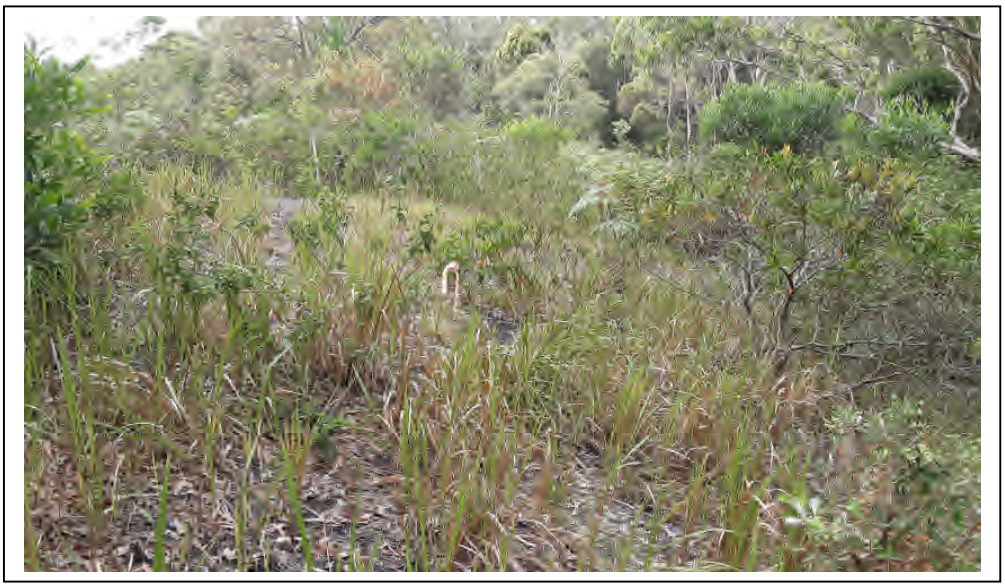
BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

Ilmenite Stockpile Rehabilitation Project

Point Plomer Road, Crescent Head NSW



Prepared for

Greencoast Environmental Rehabilitation

by

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June 2020

Report No. *2002001RP1*

The preparation of this report has been in accordance with the brief provided by the Client and in compliance with the requirements of the *Biodiversity Assessment Method Order* 2020. Assessments provided therein have relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances, including the outcomes from the Biodiversity Assessment Method process. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted.

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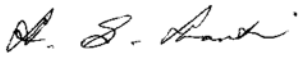
Signed:	
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Glossary of Terms and Abbreviations

BAM Biodiversity Assessment Method Order 2020 (NSW)

BC Act Biodiversity Conservation Act 2016 (NSW)

BC Reg Biodiversity Conservation Regulation 2017 (NSW)

BDAR Biodiversity Development Assessment Report

BOS Biodiversity Offsets Scheme

BV Biodiversity Value

Cth Commonwealth

DA Development Application

Dbh Diameter breast height

DPIE Department of Planning, Industry and Environment

[the] Impact Area/Footprint Proposed area for resource recovery

EPBC Act *Environment Protection and Biodiversity Conservation Act 1999* (Cth)

Impact Area Area of direct impact (=site)

KFT Koala Food Tree

HTW High Threat Weed

IBRA Interim Biogeograhic Region of Australia

LGA Local Government Area

NPWS NSW National Parks and Wildlife Service

NSW New South Wales

OEH Office of Environment and Heritage

Site Area subject to direct impacts (actual proposed resource recovery area)

Stockpile Area of the ilmenite resource and potential resource recovery area

Subject Property Refers to entire property encompassing the Ilmenite stockpile and the Impact Area as well as the surrounding areas of vegetation

TEC Threatened Ecological Community

[the] Subject property The entire Lot 2281, DP 1153793 encompassing the proposed resource recovery area

SEARs Secretary's Environmental Assessment Requirements

Executive Summary

S.1 BACKGROUND AND PURPOSE

Greenloaning was commissioned to prepare a Biodiversity Development Assessment Report for the proposed removal and subsequent rehabilitation of an ilmenite stockpile at Lot 2281 on DP 1153793, Point Plomer Road, Crescent Head, New South Wales. The stockpile/resource recovery site is a former mineral separation plant or 'dry mill' that ceased operation in 1985. The subject property is located within Crown land approximately 1km south of the township of Crescent Head and 0.5 km west of the Pacific Ocean. The purposes of the Crown reserve are: Environmental Protection and Public Recreation.

As part of the assessment process relating to biodiversity, Greenloaning have determined that a Biodiversity Development Assessment Report is required for the proposed resource recovery operations on the basis of part of the subject property and proposed resource recovery area being mapped as of 'High Biodiversity Value' as shown on the Biodiversity Value Map under the *Biodiversity Conservation Act 2016 (NSW).* Since being abandoned around 30 years ago, the site has been left to regenerate naturally which has resulted in both native species and weed infestations, in particular Lantana (*Lantana camara*).

Greencoast Environmental Rehabilitation is seeking approval under the *Mining Act 1992* (NSW) to remove the Ilmenite stockpile down to natural ground level and subsequently rehabilitate the stockpile footprint, which covers an area of approximately two hectares. The resource recovery operation would entail clearing of the following:

- the regenerating, albeit highly disturbed vegetation occurring on/within the stockpile, including a small number of isolated immature/young mature trees; and
- a small patch of regenerating (young mature) Swamp Oak (*Casuarina glauca*), representing a regenerating form of Swamp Oak swamp forest;

The total area of clearing comprises 1.35ha, encompassing .09ha of regenerating Swamp Oak swamp forest (not representing a Threatened Ecological Community in this form) and 1.26ha of vegetation previously cleared and regenerating to varying degrees (not-representing a Threatened Ecological Community). The small patches of remnant forest/woodland occurring in the north and south of the stockpile will be retained and no other disturbance to the surrounding vegetation will occur.

The primary purpose of this report is to provide an assessment of the biodiversity values of the proposed resource recovery area that is in compliance with the requirements of the *Biodiversity Conservation Act 2016* and the *Biodiversity Assessment Method Order 2020*. The report also will provide details on any credit requirements for the proposed resource recovery, as per the NSW Biodiversity Offset Scheme and address any additional requirements under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

S.2 KEY SITE ATTRIBUTES

The site is located within the Kempsey Local Government Area. The shire falls within the NSW North Coast Interim Biodiversity Regionalisation for Australia Region and Macleay-Hastings Subregion. The Impact Area footprint is located on an Alluvial Plain System of Quaternary alluvial and colluvial fan comprising fluvial sand, silt, gravel and clay, which extends to the south of the site. The soils immediately south of the stockpile have a high probability of occurrence of Acid Sulfate Soils, while the soils under the stockpile itself have not been assessed.

The topography of the subject property surrounding the stockpile is flat with a gradual south east slope towards the beach. The elevation of the stockpile varies from 6m to 13m. Removal of the stockpile is expected to result in a ground profile similar to the surrounding gently undulating topography. The drainage of the stockpile and underlying ground surface (quartz sand) reflects the low runoff and high infiltration capacity of black and quartz sand. A shallow drainage trench on the eastern boundary of the stockpile is likely to be a relic from sand mining operations and tends to contain standing water at the southern end. Two first order streams occur in close proximity but outside the proposed resource recovery footprint. There are no Important Wetlands within close proximity to the site as defined in "A Directory of Important Wetlands in Australia" (Department of Agriculture, Water and the Environment 2022)

At a broad scale, the subject property falls entirely within the North East NSW Fauna Corridor and the North East NSW Climate Change Corridor, is surrounded by NPWS Estate and is adjacent to Fauna Key Habitats. At a local scale, the subject property is primarily vegetated, supporting a mixture of remnant and regenerating native vegetation communities and exotic species. The total extent of native vegetation within a 1500m buffer area extending from, and including the subject property, has been calculated as 62%.

The total area of native vegetation inside the buffer area is contiguous and extends for considerable distances outside the buffer area and forms one patch which exceeds the maximum patch class size of >100ha under the Biodiversity Assessment Method process.

S.3 ASSESSMENT METHODS

The primary aims of the assessment procedures were to obtain appropriate data for the impact assessment process, and to comply with the *Biodiversity Assessment Method Order 2020* requirements. Integral to the assessment process has been the due consideration of relevant procedures as required under the BAM, whilst also taking into account the limited nature of the proposed resource recovery and specific site attributes. Thus there has been a robust desktop assessment process, in conjunction with site-specific surveys, the latter focusing primarily on vegetation community attributes via plot sampling, general and threatened plant species surveys and target threatened fauna species surveys. Specific procedures included small mammal Elliott trapping, spotlighting, harp trapping, microbat call detection, hair tube trapping and Koala SAT Plot sampling.

S.4 KEY SURVEY RESULTS

S.4.1 Flora

Five Plant Community Types have been identified as occurring on the subject property, viz;

1. PCT 686 - Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion

2. PCT 1064 - Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion
3. PCT 1230 - Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion and
4. PCT 1235 - Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion; and
5. PCT 1536 - Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest.

The remnant and regenerating vegetation with the Impact Area have been assigned to Plant Community Type 1230 and Plant Community Type 1235 on the basis of species occurrence recorded in plot data in 2019/2020. However, these community identifications are considered as 'best fit' only and should be viewed in the context of recognising that the vegetation occurring on an ilmenite stockpile would not be representative of a natural system. Neither Plant Community Type on the stockpile represents a swampy system.

The surveys yielded 66 native plant species overall, as well as 10 weed species, of which seven were High Threat Weeds as listed under the *Biodiversity Conservation Act 2016.*

S.4.2 Fauna

Fauna surveys yielded 20 bird species, 10 mammal species and three reptile species occurring within the subject property, the majority from within habitats occurring on the stockpile. Additional species would be expected to be recorded over time but the majority of species would be expected to frequent the forest/woodland habitats outside the proposed Impact Area.

S.4.3 Threatened Species

No threatened flora species were recorded during the site surveys, although there is always some potential for threatened species to occur. This would be most likely within the more extensive and higher condition habitats adjoining the stockpile area.

