.5. Water quality, water bodies and hydrological processes

The Project has been developed with particular regard to maintaining the hydrological regime in the subject property. With the implementation of the proposed hydrological regimes, including a stormwater design and a wastewater management system, it is expected that habitat quality in the Coastal Wetland will not be negatively impacted by the Project (Martens consulting Engineers. 2019a, d)

Furthermore, the proposed development is not expected to have any impacts on the groundwater, hence changes to the ground water table as a result of the Project and associated potential impacts on TECs or the Coastal Wetland are considered unlikely to occur (Martens Consulting Engineers. 2019b).

9.3. Adaptive Management of Uncertain Impacts

The Project is considered unlikely to result in any uncertain impacts that require adaptive management as listed in Section 9.4.2 of the BAM.

Table 19. Summary of Mitigation Measures

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
Construction and operational mitigation measures for impacts to native vegetation and habitat						
Delineation of clearing areas	Areas to be cleared will be clearly delineated by temporary fencing to ensure no areas intended for retention will be inadvertently cleared during the construction process.	Construction phase	Throughout construction period	Contractor	Low	Unnecessary damage to trees to be retained; and increased and unnecessary mortality of native fauna
Pre-clearance surveys	Pre-clearance surveys will be conducted in all areas of vegetation required to be cleared or altered. Pre-clearing surveys will be undertaken within one week of clearing, to limit fauna injury and mortality.	Construction phase	Throughout construction period	Contractor	High	Unnecessary damage to trees to be retained; and increased and unnecessary mortality of native fauna.
Clearing Supervision	Clearing supervision will be conducted in all areas of vegetation required to be cleared as well as the demolition of the buildings.	Construction phase	Throughout construction period	Contractor	High	Unintentional displacement, injury or mortality of native fauna.

	Displaced or injured fauna will be captured.					
Weed Management	Appropriate weed control activities will be undertaken in accordance with all state, regional, and local weed management plans.	Construction phase	Throughout construction period	Contractor	High	Spread of weeds throughout the subject property, including the Coastal Wetland.
Sediment Control	Installation of sediment fences, shaker pads, geo-textile filters, earth banks, and management of stockpiles.	Construction phase	Throughout construction period	Contractor	High	Sedimentation into nearby Coastal Wetland and Minnamurra River
Wastewater Management Measures	Implementation of a Wastewater Management System	Operational Phase	Over the lifetime of the Project	Contractor/Resort Staff	High	Wastewater impacts on nearby Coastal Wetland and Minnamurra River
Mitigation measures for prescribed impacts						
Human-made Structures	Pre-clearance surveys will be conducted existing buildings requiring demolition. Pre-clearing surveys will be undertaken within one week of clearing, to limit fauna injury and mortality.	Construction phase	Throughout construction period	Contractor	High	Unnecessary damage to trees to be retained; and increased and unnecessary mortality of native fauna.
Non-native Vegetation	Pre-clearance surveys will be conducted in all areas of vegetation required to be	Construction phase	Throughout construction period	Contractor	High	Unnecessary damage to trees to be retained; and increased and unnecessary mortality of native fauna.

	cleared or altered. Pre-clearing surveys will be undertaken within one week of clearing, to limit fauna injury and mortality.					
Connectivity of habitat that facilitates movement	Retention of remainder of well-connected vegetation in the subject property under a Stewardship Agreement	Operational phase	Over the lifetime of the Project	Contractor/Landowner	Moderate	Reduced connectivity within the subject property over time.
Movement of threatened species that maintains their lifecycle	Retention of remainder of well-connected vegetation in the subject property under a Stewardship Agreement	Operational phase	Over the lifetime of the Project	Contractor/Landowner	Moderate	Reduced connectivity within the subject property over time.
Water quality, waterbodies, and hydrological processes	Implementation of stormwater design and wastewater management system,	Construction and operational phase	Throughout construction period and over the lifetime of the Project	Contractor/Resort staff	High	Impacts on water quality and hydrological processes of the Coastal Wetland

10. Impact Summary

10.1. Assessment Thresholds

Unavoidable impacts of the Project have been considered and a determination made of the assessment thresholds. The following sections outline the assessment thresholds and their relevance to the Project.

10.1.1. Impacts to Potential Serious and Irreversible Impact Entities

No Serious and Irreversible Impact entities will be directly or indirectly impacted as a result of the Project.

10.1.2. Impacts that Require an Offset

i. Native Vegetation

In accordance with the BAM, the Project requires offsets for the clearing of native vegetation as the following criterion is met:

- A vegetation zone that has a vegetation integrity score ≥ 15 where the PCT is representative of an EEC or CEEC.

The PCTs and vegetation zones requiring offsets, and the number of ecosystem credits required, are documented in **Table 20**, whilst the areas requiring offsets are mapped in **Figure 14**.

Please note that although vegetation zone 3 is not associated with a TEC, it was selected as 'Illawarra Lowlands Grassy Woodland TEC' in the calculator due to vegetation zone 2 corresponding to a limited degree to the aforementioned TEC. The current version of the BAM calculator does not enable selection of both 'TEC' and 'not a TEC' for the same PCT. This issue has been reported to DPIE but is yet to be fixed. Nevertheless, no offsetting liability is associated with vegetation zone 3 since the Vegetation Integrity Score is below 15.

Table 20. Ecosystem credit liability

Zone	PCT	TEC	Approximate Area (ha)	Credits	Offset Required?
1	1300_Mod	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	0.17	2	Yes
2	838_Mod	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	0.01	1	Yes
3	838_Acacia	Not a TEC	0.27	0	No

ii. Threatened Species

An offset is required for one threatened species impacted by the Project that is determined to be a species credit species. The relevant species and associated species credits required are documented in **Table 21** below.

Table 21. Species credit liability

Species Credit Species	Zone	Habitat Condition (Vegetation Integrity) Loss	Approximate Area of Habitat Lost	Credits
Southern Myotis	1_1300_Mod	24.1	0.17	2

2_838_Mod	30.8	0.01	0
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10.1.3. Impacts that do not Require an Offset

Impacts to vegetation zone 3 are not required to be offset, as previously discussed in **Section 10.1.2.i** and shown in **Table 20**, due to the vegetation integrity score being less than 15.

Furthermore, all areas identified as 'Exotic Grassland' and 'Exotic Vegetation' within the subject land do not require an offset. These areas comprise approximately 1.58 ha (see **Figure 15**).

Although the Project has the potential to cause a number of indirect and prescribed impacts, as outlined in **Section 8.2** and **8.3** respectively, the mitigation measures that are outlined in **Chapter 9** will reduce and control the likelihood of these impacts. Therefore, it is considered that there will be no residual impact in relation to indirect or prescribed impacts and as a result, these impacts do not generate an offset requirement.

10.1.4. Impacts that do not Require Further Assessment

All areas identified as 'Cleared' that occur within the development site do not require further assessment, in accordance with the BAM. These areas comprise approximately 0.59 ha and are shown in **Figure 16**.

10.2. Summary of Offset Credits Required

The ecosystem credit requirement for the Project is summarised in **Table 22**, whilst the 'like for like' offsetting options for the ecosystem credits are provided in **Table 23**.

One species credit species requires an offset: the Southern Myotis. The species credit requirement for the Project is summarised in **Table 24**, whilst the 'like for like' offsetting options for the ecosystem credits are provided in **Table 25**.

A credit report from the BAM calculator has been included in **Appendix C**.

Table 22. Summary of ecosystem credit liability

PCT	TEC	Approximate Area (ha)	Credits Required
838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion *	0.28	1
1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	0.17	2
Total		0.45	3

* Only 0.01 ha of PCT 838 conforms to the TEC, as previously discussed in earlier Chapters of this BDAR.

Table 23. Like for like offsetting options for PCTs

Original PCT to be offset	Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
838	Illwarra Lowlands Grassy Woodland in the Sydney Basin Bioregion, including PCT 838 and 1326	No	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalt or any IBRA subregion that is within 100 km of the outer edge of the impacted site
1300	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion, including PCT 906, 1300	No	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalt or any IBRA subregion that is within 100 km of the outer edge of the impacted site

Table 24. Summary of species credit liability

Species	Approximate Area (ha)	Credits
<i>Myotis macropus</i> / Southern Myotis	0.18	2

Table 25. Like for like options for species credits

Only the below species	In the below IBRA subregions
<i>Myotis macropus</i> / Southern Myotis	Any in NSW

11. Conclusion

This BDAR has been prepared to assess the impacts of the proposed development on biodiversity values, utilising the BAM. The Project involves the demolition of an existing derelict building and construction of an eco-tourism development within the subject land.

Native vegetation occurring within the subject land includes small areas of Illawarra Lowlands Grassy Woodland TEC and Illawarra Subtropical Rainforest TECs, which extend beyond the subject land in an easterly direction within the subject property. An area of Acacia regrowth over exotic-dominated grassland is also present within the subject land, however the ecological value associated with this vegetation is considered to be low. A mapped Coastal Wetland occur south of the subject land, in the wider subject property, which comprise Coastal Saltmarsh TEC, Swamp Oak Floodplain TEC and mangroves.

The proposed development will include the demolition of an existing derelict building and construction of an eco-tourism development and associated APZ, and will predominantly avoid TEC vegetation, and will not remove any areas of Coastal Wetlands.

As the Project includes the removal of some areas of native vegetation, a small number of offsets are required in the form of ecosystem credits. This assessment indicates that the removal of the native vegetation within the subject land requires a total of 3 ecosystem credits, comprising of PCT 838 and PCT 1300.

No threatened flora was recorded within the subject land and none are considered likely to occur. Similarly, no candidate fauna species credit species were identified during field surveys. However, in the absence of fauna surveys for the Southern Myotis, the aforementioned predicted species credit species have been assumed present. Therefore, potential impacts to the habitat of the Southern Myotis identified in this assessment will need to be offset with the provision of 2 species credits.

Further impacts of the Project may entail indirect impacts and prescribed impacts, including impacts on hydrological processes in relation to the wetland. Nevertheless, mitigation measures are proposed to minimise the impacts to biodiversity values and maintain the hydrology required for the health and survival of the adjacent wetland in the subject property. Furthermore, it is proposed that most of the remainder of the subject property including the Coastal Wetland will be conserved and managed in perpetuity under a Biodiversity Stewardship Agreement.