Two threatened mammal species were recorded during field surveys. The Koala (*Phascolarctos cinereus)*, was recorded from one pellet sample within the northern forest woodland remnant to be retained within the stockpile footprint. The results indicate the stockpile habitats to be 'low use' habitat for the species. Microbat detection surveys also yielded one record of the Little Bent-winged Bat (*Miniopterus australis*). One threatened bird species, the Little Lorikeet, was tentatively identified flying through the subject property. None of these three species would have any reliance on the habitats occurring within the resource recovery /proposed Impact Area, although they may pass through/over the area. The lorikeet and microbat also could use the habitat for very limited foraging purposes. Two other threatened mammal species, the Brush-tailed Phascogale (*Phascogale tapoatafa*) and the Common Planigale (*Planigale maculata*), were not detected during the field surveys. However, owing to some limitations in the surveys in the context of additional survey requirements under the *Biodiversity Assessment Method Order 2020* and logistical issues with sampling techniques, these species were assumed to be present for the purposes of the assessment process.

S.5 IMPACT ASSESSMENT

Clearing of a total of approximately 1.35 ha of previously cleared and regenerating land, much of which has substantial HTW infestations, is unavoidable if the proposed resource recovery project is to proceed. The extent of clearing has been minimised however, by ensuring the resource recovery operations are to be located within the existing previously cleared area and not impinge on the small

remnant forest/woodland areas supporting Koala Food Trees and old growth/large mature trees, nor on the adjoining forested areas representing Threatened Ecological Communities. The clearing operations trigger the requirement for a total of 3 ecosystem credits to be retired under the Biodiversity Offset Scheme.

There will be some minor increases in habitat fragmentation within the ilmenite stockpile footprint for the duration of the resource recovery process and subsequent early stages of regeneration/rehabilitation of the Impact Area. There also will be some short term (approximately 36 weeks) increase in diurnal noise levels during weekdays. However, no threatened flora or fauna species is considered likely to be significantly adversely affected by the clearing activities and subsequent works within the resource recovery area. A range of mitigation measures are proposed to minimise any risks of physical damage to Koala Food Trees and habitat to be retained, and injury to fauna species from clearing operations or ongoing resource recovery procedures.

The proposed management measures, encompassing preparation and implementation of a site-specific Revegetation/Rehabilitation Plan, are expected to improve the habitat value of the Impact Area and stockpile per se over time. The overall outcome will be protection of existing, albeit low use, Koala habitat within the subject property, a relatively short term loss of the current limited biodiversity values within the Impact Area, and in the longer term, a net gain in biodiversity stockpile area.

S.6 CONCLUSIONS

The following conclusions have been made on the basis of the Biodiversity Assessment Method process for the project:

- The subject property forms part of a patch of remnant and regenerating bushland, well connected with other coastal vegetation in the area and represents part of a defined wildlife corridor and key fauna habitat area;
- The total extent of native vegetation within the 1500 m buffer for the subject property has been estimated to be 62%;
- The resource recovery/Impact Area and subject property, have been subject to substantial past disturbances associated with sand mining operations in the 1950s to 1980s. The ilmenite stockpile was formed during the course of the sand mining activities;
- The majority of the resource recovery /Impact Area has been cleared previously, these areas supporting varying stages and forms of natural regeneration, as well as some dense Lantana infestations. Only two small patches of remnant forest/woodland remnant and regenerating vegetation remain within the general stockpile area;
- Five Plant Community Types have been identified as occurring on the subject property, with the identification of Plant Community Types occurring on the stockpile considered as 'best fit' only. Vegetation occurring on the ilmenite stockpile would not be representative of a natural system;;
- Both Plant Community Types identified within the resource recovery /Impact Area can represent Threatened Ecological Communities but the occurrence of these communities on an elevated ilmenite stockpile renders both communities as not conforming to the definition of the associated Threatened Ecological Communities listed under the *Biodiversity Conservation Act 2016*,

- No threatened flora species has been detected on the subject property, or within the resource recovery /Impact Area, although there remains minor potential for such species to occur in the main body of vegetation beyond the ilmenite stockpile to be retained,;
- One threatened fauna species, the Koala, was detected from one Koala pellet in one of the remnant forest/woodland patches to be retained. The results indicate that the stockpile habitat represents 'low use' Koala habitat;
- There was a tentative record of another threatened fauna species, the Little Lorikeet, flying through the subject property and microbat detection surveys yielded one record of the Little Bent-winged Bat. None of these three species would have any reliance on the habitats occurring within the resource recovery /Impact Area, although they may pass through/over the area. Two small mammal species, the Brush-tailed Phascogale and Common Planigale have been assumed to be present on the site;
- Development of the site will require the clearing of a total of 1.35 ha of regenerating vegetation, comprising 1.26 ha of low condition Plant Community Type 1230, and 0.09 ha of moderate condition Plant Community Type 1235. No old growth or large mature trees will be removed and the majority of young trees to be removed are less than 20 cm diameter breast height;
- The potential for Serious and Irreversible Impacts associated with the project appears to be minimal;
- The two patches of remnant and regenerating forest/woodland supporting Koala Food Trees will be retained and protected;
- All vegetation beyond the resource recovery /Impact Area, which encompasses some areas of Threatened Ecological Communities, will be retained and protected from disturbance during the course of the resource recovery operations;
- Eleven credits are required to be retired for each of the two threatened fauna species assumed to be present (the Brush-tailed Phascogale and the Common Planigale), and he proposed clearing activities also trigger the requirements for 3 ecosystem credits to be retired;
- The detailed measures required to protect vegetation to be retained, and to rehabilitate and revegetate the ilmenite stockpile post resource recovery operations will be provided in a site specific Revegetation/Rehabilitation Management Plan prior to the commencement of works on the subject property;
- The project will result in a short term loss in existing, but limited biodiversity values within the resource recovery /Impact Area, and short term increases in local noise levels (non-continuously over 36 months). The overall outcome in the long term however, is expected to be an improvement in biodiversity on the subject property.

S.7 RECOMMENDATIONS

The following broad measures are recommended to minimise short term risks of damage to habitat to be protected or injury to fauna during clearing operations, and to maximise the potential for long term positive biodiversity outcomes from the resource recovery project as a whole:

- All clearing and construction works follow best practice procedure, incorporating the measures provided in **Chapter 6** of this BDAR; and
- Habitat regeneration, enhancement processes and weed control measures be detailed in a site-specific Revegetation/Rehabilitation Management Plan for the property.

1 Introduction and Site Context

1.1 INTRODUCTION AND BACKGROUND

Greenloaning was commissioned to prepare a Biodiversity Development Assessment Report (BDAR) for the proposed rrecovery and subsequent rehabilitation of an ilmenite stockpile at Lot 2281 on DP 1153793, Plomer Road, Crescent Head, NSW. The location of the proposed resource recovery area and associated subject property as a whole is indicated on **Figure 1** and **Figure 2**. The ilmenite will be transported offshore for reprocessing via a depot in South Kempsey and the Port of Newcastle (PS, 2019). A mineral separation plant previously operated on the site until 1985 in association with coastal sand mining activities (DoI, 2017). As the ilmenite stockpile is material from former sand mining activities (DoPE, 2017), it is likely to be classified as waste by the Environmental Protection Authority (EPA, 2017). The stockpile is located within (Mining) Exploration Licence 8085, held under Crown Reserve No. 1003 268 and comprises approximately 47,500m³ covering an area of 19,623m² (EPA, 2017).

In November 2017, Pandanus Solutions was appointed by the client, Greencoast Environmental Rehabilitation (GER), to prepare an Environmental Impact Statement (EIS), which is a requirement of the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (Resources and Geosciences) (PS, 2019). The EIS requirements include addressing the Biodiversity Assessment Method provisions of the revised *Biodiversity Conservation Act 2016* (NSW) (BC Act) for a Development Application with Kempsey Shire Council (KSC). The project subsequently has been determined to be a State Significant Project, for which a biodiversity assessment is required.

Greenloaning determined that a BDAR is required for the resource recovery, based on part of the subject property being mapped as of 'High Biodiversity Value,' as shown on the Biodiversity Value Map (BV Map) (Department of Planning, Industry and Environment, 2022) (refer to **Figure 3**)**.** The BV Map forms part of the Biodiversity Offsets Scheme Threshold and is one of the triggers for determining whether the Biodiversity Offset Scheme (BOS) applies to a clearing or development proposal (s7.3, *Biodiversity Conservation Regulation 2017* (NSW) [BC Reg]). The BDAR is required to be prepared according to the *Biodiversity Assessment Method Order 2020 (NSW)* (the BAM). A site-based assessment is required and the 1500m buffer zone for the subject property is required to be used to assess native vegetation cover under s 3.2 of the BAM, as shown on **Figure 3**. Further details on the legislative and planning context for the proposed resource recovery, in the context of biodiversity, are provided in **Chapter 2** of this report.

GER is seeking approval under the *Mining Act 1992* (NSW) to remove the Ilmenite stockpile down to natural ground level and subsequently rehabilitate the stockpile footprint, which covers an area of approximately two hectares (ha) (PS, 2018). The boundary of the stockpile (the potential resource recovery/impact area) and vegetation occurring within, in the context of the subject property, is shown on **Figure 4**. The area proposed for resource recovery comprises the stockpile and access track, the majority of which appears to have been abandoned and left to revegetate naturally, although there are some larger/old growth trees which must have been present prior to stockpile placement.

The occurrence of these trees is discussed in detail in **Section 4.2.1** of the BDAR and general site attributes are discussed in **Section 1.4.4**.

The resource recovery would entail clearing of the following:

- the regenerating vegetation occurring on/within the stockpile, including a small number of isolated trees; and
- a small patch of regenerating (young mature) Swamp Oak (*Casuarina glauca*), representing a regenerating form of Swamp Oak swamp forest; and

These areas all conform to the definition of 'native vegetation' under the BC Act. Although the forest communities can represent Threatened Ecological Communities, the occurrence of these communities on the stockpile render their status as not conforming to the respective TEC definitions (REFS). This is discussed further in Section 4.2.1 of this BDAR.

The total area of clearing comprises 1.35ha, encompassing .09ha of Swamp Oak swamp forest and 1.26ha of previously cleared and regenerating vegetation, with some areas of heavy weed infestation (refer to **Sections 4.2 and 6.2**). The small patches of remnant forest/woodland occurring in the north and south of the stockpile will be retained and no other disturbance will occur in the surrounding vegetation (PS, 2019).