With the implementation of the proposed mitigation measures and the offsetting described previously, it is considered that the impacts of this Project on biodiversity, in particular on TECs and threatened fauna habitat, will be minimal and can be appropriately managed.

12. References

- ABPP. 2019. Bushfire Protection Assessment for the Construction of the Proposed Eco-Tourism Accommodation on Lot 3 in DP717776 No. 71 Fig Hill Lane, Dunmore.
- Botanic Gardens Trust. 2019. PlantNET. National Herbarium of NSW, Royal Botanic Garden, Sydney.
- DEC (NSW). 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities. Working Draft. Department of Environment and Conservation (NSW), Sydney.
- DoEE. 2019. Directory of Important Wetlands in Australia.
- DPIE. 2019. Threatened Biodiversity Profile Search.
- Eco Logical Australia. 2015. Biometric Vegetation Compilation.
- Lindenmayer, D. B. and J. Fischer. 2006. *Habitat fragmentation and landscape change: An Ecological and Conservation Synthesis*. Island Press, Washington D.C.
- LLS: North West, editor. 2017. North West Regional Strategic Weed Management Plan 2017 - 2022. Local Land Services NSW.
- Martens consulting Engineers. 2019a. Concept Stormwater Management Plan.
- Martens Consulting Engineers. 2019b. Preliminary Acid Sulfate Soil Assessment: Proposed Eco Tourist Facility - 71 Fig Hill Lane, Dunmore, NSW.
- Martens Consulting Engineers. 2019c. Preliminary Geotechnical Assessment: Proposed Eco Tourist Facility - 71 Fig Hill Lane, Dunmore, NSW.
- Martens Consulting Engineers. 2019d. Wastewater Management Plan: Proposed Eco-Tourism Development - 71 Fig Hill Lane, Dunmore, NSW.
- NSW Government. 2011. Illawarra Biodiversity Strategy.
- NSW Local Land Services. 2017. South East Regional Strategic Weed Management Plan 2017-2022.
- NSW Scientific Committee. 2011. Illawarra lowlands grassy woodland in the Sydney Basin Bioregion - endangered ecological community listing. *in* Office of Environment and Heritage (NSW), editor., Hurstville.
- NSW Scientific Committee. 2011. Illawarra Subtropical Rainforest in the Sydney Basin Bioregion - Determination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act.
- OEH. 2016. NSW Guide to Surveying Threatened Plants. Office of Environment and Heritage,, Sydney.
- OEH. 2018a. BioNet Atlas. Office of Environment and Heritage.
- OEH. 2018b. 'Species credit' threatened bats and their habitats. NSW survey guide for the Biodiversity Assessment Method. Office of Environment and Heritage, Sydney.
- OEH. 2019a. eSPADE. *in* OEH, editor.
- OEH. 2019b. Southern Myotis - Profile. NSW Office of the Environment and Heritage, Hurtsville.
- Shellharbour City Council. 2013. Shellharbour Local Environmental Plan 2013.
- TSSC. 2016. Approved conservation advice (incorporating listing advice) for the Illawarra and south coast lowland forest and woodland ecological community.
- TSSC. 2019. Conservation Advice (incorporating listing advice) for Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion.
- Yahner, R. H. 1988. Changes in wildlife communities near edges. *Conservation Biology* **2**:333-339.

APPENDIX A :

BAM Plot Data

Table 26. BAM Plot Data

plot	pct	area	patchsize	conditionclass	compTree	compShrub	compGrass	compForbs	compFems	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFems	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLeafLitterLogs	funTreeStem 5to10	funTreeStem 10to20	funTreeStem 20to30	funTreeStem 30to50	funTreeStem 50to80	funTreeRegen	funHighlightExotic
1	838	0.01	101	Zone 1_Mod	3	2	1	0	0	2	45.1	10.1	0.1	0.0	0.0	0.5	0	0	81.0	0.0	1	1	1	1	2	1	97.2
2	1300	0.17	101	Zone 2_Mod	6	1	1	2	0	3	15.9	25.0	2.0	0.3	0.0	1.7	0	0	77.0	0.0	1	1	1	1	0	1	98.1
3	838	0.27	101	Zone 3_Acacia	2	0	1	2	0	1	15.5	0.0	0.1	0.4	0.0	0.1	0	0	33.0	0.0	1	1	1	0	0	1	4.2

APPENDIX B :

Fauna Species List

Table 27. Fauna species recorded in the subject land

Family	Scientific Name	Common Name	Exotic	BC Act	EPBC Act
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill		-	-
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren		-	-
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite		-	-
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra		-	-
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie		-	-
Artamidae	<i>Strepera graculina</i>	Pied Currawong		-	-
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah		-	-
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		-	-
Cacatuidae	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo		-	-
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing		-	-
Columbidae	<i>Streptopelia chinensis</i>	Spotted Dove	*	-	-
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough		-	-
Corvidae	<i>Corvus coronoides</i>	Australian Raven		-	-
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch		-	-
Hirundinidae	<i>Petrochelidon ariel</i>	Fairy Martin		-	-
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow		-	-
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren		-	-
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill		-	-
Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's Honeyeater		-	-
Meliphagidae	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater		-	-
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird		-	-
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater		-	-
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-Lark		-	-
Monarchidae	<i>Myiagra cyanoleuca</i>	Satin Flycatcher		-	-
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		-	-
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote		-	-
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote		-	-
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin		-	-
Psittacidae	<i>Alisterus scapularis</i>	Australian King Parrot		-	-
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella		-	-
Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		-	-
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird		-	-
Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird		-	-

Pycnonotidae	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	-	-
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail	-	-
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	-	-
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling	-	-
Threskiornithidae	<i>Threskiornis moluccus</i>	Australian White Ibis	-	-
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	-	-

Key: * Denotes exotic species

APPENDIX C :

Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00015257/BAAS17027/19/00015258	17231 - Development Site	27/09/2019
Assessor Name	Report Created	BAM Data version *
David Robertson	10/10/2019	15
Assessor Number	BAM Case Status	Date Finalised
BAAS17027	Finalised	10/10/2019
Assessment Revision	Assessment Type	
3	Part 4 Developments (General)	

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion								
2	838_Moderate	30.8	0.0	0.25	High Sensitivity to Potential Gain	2.00		1
3	838_Acacia	12.9	0.3	0.25	High Sensitivity to Potential Gain	2.00		0
							Subtotal	1

Assessment Id	Proposal Name
00015257/BAAS17027/19/00015258	17231 - Development Site

BAM Credit Summary Report

Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion							
1	1300_Moderate	26.1	0.2	0.25	High Sensitivity to Potential Gain	2.00	2
						Subtotal	2
						Total	3

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
Myotis macropus / Southern Myotis (Fauna)						
1300_Moderate	26.1	0.17	0.25	2	False	2
838_Moderate	30.8	0.01	0.25	2	False	0
					Subtotal	2

FIGURES



Legend

- Subject Land
- Subject Property

Image Source:
NearMap
(dated 29-3-2019)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Shellharbour LGA

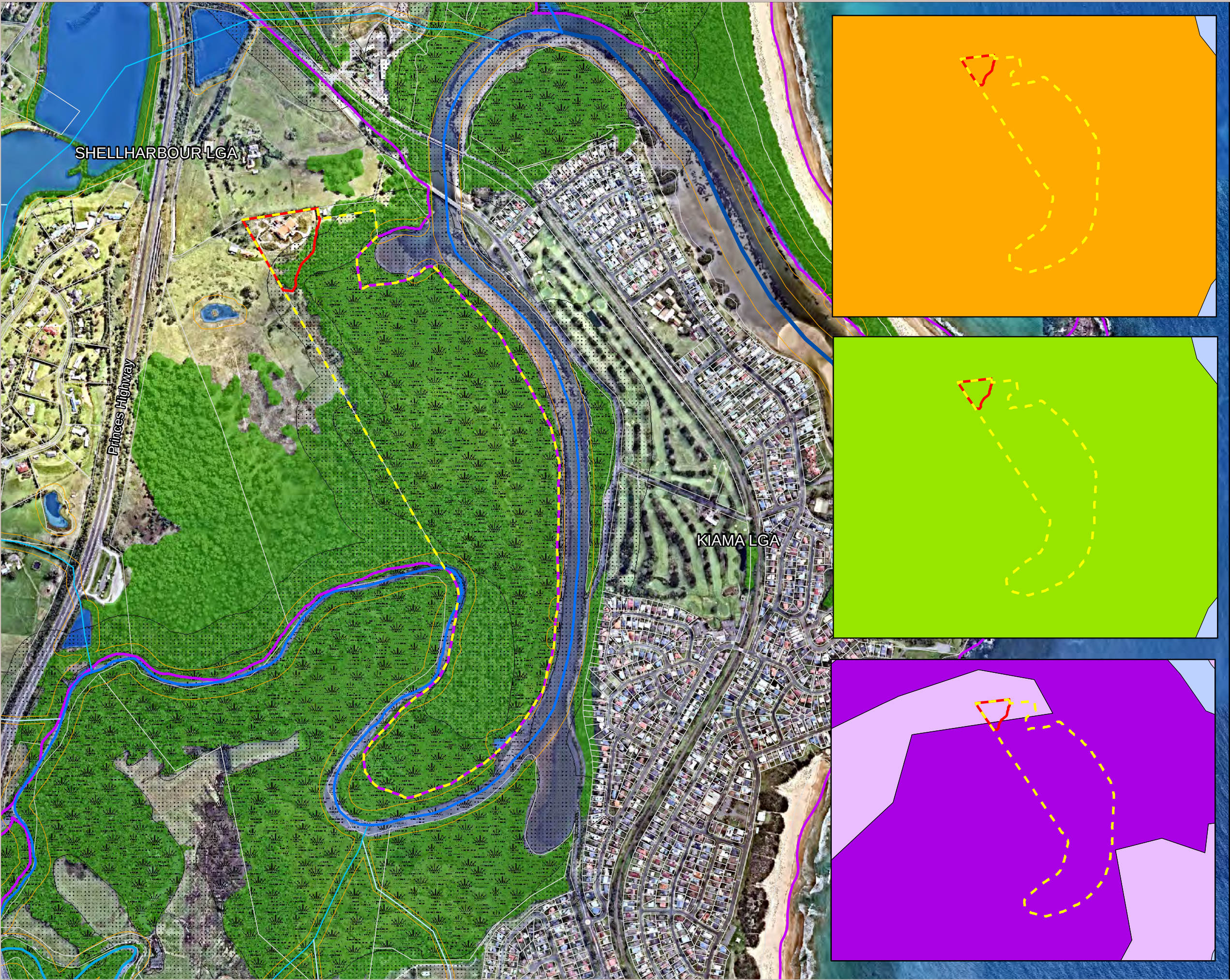
Coordinate System: MGA Zone 56 (GDA 94)