The resource recovery and subject property area have been the subject of previous studies, which have been drawn upon as background for this BDAR. These studies are included in the full reference list and bibliography provided at the end of the body of this report, but also are listed below as key sources of information for the BDAR:

- Greencoast Environmental. 'Stockpile Rehabilitation Crescent Head'. Site Survey report prepared by Pandanus Solutions for Greencoast Environmental Rehabilitation, Feb 2018. (PS, 2018);
- Pandanus Solutions. 'Crescent Head Ilmenite Stockpile Economic Rehabilitation Project - Environmental Impact Statement'. Prepared by Pandanus Solutions, December 2019 for Greencoast Environmental Rehabilitation as part of an application for Development Consent over Lot 2281/DP 115793, for Extractive Industries, section 1.5, Part 4 – Designated Development under the *Environmental Planning and Assessment Act (1979).* Submitted to Kempsey Shire Council. (PS ,2019);
- JB Enviro, 2018 'Preliminary Biodiversity Development Assessment Report for Rezoning of Lot 703 and 704 DP749885 and part Lot 707 DP1032859, Crescent Head Rd, Crescent Head'. Submitted to Kempsey Shire Council September 2018 (JBE, 2018);
- Biodiversity Value Map (Department of Planning, Industry and Environment 2020/2022a);
- Kempsey Shire Council website https://www.https://www.kempsey.nsw.gov.au/);
- SEED data Portal (DPIE, 2020d/2022b);
- BioNet Vegetation Classification Data Collection (DPIE, 2020e);
- BioNet Atlas (DPIE, 2020f);
- Threatened Species Profiles DPIE, 2020g);
- Atlas of Living Australia (ALA, 2020).

1.2 PURPOSE OF REPORT

The primary purpose of this BDAR is to provide an assessment of the biodiversity values of the proposed resource recovery area, which is in compliance with the requirements of the BC Act and the BAM 2020. This BDAR represents an update from the BDAR prepared for the project under the BAM 2027 and submitted in April 2020. The report will provide details on any credit requirements for the proposed resource recovery, as per the NSW BOS and address any additional requirements under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The assessment process however, is subject to an approved bilateral agreement between the Commonwealth and NSW such that the Commonwealth Minister for the Environment, when assessing actions under the EPBC Act, can rely on the NSW specified environmental impact assessment processes (DoE, 2015).

The report also is to comply with all other relevant legislation, as detailed in **Chapter 2** of the BDAR.

1.3 SCOPE OF WORKS

The scope of works has been determined primarily according to the specific requirements of the BAM, with reference to the summary of requirements provided in **Table 24** and **Table 25**, **Appendix K** of the BAM.2020 Slightly summarised versions of these tables are presented in **Appendix A** of this BDAR, together with details on the relevant sections/items within the BDAR that address the various requirements. In brief, the scope of works was determined to entail the following key tasks:

1. Preliminary desktop assessments to identify existing information and mapping relevant to the subject property and impact area;
2. An initial inspection of the proposed impact area and the immediate surroundings, and preliminary site surveys, to confirm generally the site features, representation of vegetation communities and vegetation condition;
3. Follow-up comprehensive desktop assessments to determine the likely extent and distribution of vegetation zones and extent of additional surveys required and preparation of relevant background GIS maps;
4. Plot-based sampling and field surveys as determined to be required by the desktop assessments and any additional information obtained during the initial vegetation sampling process;
5. Data entry into the BAM Calculator to determine the vegetation integrity score, particularly for the proposed impact area and whether any ecosystem or species credits would be required to be retired;
6. Preparation of the BDAR report;
7. Submission of the Biodiversity Credit Report from the BAM Calculator to the Office of Environment and Heritage (OEH); and
8. Review of feedback on the BDAR and Biodiversity Credit Report and updating of relevant components of these documents as may be required.

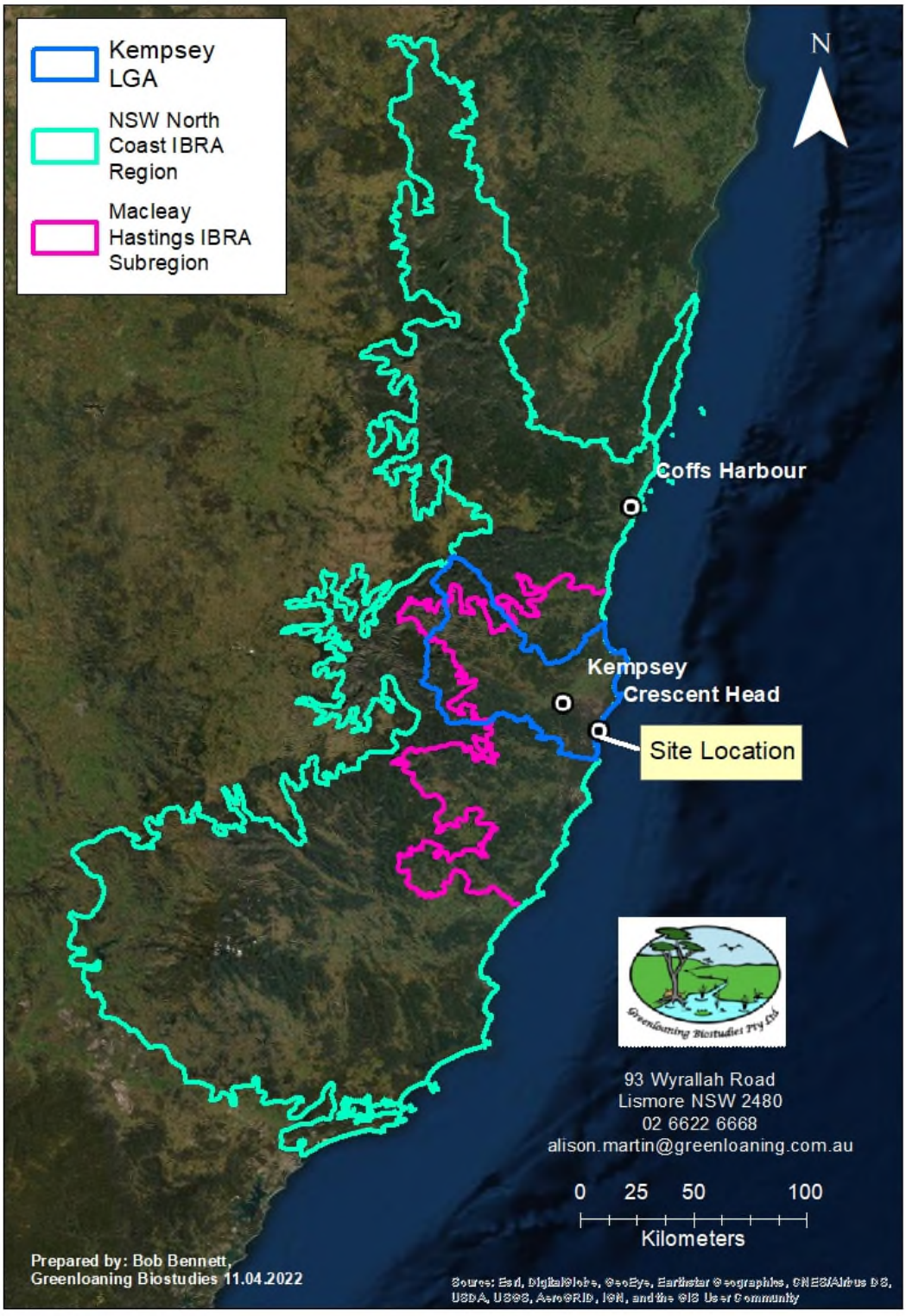


Figure 1 Location of subject property within the Local Government Authority and Interim Biogeographic Regionalisation for Australia (IBRA) indicating the Region and Subregion.