cumberland
ecology

0 100 200 300 m

Figure 1. The subject land and subject property



Legend

Subject Land

Subject Property

Cadastre

Native Vegetation Cover

LGA Boundary

Coastal Wetland

Coastal Wetland Proximity Area

Local Wetland

Rivers and Streams

1st Order Stream

2nd Order Stream

3rd Order Stream

4th Order Stream

5th Order Stream

6th Order Stream

Riparian Buffers

IBRA RegionSydney BasinWater**IBRA Subregion**IllawarraWater**Mitchell Landscape**Kiama Coastal SlopesLake Illawarra Alluvial PlainsWater

Image Source:
NearMap
(dated 29-3-2019)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Shellharbour LGA;
DSEWPaC (2012). Interim
Biogeographic Regionalisation for Australia
(IBRA) - Version 7.1;
DECCW (2008). Landscapes (Mitchell)
of NSW - Version 3.1;
LPI (2001). New South Wales
DCDB Local Government Area
Boundaries;
State Government of NSW and DPIE
(2018).SEPP Coastal Management
- Coastal
Wetlands.

Coordinate System: MGA Zone 56 (GDA 94)

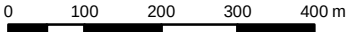
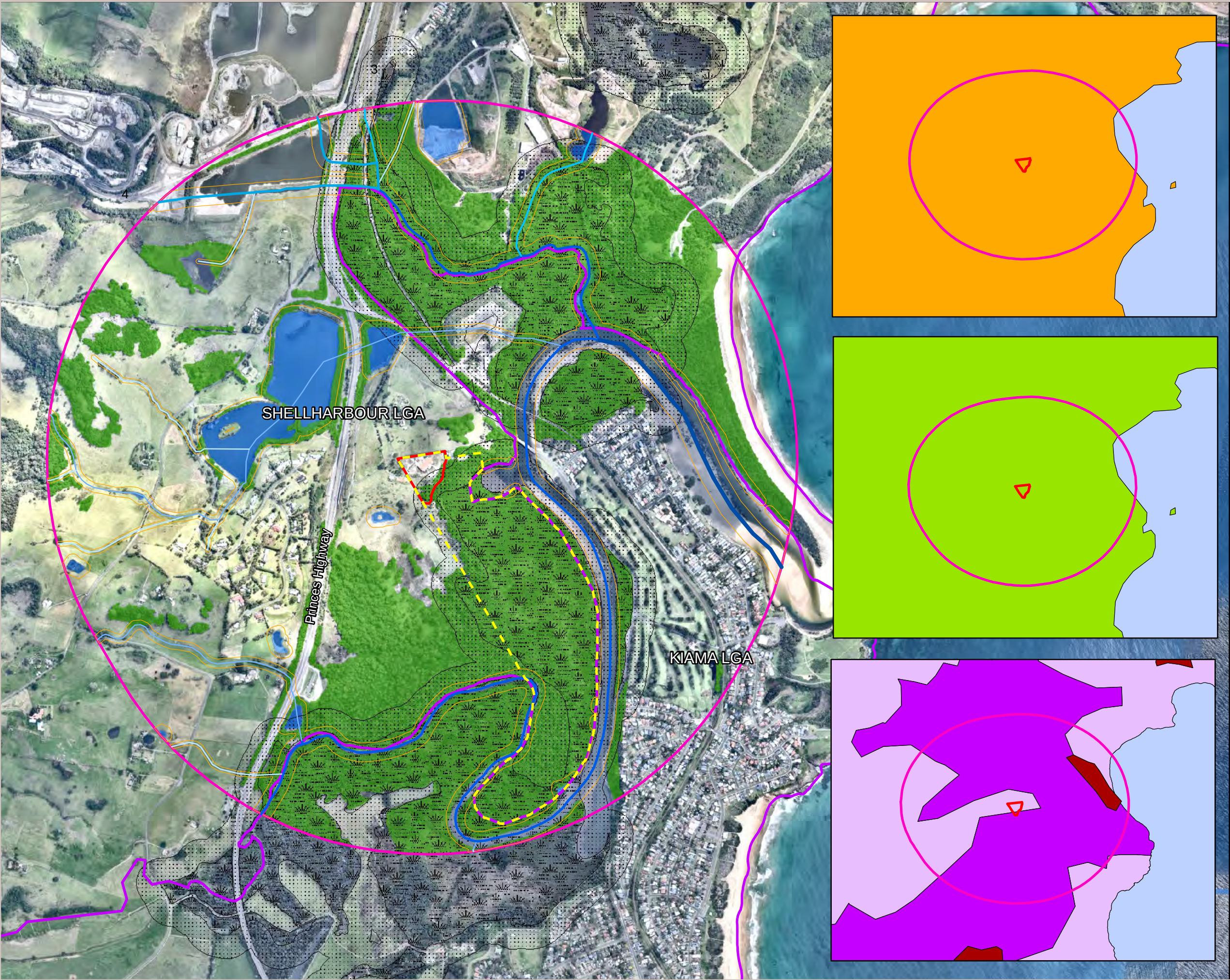