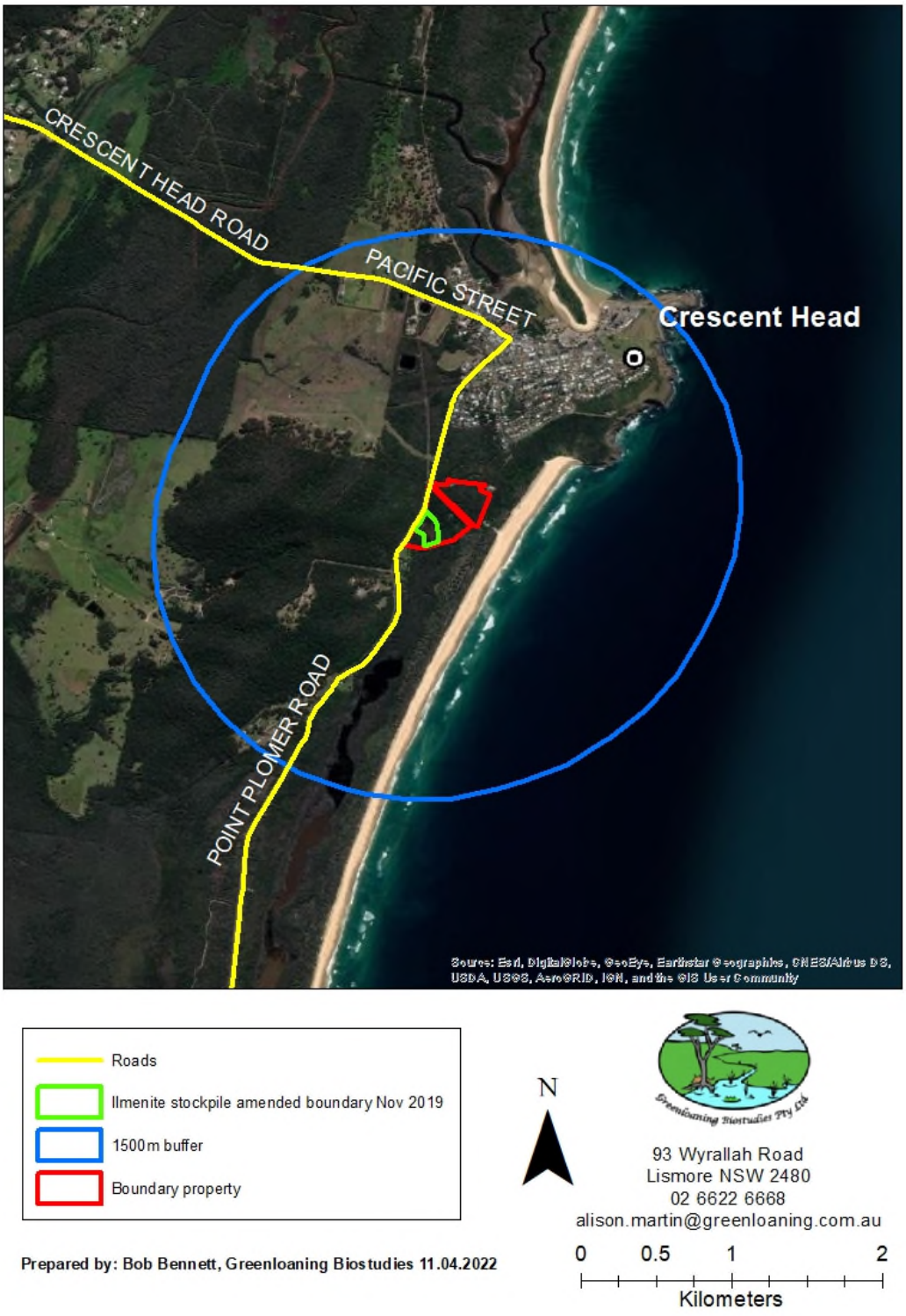
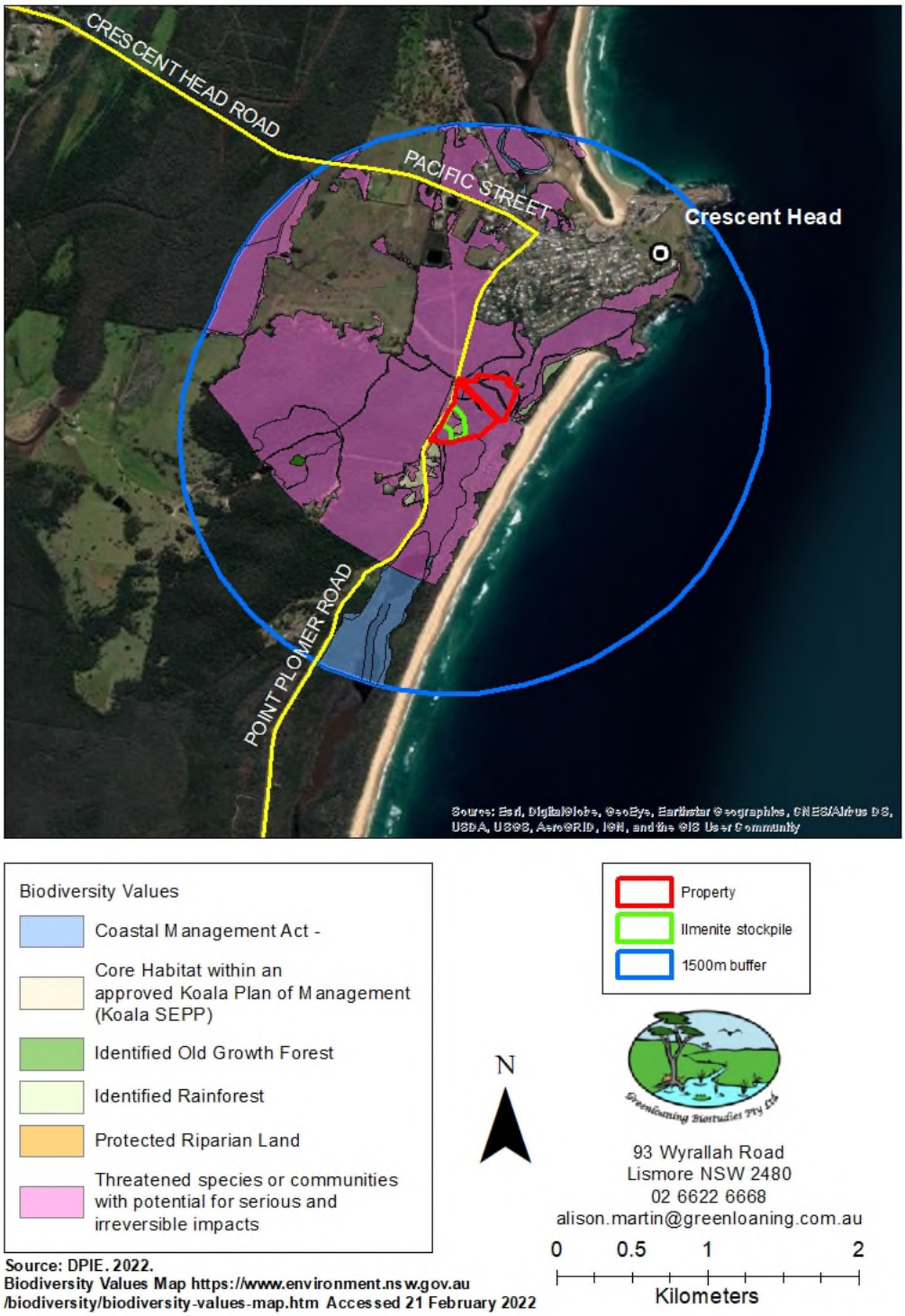


Figure 2 Location Map of subject property with key landscape features and



Source: DPIE. 2022.
Biodiversity Values Map https://www.environment.nsw.gov.au /biodiversity/biodiversity-values-map.htm Accessed 21 February 2022

Figure 3 Map of High Biodiversity Values prepared by the Office of Environment and Heritage under Part 7 of the Biodiversity Conservation Act 2016).

Mitchell Landscapes
Brooms Head - Kempsey Coastal Ramp
Manning - Macleay Barriers and Beaches

Property
Resource Recovery Footprint - Ilmenite Stockpile and Access Track

N

0 50 100 200
Meters

Source: DPIE. 2022. NSW (Mitchell) Landscapes - version 3.1 https://datasets.seed.nsw.gov.au/dataset/nsw-mitchell-landscapes-version-3-1 Accessed 28 April 2022

Prepared by: Bob Bennett, Greenloaning Biostudies 28.04.2022

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Figure 4 Resource (Ilmenite Stockpile) Area and Associated Mitchell Landscapes

1.4 GENERAL SITE CONTEXT/LANDSCAPE FEATURES

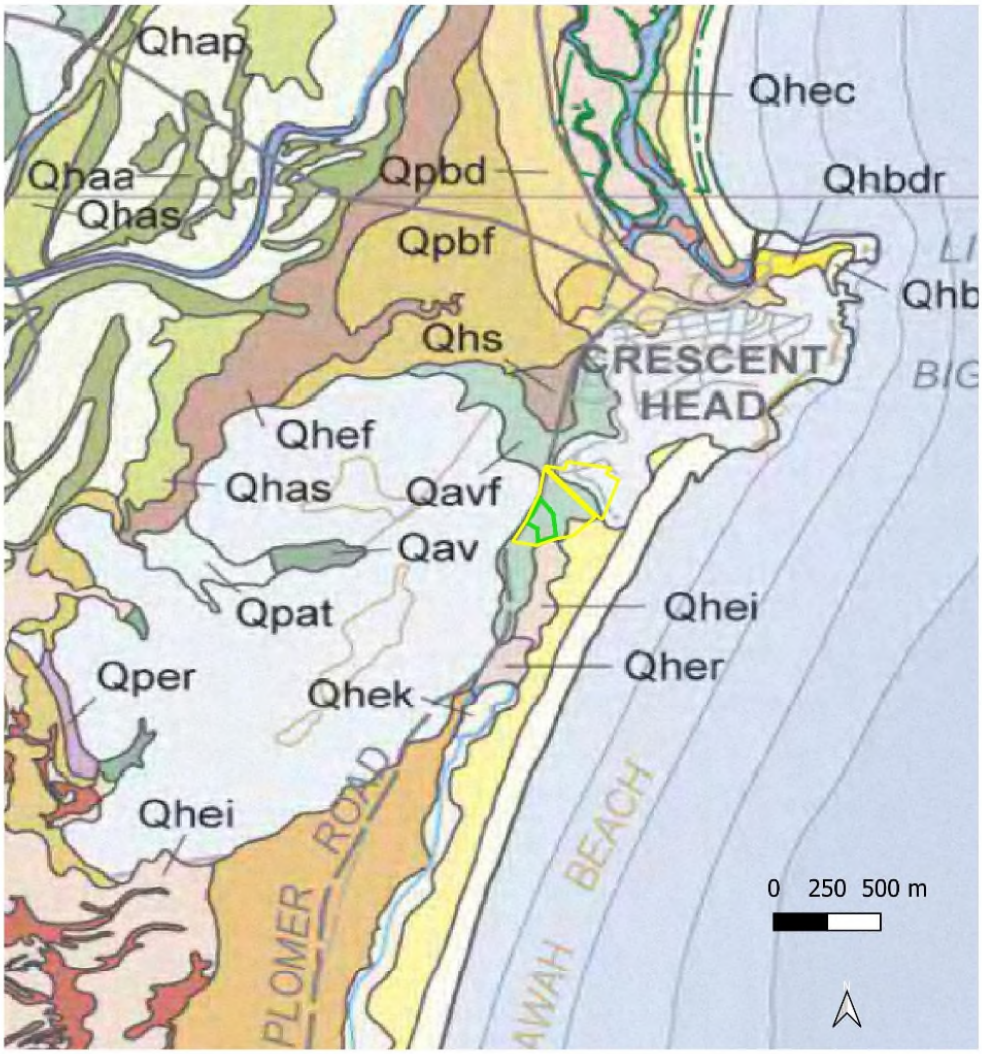
1,4,1 Regional Context and Geology

The site is located within the Kempsey Local Government Area (LGA) which covers an area of 3,381 km^2, extending along the coastline from Point Plomer in the south to Scotts Head in the north and westwards to elevated areas of the Great Dividing Range (Phillips & Hopkins, 2008). The shire falls within the NSW North Coast Interim Biogeographic Region of Australia (IBRA Region) and Macleay-Hastings IBRA Subregion (refer to **Figure 1**). The climate of this Region from east to west is that of a sub-tropical climate on the coast, with hot summers, through sub-humid climate on the slopes, to a temperate climate in the western uplands (DPIE, 2016).

The geology of the Manning-Macleay subregion is a complex faulted terrain where the New England Fold belt over-thrusts the Sydney Basin. The main rocks are Silurian and Devonian slates, quartzites and acid volcanics, Carboniferous mudstones, lithic sandstones and Permian shales and sandstones. In addition, Quaternary coastal sands are a feature (DPIE, 2016).

According to the Kempsey Area Coastal Quaternary Geological Map (2008), the impact area footprint is located on an Alluvial Plain System of Quaternary alluvial and colluvial fan comprising fluvial sand, silt, gravel and clay, which extends to the south of the site. The south east of the site is mapped as an Estuarine Plain System comprising Holocene interbarrier creek deposits of marine sand, silt, clay, organic mud, peat, gravel and shell. To the east, a strip of Holocene dune marine sand borders the beach (refer to **Figure 5**) There are no karsts, cliffs, or any geological features of significance or human-made structures on the site, The only human associated object is a disintegrating burnt-out car body on the existing access track 9refer to Photographs in **Appendix B**..

Crescent Head Ilmenite Stockpile NSW Geology Map



Site Lot 2281 DP1153793

Ilmenite Stockpile

Qhei Eustuarine Plain System (Holocene interbarrier creek deposits)
Qhbd Coastal Barrier System (Holocene dune)
Qavf Alluvial Plain System (Quaternary alluvial and colluvial fan)

Prepared by Fiona Dawson 16/1/2020 MGA Zone 56 (GDA 94)

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Figure 5 Kempsey Area Coastal Quaternary Geological Map (2008) M 258 sourced from NSW Resources & Geoscience

1.4.2 Land Systems and Soils

As identified on the Sharing and Enabling Environment Data in NSW (SEED) Web map the relevant NSW Mitchell Landscapes comprise the following: the southern half of the subject property, including the impact area and ilmentite stockpile as a whole, is mapped as Manning – Macleay Barriers and Beaches while the northern half falls within the Brooms Head - Kempsey Coastal Ramp area (Mitchell, 2002). The occurrence of these landscape systems in the site context are shown on **Figure 4.**

Macleay Barriers and Beaches include dunes, swamps and lagoons on Quaternary coastal sands, with inner and outer barrier dune sequences. General elevation is 0 to 25m and local relief is 10 to 20m. Yellow or white single grain quartz sand occurs on destabilised dunes above well-developed iron and humic podsols with depth to pan varying with position in the dune sequence, topography and depth to groundwater (Mitchell, 2002).

Brooms Head - Kempsey Coastal Ramp includes hills and low ranges of the coastal fall on lower Devonian greywacke, slate phyllite, quartzite, Permian phyllite and schistose sandstone. The general elevation ranges from 50 to 450m, with local relief up to 300m. Thin, stony gradational loam and sandy loam occurs on the slopes, grading to yellow brown texture-contrast soils on lower slopes and in valleys (Mitchell, 2002).

The stockpile itself comprises ilmenite, (FeTiO3), a dense, black, weakly magnetic mineral with a high resistance to weathering. Ilmenite is a common accessory mineral present in the beach sands of eastern Australia, believed to be ultimately derived from the erosion of Tertiary Volcanic rocks from the New England Fold Belt. Australia's east coast beaches formerly contained substantial deposits of ilmenite that were concentrated in strandlines by wave action. Economic concentrations of mineral sands were extensively mined from beaches and dunes from the Central Coast of NSW north to Fraser Island in Queensland, mainly from the mid to late 1900s (PS, 2019).

1.4.3 Topography and Drainage Patterns

The topography of the subject property surrounding the stockpile is flat with a gradual south east slope towards the beach. Based on hand auger drilling completed by GER (14 holes), it is predicted that the removal of the stockpile will result in a ground profile similar to the surrounding gently undulating topography (PS, 2019) (refer to **Figure 6** and **Figure 7)**. The elevation of the existing stockpile varies from 6m to 13m, as indicated on **Figure 7**, while the surrounding subject property varies from 2m to 6m in the south - south west and eastern drainage line, to 4m to 8m to the immediate east and 8m to 30m in the far eastern portion.

The drainage of the stockpile and underlying ground surface (quartz sand) reflects the low runoff and high infiltration capacity of black and quartz sand, as evidenced by the absence of surface water features, ponding or drainage lines (PS, 2019). A shallow drainage trench (230m in length) on the eastern boundary of the stockpile is likely to be a relic from sand mining operations and tends to contain standing water at the southern end (PS, 2019).

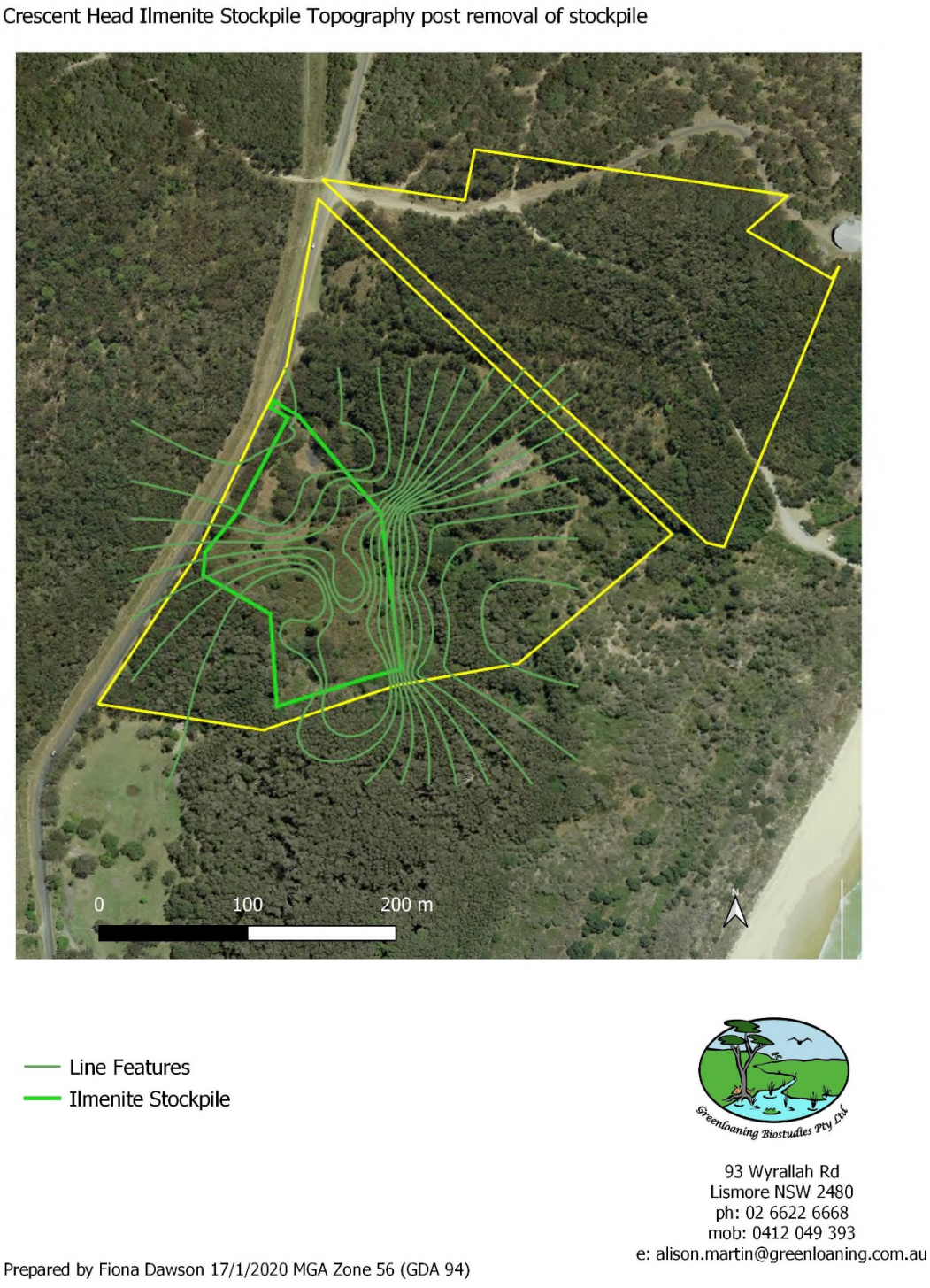

Figure 6 Topography post stockpile removal (natural ground contours) (PS, 2019).

Crescent Head Ilmenite Stockpile Topography

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Prepared by Fiona Dawson 26/2/2020 MGA Zone 56 (GDA 94)

Figure 7 Current topography of subject property (Source ELVIS 2022).

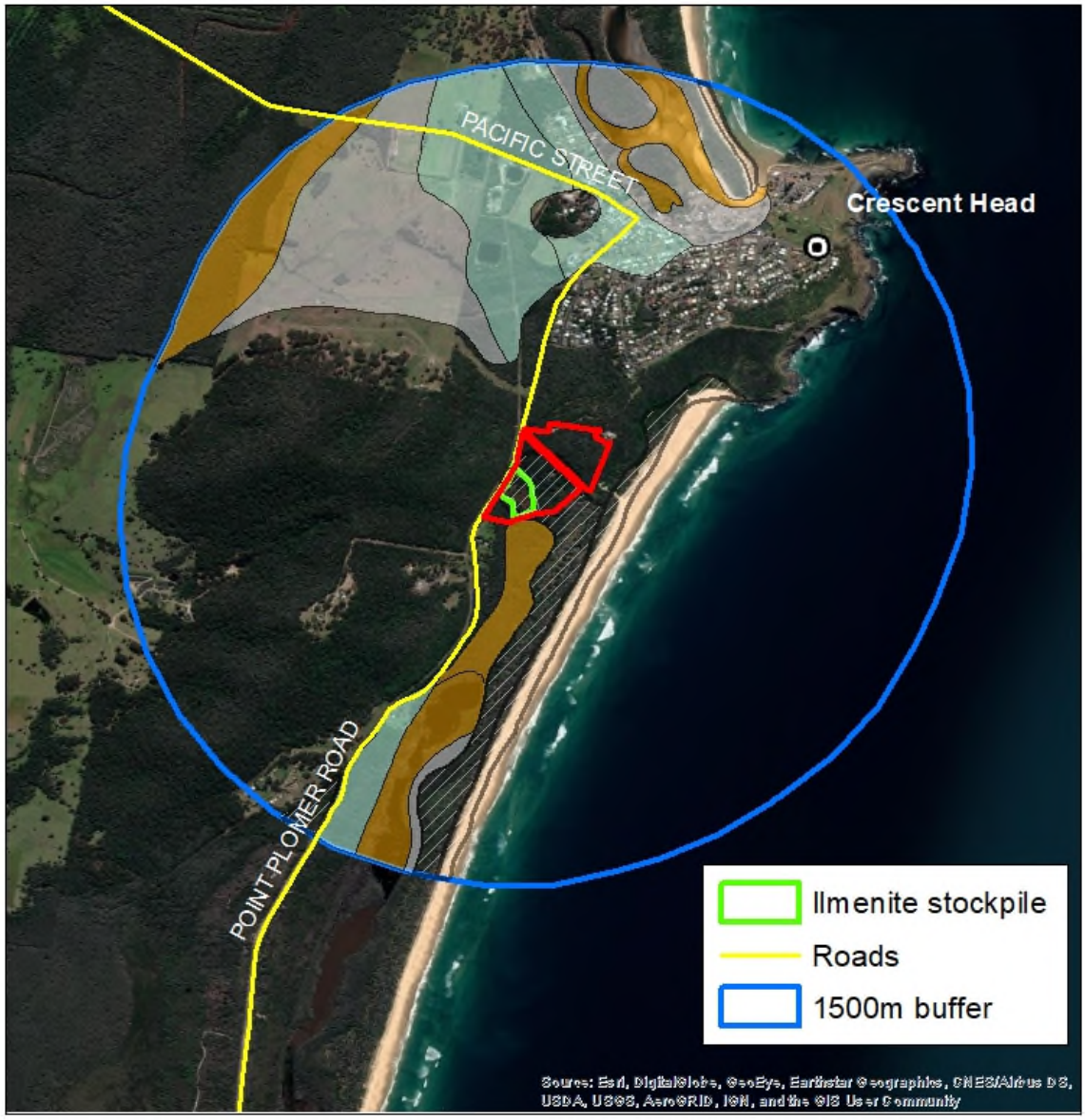
The presence and risk of Acid Sulfate Soils is indicated on **Figure 8,** with the soils immediately south of the stockpile having a high probability of occurrence of Acid Sulfate Soils. The soils underlying the stockpile itself have not been assessed (Naylor et al, 1998).