Figure 2. Site Map



Legend

- Subject Land
- Subject Property
- Assessment Area
- Native Vegetation Cover
- LGA Boundary
- Coastal Wetland
- Coastal Wetland Proximity Area
- Local Wetland

Rivers and Streams

- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- 5th Order Stream
- 6th Order Stream
- Riparian Buffers

IBRA Region

- Sydney Basin
- Water

IBRA Subregion

- Illawarra
- Water

Mitchell Landscape

- Kiama Coastal Slopes
- Lake Illawarra Alluvial Plains
- Lake Illawarra Barrier
- Water

Image Source:
NearMap
(dated 29-3-2019)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Shellharbour LGA;
DSEWPac (2012). Interim
Biogeographic Regionalisation for Australia
(IBRA) - Version 7.1;
DECCW (2008). Landscapes (Mitchell)
of NSW - Version 3.1;
LPI (2001). New South Wales
DCDB Local Government Area
Boundaries;
State Government of NSW and DPIE
(2018). SEPP Coastal Management -
Coastal Wetlands.

Coordinate System: MGA Zone 56 (GDA 94)

cumberland
ecology

0 500 1,000 1,500 2,000 m

Figure 3. Location Map



Figure 4. Development Layout

Image Source: NordonJago Architects (2019)



Legend

Subject Land

Subject Property

Flora Survey Locations

BAM Plot (20 x 20m)

BAM Midline

Targeted Threatened Flora Survey (May 2019)

Targeted Threatened Flora Survey (July 2019)

Fauna Survey Locations

Bird survey location

PCT

PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (Acacia Regrowth)

PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

PCT 1126: Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (degraded)

Exotic Vegetation

Exotic Grassland

Cleared

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)





0 20 40 m

Figure 5. Survey locations



Legend

- Subject Land
- Subject Property
- Environmentally Sensitive Land (Council Terrestrial Biodiversity Map)
- Illawarra Regional Biodiversity Corridor

Image Source:
NearMap
(dated 29-3-2019)

Data Source:
OEH (2015), Illawarra
Region BIO Map Corridors.;
Shellharbour Council (2013)
Shellharbour LEP 2013 -
Terrestrial Biodiversity Map.

Coordinate System: MGA Zone 56 (GDA 94)



Figure 6. Illawarra Regional Biodiversity Corridor and Environmentally Sensitive Land within the subject land