1.4.4 Streams, Rivers and Wetlands

In order to comply with s 3.1.3 and Appendix E of the BAM 2020, spatial data representing surface water in NSW was used to determine the Strahler stream order and map the associated buffers (**Figure 9**). Two first order streams occur in close proximity but outside the proposed resource recovery footprint, including the shallow trench referred to in **Section 1.4.3,** and these have been mapped with a buffer of 10m on each side. All other streams within the 1500m buffer are first or second order streams, but have been buffered for prudence and expediency as second order streams with a buffer of 20m on each side.

State Environmental Planning Policy (SEPP) Coastal Management 2018 updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection) by specifying how development proposals are to be assessed if they fall within the coastal zone. As indicated on **Figure 9**, the stockpile is adjacent to, and partly overlies, the 100m Proximity Area for Coastal Wetlands which are described as plant communities dominated by any of six vegetation types, viz: mangroves, salt marshes, melaleuca forests, casuarina forests, sedgelands, brackish swamps, freshwater swamps and wet meadows (DPE, 2018). Although development within the mapped proximity area is not designated development, any development requiring consent cannot be approved by a consent authority unless they are satisfied that the development will not significantly impact on the biophysical, hydrological or ecological integrity of (including the quantity and quality of surface and ground water flows to and from) the adjacent coastal wetland or littoral rainforest (DPE, 2018).

There are no 'Important Wetlands' within close proximity to the site, as defined in "A Directory of Important Wetlands in Australia" (Department of Agriculture, Water and the Environment 2022). However the extreme western perimeter of the 1500m buffer is adjacent to the Limeburners Creek Nature Reserve wetland, to which a 50m buffer has been applied (**Figure 9**).



Acid Sulfate Soil Risk
- High probability of occurrence
- Low probability of occurrence
- No known occurrence
- Not assessed

Source: DPIE. 2022. Acid Sulphate Soils Risk https://datasets.seed.nsw.gov.au/dataset/acid-sulfate-soils-risk0196c Accessed 21 February 2022
Prepared by: Bob Bennett, Greenloaning Biostudies 05.04.2022

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0 0.5 1
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Figure 8 ***Occurrence of Acid Sulfate Soils within the Vicinity of the Subject Site***

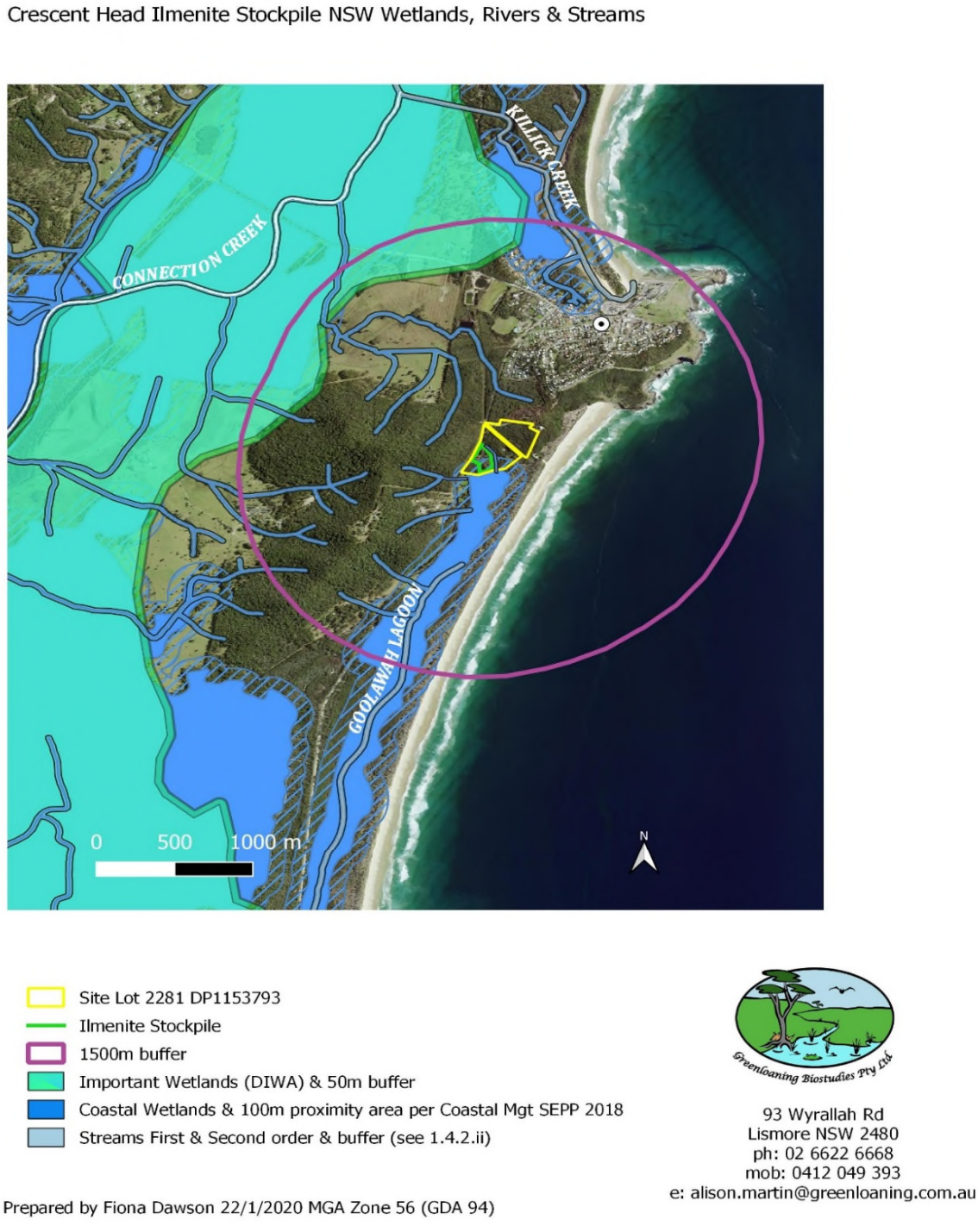

Figure 8 Rivers, streams and wetlands with buffers as per BAM Appendix E (Department of Agriculture, Water and the Environment. 2022)

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1.4.5 Land use and History of Disturbance

The subject property is located within Crown land, approximately 1km south of the township of Crescent Head and 0.5 km west of the Pacific Ocean. At a local scale, it is bounded by Goolawah National Park to the east, Crown Land to the north, freehold land with a residence to the south and Point Plomer Road to the west (PS, 2019), while at a landscape scale it is largely surrounded by NPWS estate (**Figure 2**). The purposes of the Crown reserve are Environmental Protection and Public Recreation. The land is managed by the Goolawah Reserve Trust [being a Corporation under the Minister Administering the *National Parks & Wildlife Act 1974*] – gazetted 16 April 2010 (DoI, 2017). The adjoining residence to the south is situated within cleared bushland and scattered native vegetation.

The subject property is zoned Rural Landscape (RU2) under the *Kempsey Local Environmental Plan (2013)* (refer to **Figure 10**), the objectives of which are to "encourage sustainable primary industry production by maintaining and enhancing the natural resource base, to maintain the rural landscape character of the land and to provide for a range of compatible land uses, including extensive agriculture" (PS, 2019).

The stockpile/resource recovery site is a former mineral separation plant or 'dry mill' that ceased operation in 1985. Sand mining around the township of Crescent Head commenced in 1957 by Mineral Deposits Ltd (MDL), with the operation comprised of three simple dredges in ponds and a separating plant, using land based spiral units and magnetic separators (PS, 2019) (refer to **Figure 11)**. The concentrates were treated at a dry mill, the concrete foundations of which are still present to the east of the stockpile. Mineral sand from MDL's mining leases on the east coast is believed to have been processed at the Crescent Head dry mill until 1985 and the plant removed in 1987 (PS, 2019).

Since being abandoned around 30 years ago, the site has been left to regenerate naturally which has resulted in both native species and weed infestations, in particular Lantana (*Lantana camara*). Illegal rubbish dumping has taken place in recent years, including dumping of domestic waste and burnt out cars (refer photograph in **Appendix B**). The illegal removal of ilmenite from the northern end of the stockpile has been reported to Crown Lands (PS, 2019).

An exploration Licence (No 8505) and issued on 16 May 2013, expired on the 16th of May 2015, with China Australia Mining Pty Ltd's exploration work being completed in this time (DoI, 2017).

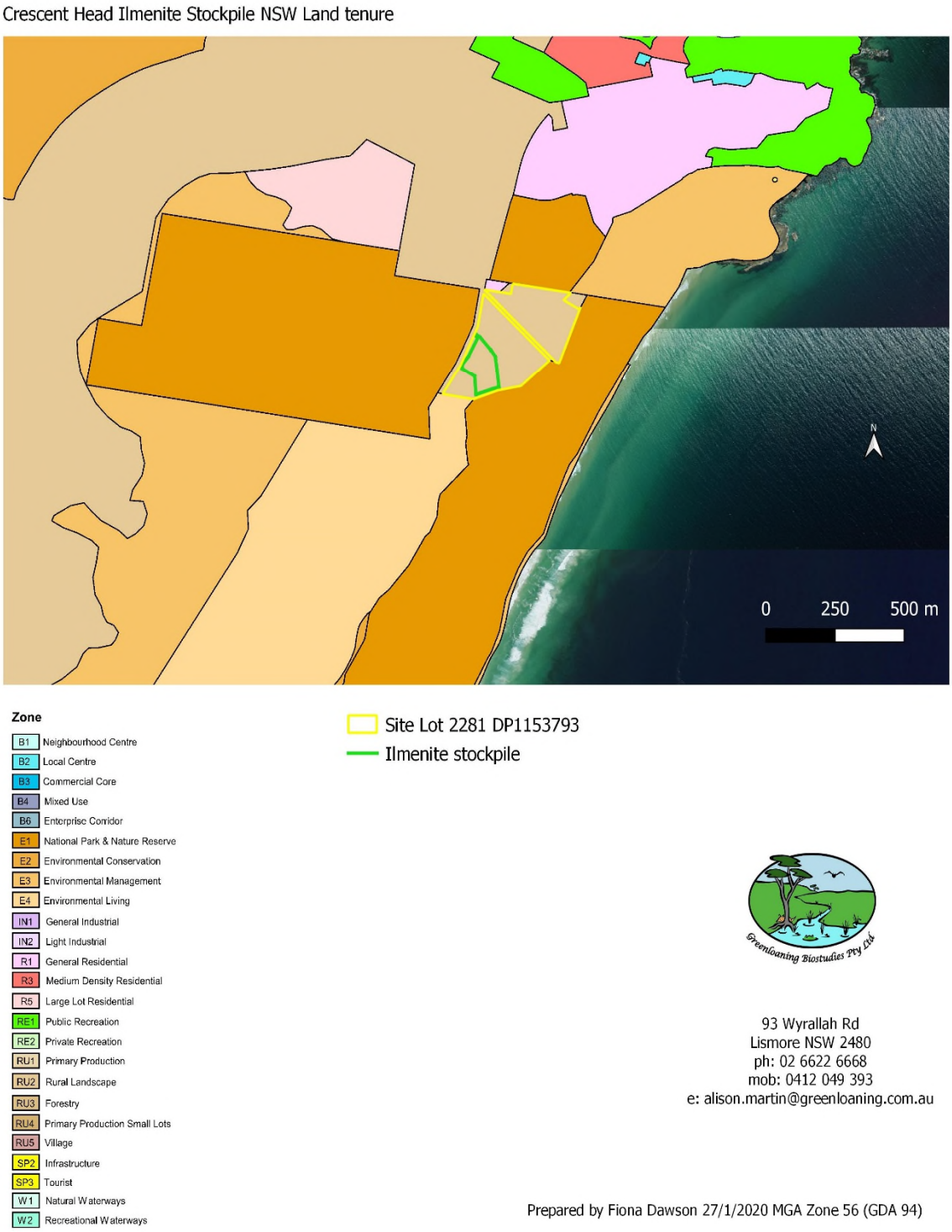

Figure 9 Land Zoning in the Vicinity of the Subject Property

Source: Kempsey LGA LEP (2013) Land Zoning Sheet LZN_012B

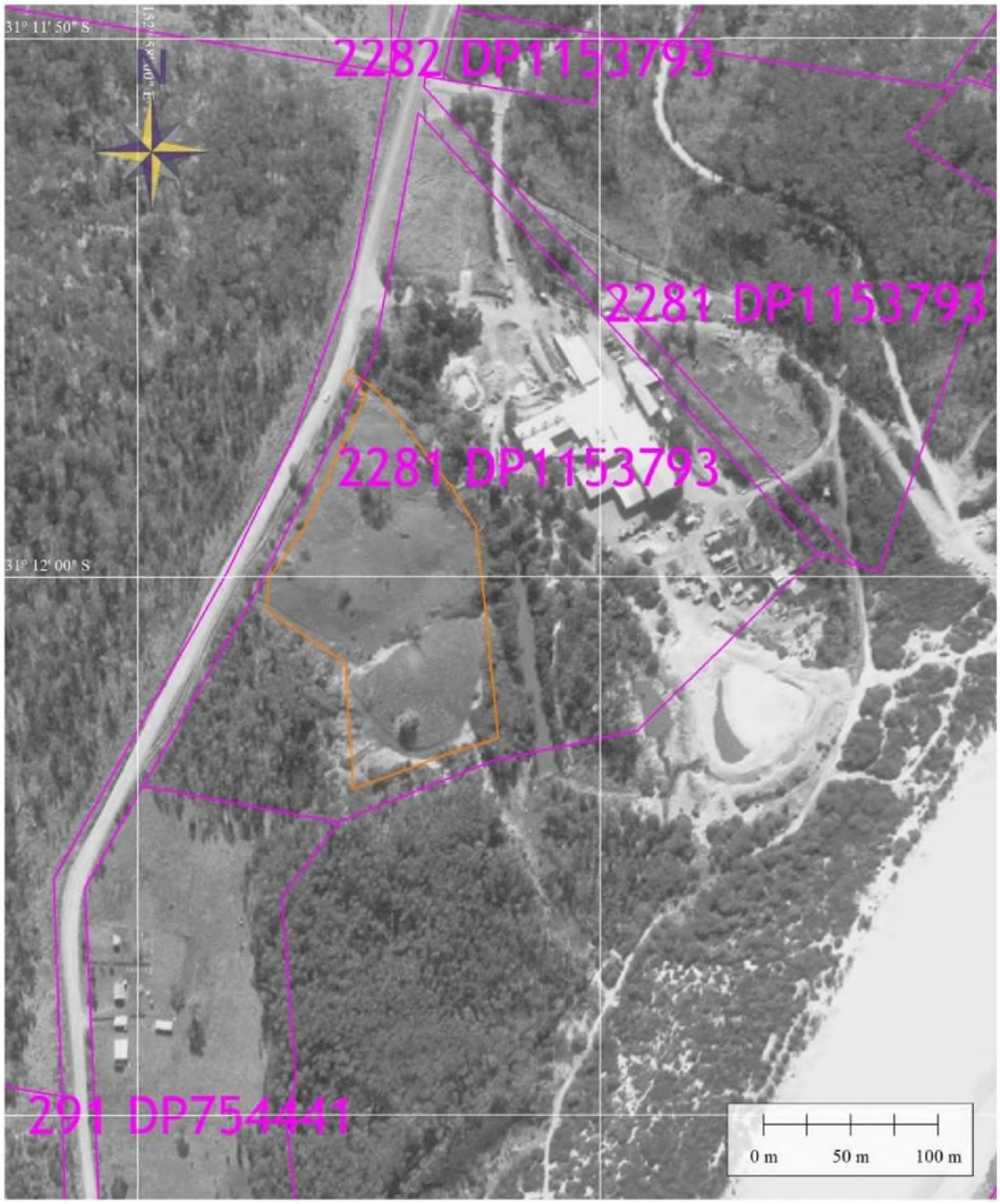

Figure 10 Historical Mineral Processing on existing site in 1981 (PS, 2019).

1.4.6 Connectivity, Native Vegetation Extent (% Cover) and Patch Size

At a broad scale, the subject property falls entirely within the North East NSW Fauna Corridor and the North East NSW Climate Change Corridor (Department of Planning, Industry and Environment,, 2020b), is surrounded by NPWS Estate and is adjacent to Fauna Key Habitats (refer to **Figure 12**). Wildlife corridors comprise connecting areas and habitat for such processes as migration, colonisation, dispersal and breeding exchanges while key fauna habitats comprise areas predicted to be of high value to forest fauna, both in reserve systems and other land tenures (Department of Planning, Industry and Environment, 2021). The spatial data for **Figure 12** was sourced from a GIS program "NPWS CORRIDORS" which was used to derive regional scale habitat corridors based on the predicted distributions of priority fauna species assemblages (Department of Planning, Industry and Environment, 2021).

At a local scale, the subject property as a whole is primarily vegetated, supporting a mixture of remnant and regenerating native vegetation communities and exotic species. The vegetation of the stockpile itself, although of a lower quality, nevertheless provides some habitat and connectivity to other local corridors such as the adjacent Goolawah National Park (**Figure 12**). There are no areas however, of outstanding biodiversity value associated with the subject property or environs.

The total extent of native vegetation within a 1500m buffer area extending from, and including the subject property, has been calculated as 62%, as indicated on **Figure 13**, and allocated to the 30 - 70% class (refer to **Section 3.2** for details of methods).

The extent of native vegetation inside the buffer area is contiguous and extends for considerable distances beyond the buffer, as can be seen on **Figure 3**. The area within the buffer is approximately 380ha (**Figure 13**) and forms one patch which exceeds the maximum patch class size of >100ha. Thus each Plant Community Type (PCT) and vegetation zone was allocated to the maximum patch size class (refer to **Section 3.2** for details of the methods undertaken).