Legend

Subject Land

Vegetation Extent

Native Vegetation

Exotic Vegetation

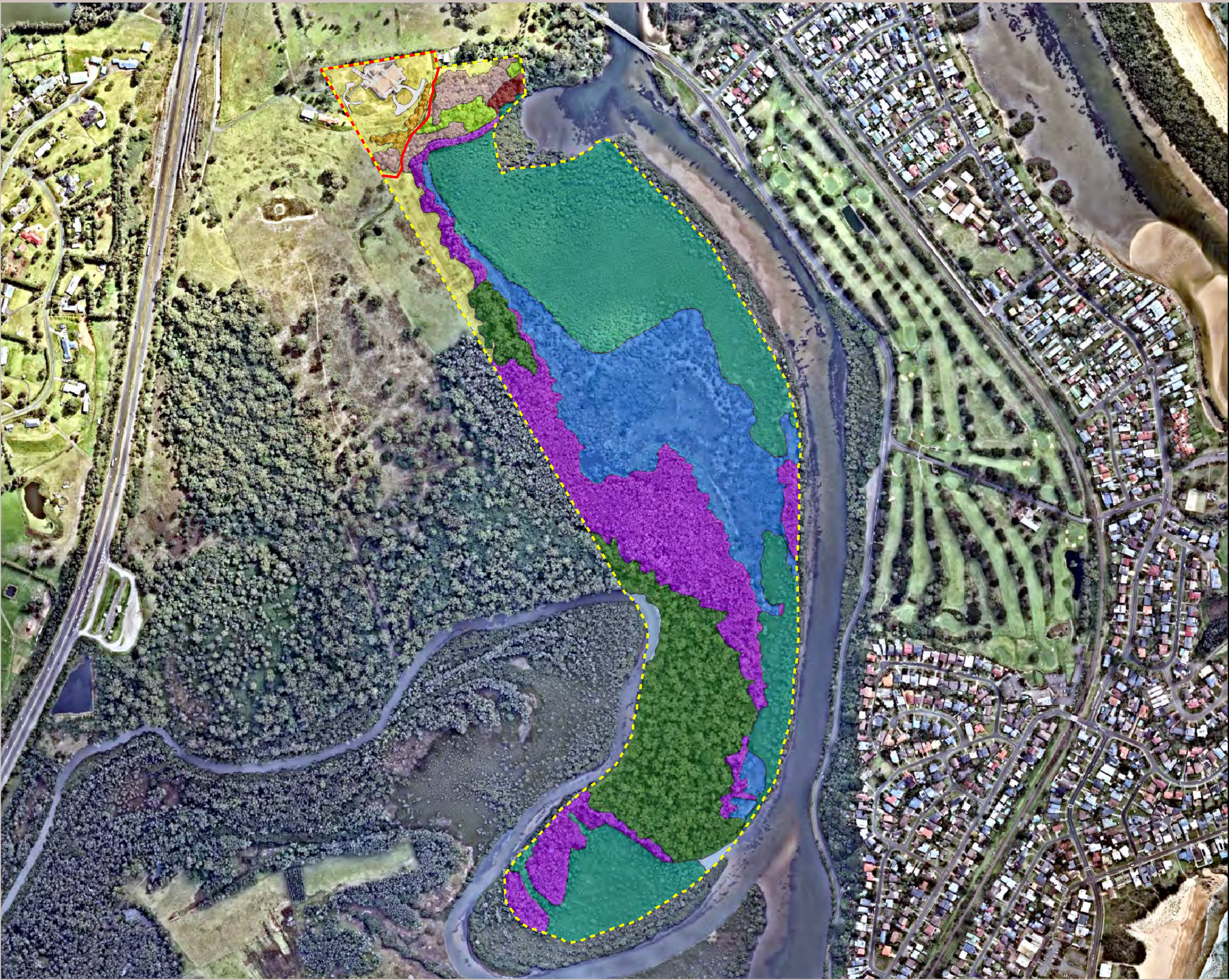
Cleared

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)



Figure 7. Native vegetation extent within the subject land



Legend

- Subject Land
- Subject Property
- PCT**
 - PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion
 - PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (Acacia Regrowth)
 - PCT 910: Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion
 - PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
 - PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion
 - PCT 1126: Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
 - PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion
 - PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (degraded)
 - Exotic Vegetation
 - Exotic Grassland
 - Cleared
 - Water

Image Source:
NearMap
(dated 29-3-2019)



Coordinate System: MGA Zone 56 (GDA 94)



0 50 100 150 200 m

Figure 8. PCT mapping within the subject property



Legend

Subject Land

PCT

PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

Image Source:
NearMap
(dated 29-3-2019)



Coordinate System: MGA Zone 56 (GDA 94)

cumberland
ecology

0 10 20 30 m

Figure 9. PCTs within the subject land



Legend

- Subject Land
- TEC**
- Illawarra Lowlands Grassy Woodland (BC Act: EEC)
- Illawarra subtropical rainforest in the Sydney Basin Bioregion (BC Act: EEC)

Image Source:
NearMap
(dated 29-3-2019)



Coordinate System: MGA Zone 56 (GDA 94)



Figure 10. Threatened Ecological Communities (TECs) within the subject land



Figure 11. Vegetation zones within the subject land



Legend

- Subject Land
- Species Polygon**
 - Southern Myotis

Image Source:
NearMap
(dated 29-3-2019)



Coordinate System: MGA Zone 56 (GDA 94)



Figure 12. Species polygon



Legend

- Subject Land
- Habitat Features**
- Existing derelict building (roof cavities potentially suitable as roost sites for microbats)
- Rainforest
- Grassy Woodland
- Acacia shrubland
- Fairy martin/swallow nests
- Hollow-bearing tree
- Wooden rubbish pile

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)



Figure 13. Habitat features of the subject land



Legend

Subject Land

Vegetation Zone

Zone 1_1300_Mod

Zone 2_838_Mod

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)

Figure 14. Impacts that require an offset



Legend

Subject Land

Vegetation Zone

Zone 3_838_Acacia

Non-native Vegetation

Exotic Vegetation

Exotic Grassland

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)



Figure 15. Impacts that do not require an offset



Legend

-  Subject Land
-  Cleared Areas

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)

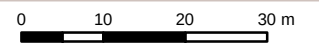


Figure 16. Impacts that do not require futher assessment

From: [Cecilia Eriksson](#)
To: [Stephen Nordon](#)
Cc: ["Tony Peterson"](#); ["David Moodie"](#)
Subject: Minnamurra development - BDAR credit calculations
Date: Monday, 16 September 2019 1:51:05 PM

Hi Stephen,

As discussed, I will send through our draft Biodiversity Development Assessment Report (BDAR) by COB Fri 20 Sep. However, to assist with your meeting tomorrow I have outlined some information below in regards to the credit calculations that will be the main result from our BDAR, as well as the structure/content of our report and some other information.

1. BDAR structure

Our BDAR will be structured in the following way:

Chapter 1 - Introduction: General introduction of site, development footprint, existing environment, etc;

Chapter 2 - Methodology: Describes the methods used in our field surveys;

Chapter 3 - Landscape Features: Requirement under the BAM, describing landscape features in the site and wider assessment area;

Chapter 4 - Native Vegetation: Requirement under the BAM, describing native vegetation within the site and wider property, including plant community type (PCT) selection and justification, Threatened ecological communities (TECs) etc.;

Chapter 5 - Threatened Species: Requirement under the BAM, assessing potential threatened species that may occur for the purpose of calculating species credits;

Chapter 6 - Identification of prescribed impacts: Requirement under the BAM, identifying potential prescribed impacts;

Chapter 7 - Avoid and Minimise Impacts: Requirement under the BAM, outlining measures taken to avoid and minimise the impact of the development in regards to location and design of the project;

Chapter 8 - Impact assessment: Assessing direct impacts, indirect impacts, and prescribed impacts in accordance with the BAM. Will also include assessment of impacts on Coastal Wetland proximity area under the Coastal Management SEPP;

Chapter 9 - Mitigation: Describing proposed mitigation measures for direct, indirect and prescribed impacts;

Chapter 10 - Impact Summary: Outlines the credit liability for ecosystem credits and species credits;

Chapter 11 - Conclusion

2. BAM Credit calculations

I have completed the credit calculations for ecosystem credits (credits associated with clearing native vegetation) and the results are presented below. I will still need to do some further work regarding the species credit species, however there might be some species credits for some bat species that we will need to assume present as (as previously mentioned) the survey season for these bats do not start until November. The species credit liability (if any) will be included in the

draft that I am sending you on Friday.

The following should be noted regarding the table below:

- Areas in the BAM calculator are automatically rounded up to two decimals;
- The clearing of the Acacia regrowth area does not generate a credit liability due to the low condition of the vegetation (which is what I was hoping for);
- The cost included is only relevant to today's date and may increase/decrease depending on the market. It only relates to the option to pay into the Biodiversity Conservation Fund to offset your impacts;
- If you will go ahead with the onsite stewardship site for offsetting you will need to include some areas of the Illawarra Lowlands Grassy Woodland and Dry Subtropical Rainforest located east of the development site to offset these impacts, as the impacts cannot be offset by the credits further south on your site (need to be matching Plant community types and TECs);
- The credits for the remainder of your site can be sold on the market;
- Once the credit calculations are submitted in the online BAM calculator, the BDAR (i.e. the DA) needs to be submitted to the consent authority within 14 days. Hence, I will not submit/finalise the calculations until you have specified the actual submission date for the DA.

Vegetation Community	Zone	PCT	Area (ha)	Credits	Cost to pay into Biodiversity Conservation Fund (BCT)	Cost incl GST to pay into the BCT
Subtropical Dry Rainforest	1	1300	0.16	2	\$18,104.10	
Illawarra Lowlands Grassy Woodland	2	838	0.01	1	\$8,831.36	
Acacia Regrowth	3	838	0.27	0	\$0.00	
			0.44	3	\$26,935.46	\$29,629.01

Please note that I have assumed total clearance of existing vegetation within the APZ, however if this is not the case, please advise and I may need to adjust the calculations for the final BDAR.

3. Assessment of impact on proximity area to Coastal Wetland

The assessment of the impact on a proximity area to a Coastal Wetland (as mapped under the Coastal Management SEPP) is a very important part of our BDAR. As previously mentioned, the SEPP states the following regarding development within the proximity area:

" Development consent must not be granted to development on land identified as "proximity area for coastal wetlands" or "proximity area for littoral rainforest" on the Coastal Wetlands and Littoral Rainforests Area Map **unless the consent authority is satisfied that the proposed development will not significantly impact on:**

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal

wetland or littoral rainforest."

Our report will largely rely on the findings and the mitigation measures proposed in Marten's reports for the hydrological and groundwater components for this section, hence I will need Marten's final reports before finalising our final BDAR.

4. Setting up a biodiversity stewardship site/onsite offset site

This may have been mentioned to you before, during our investigations for the stewardship site, however I thought I would mention it again. It is likely that if the DA is approved for the development, the consent conditions will say that prior to any construction taking place the credit liability will need to be retired/met.

In regards to timing for the onsite stewardship site, based on our experience to date, we recommend that you account for about 12 months time for the stewardship agreement to be finalised by the government (should you decide to go ahead with this). Prior to this a Biodiversity Stewardship Site Assessment report, management plan and TFD spreadsheet will need to be prepared for the application.

Depending on the timing of the development, the other option is obviously either to seek credits on the market or to pay into the Biodiversity Conservation Fund to offset the credit liability.

5. Management Plans as part of the DA

Following your meeting on Tuesday, could you please confirm which (if any) management plans will be included in the DA? I.e. are there any Soil and Water management plans, or Landscape management plans, etc. I will incorporate this in my mitigation section (if there are any).

If you have any further questions during the meeting tomorrow, please feel free to give me a call.

Regards,

Cecilia Eriksson Pinatacan | Senior Project Manager/GIS Specialist

Cumberland Ecology | Sydney - Brisbane

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