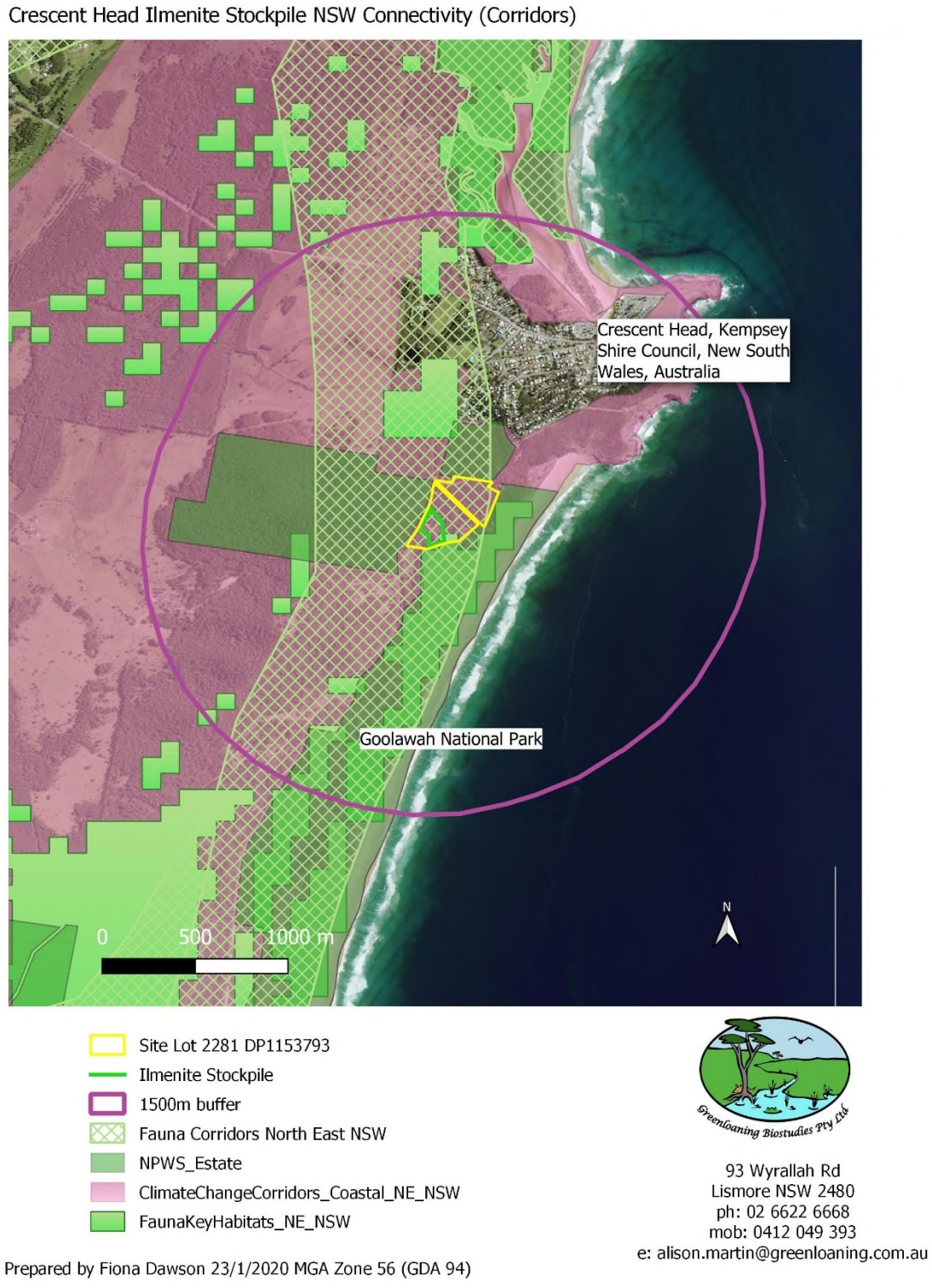

Figure 11 Location of subject property within North East NSW regional corridors (Department of Planning, Industry and Environment 2021.

Native Vegetation Extent and Patch Size

Property Boundary
Ilmenite stockpile amended boundary Nov 2019
1500m buffer

Source: Greeloaning Biostudies 2020

Prepared by Bob Bennett, Greenloaning Biostudies, 22.02.2022

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Figure 12 Native vegetation extent within the 1500m buffer (62%)

1.5 DESCRIPTION OF DEVELOPMENT AREA AND ENVIRONS

The resource recovery /impact area comprises the ilmenite stockpile and access track from Point Plomer Rd. The stockpile comprises a mound of black sand 2m to 5m high (refer to **Figure 7**), which has regenerated to some extent naturally since being abandoned in the late 1980's. The stockpile is dominated by the native plant species Blady Grass (*Imperata cylindrica*) and Bracken Fern (*Pteridium esculentum*), with thickets of the exotic species Lantana (*Lantana camara*) and Bitou Bush (*Chrysanthemoides monilifera*). Scattered small trees also are regenerating. The north eastern side is dominated by a patch of regenerating Swamp Oak (*Casuarina glauca*) and some Lantana thickets, whilst the northern part of the stockpile supports a cluster of old-growth trees including Forest Red Gum (*Eucalyptus tereticornis*). There are clusters of Figs (*Ficus spp.*), Swamp Mahogany (*E. robusta)* and Forest Red Gum in the centre and south but in general the stockpile is dominated by Blady Grass, Bracken Fern and Lantana, the latter occurring particularly around the perimeter and in the southern portion (refer to photographs in **Appendix B**).

The roadside vegetation on the north western side of the stockpile supports planted Koala food trees (Forest Red Gums). A drainage trench borders the eastern edge of the stockpile and is dominated by Paperbark (*Melaleuca quinquenervia)*. To the southwest of the stockpile, the vegetation is also dominated by Paperbark with Red-fruit Saw-Sedge (*Gahnia sieberiana*) dominating the understorey. The area adjacent to the stockpile to the north and east supports communities dominated by Blackbutt (*Eucalyptus pilularis*) or Swamp Oak (*Casuarina glauca*), whilst the far eastern portion of the subject property supports Paperbark and Forest Red Gum with rainforest elements.

In general, the site environs can be described as complying with the Manning-Macleay subregion description, as this description includes a coastal complex of Banksia, Paperbark, Smooth-barked Apple (*Angophora costata*) and Blackbutt with numerous shrubs, areas of heath, swamp on dunes and mangroves in estuaries (DPIE, 2016). The southern half of the subject property is mapped as Manning-Macleay Barriers and Beaches which comprises foredunes with Coastal Spinifex (Spinifex *sericeus*), Coast Wattle (*Acacia sophorae*), hind dunes with Blackbutt, Pink Bloodwood (*Corymbia intermedia*), Banksia (*Banksia spp.*) and rainforest elements such as Blue Lilly Pilly (*Syzygium oleosum*), Tuckeroo (*Cupaniopsis anacardioides*) and vines. Swampy lagoon zones of wet heath and swamp forest comprise dense Paperbark, Swamp Oak and Swamp Mahogany, rushes and sedges (Mitchell, 2002). The northern half of the subject property is mapped as Brooms Head - Kempsey Coastal Ramp and comprises dry hardwood forest of Blackbutt, Sydney Blue Gum (*E. saligna*), and Large-fruited Blackbutt (*E. pyrocarpa*) (Mitchell, 2002).

The characteristics of the resource recovery area and surrounding property are illustrated in the photographs provided in **Appendix B.**

2 Legislative Context

2.1 INTRODUCTION

An outline of the legislation, planning instruments and management plans/strategies relevant to the ecological attributes of the proposed resource recovery area is provided in the following sections.

2.2 COMMONWEALTH STATUTORY CONSIDERATIONS

2.2.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act provides protection for Matters of National Environmental Significance (MNES), the MNES relevant to the Development Area and subject property including:

- Nationally listed threatened species and ecological communities; and
- Listed migratory species;

Environmental approvals under the EPBC Act may be required for an 'action' that is considered likely to have a significant impact on MNES or the environment on Commonwealth land, i.e. species and/or vegetation communities listed as threatened under the Act. Further consideration of MNES is provided in **Section 3.2** and **Section 4.1** of this report.

2.3 NEW SOUTH WALES STATUTORY AND PLANNING CONSIDERATIONS

2.3.1 Relevant legislation

i. Biodiversity Conservation Act 2016

The BC Act has replaced the *Threatened Species Conservation Act 1995* (NSW) (TSC Act). The purpose of the BC Act 'is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development…'(s1.3). The Biodiversity Offset Scheme (BOS) has been established under Pt 6 of the BC Act, with thresholds for mandatory entry into the scheme prescribed by the regulations under this Act. For development required to be assessed under the BC Act, an assessment report must be prepared by an accredited person, with the impacts from the proposed development, and any offset requirements duly considered. The establishment of a biodiversity assessment method, in connection with the biodiversity offsets scheme, is prescribed under s6.7 of the BC Act.

Threatened species and communities are those now listed under the BC Act under Schedules 1 and 2 of the Act. Key Threatening Processes that need to be considered as part of the assessment of impact process also are listed under Schedule 4 of the BC Act.

Under Pt 7, div 2, s 7.9 (1) of the BC Act, the biodiversity assessment for State significant development or infrastructure applies to:

> *(a) an application for development consent under Part 4 of the Environmental Planning and Assessment Act 1979 for State significant development, and*
>
> *(b) an application for approval under Division 5.2 of the Environmental Planning and Assessment Act 1979 to carry out State significant infrastructure.*

Further to this, the following applies:

> *(2) Any such application is to be accompanied by a biodiversity development assessment report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.*
>
> *(3) The environmental impact statement that accompanies any such application is to include the biodiversity assessment required by the environmental assessment requirements of the Planning Agency Head under the Environmental Planning and Assessment Act 1979.*

Thus the preparation of this BDAR is required for the project.

ii. Biodiversity Conservation Regulation 2017 (BC Reg)

The BC Reg provides, inter alia, rules for offsetting and thresholds for triggering entry into the BOS. Under cl 7.1 of the BC Reg, 'the clearing of native vegetation…on land included on the *Biodiversity Values Map* published under clause 7.3' triggers entry into the (BOS). Under cl 7.3, the Biodiversity Values Map is to be prepared and published by the Environment Agency Head, from time to time, on an appropriate Government website. As indicated in **Section 1.1** of this BDAR, and on **Figure 3**, a portion of the resource recovery area lies within an area shown on the BV Map and some clearing of native vegetation is proposed.

iii. Biodiversity Assessment Method Order 2020

As indicated in Section 2.3.1.i, the establishment of a biodiversity assessment method, in connection with the biodiversity offsets scheme, is prescribed under s6.7 of the BC Act. The *Biodiversity Assessment Method Oder 2017* ('the BAM') was gazetted in August 2017, and was 'established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values, where required under the BC Act, *Local Land Services Act 2013* (LLS Act) or the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017)*.'

The BAM was updated in October 2020 (*Biodiversity Assessment Method Oder 2020 – BAM 2020*), and is described as providing 'a consistent method to assess impacts on biodiversity values from a proposed development (including major projects), activity, clearing or biodiversity certification as well as improvements in biodiversity values from management actions undertaken at a stewardship site. The survey and assessment effort required by the BAM is scaled according to the extent and risk of impacts on biodiversity from a proposal, the availability and quality of existing information (such as native vegetation maps), and the area of land being assessed' (BAM 2020).

iv. Biosecurity Act 2015

The *Biosecurity Act 2015* has replaced the *Noxious Weeds Act 1993*. The main objective of the *Biosecurity Act is '*to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers' *(*s3 [1])

The Act provides for a shared responsibility for biosecurity matters that includes community and industry, as well as government authorities (s3 [2] [a]) and aims, inter-alia, 'to provide a framework for the timely and effective management of … threats to terrestrial and aquatic environments arising from pests, diseases, contaminants and other biosecurity matter' (s3 [2] [b] [ii]). This has relevance to the project in assigning some community responsibility for biosecurity matters such as invasive weed species management. Under s15 (2)A of the act, a 'pest' is defined as including 'anything declared by the regulations to be a pest for the purposes of this Act.'

These objectives, together with consideration of the provisions of the *Biosecurity Regulations 2017* (refer to **Section 2.3.1.iv)** have been taken into account in relation to the development of weed

management strategies and associated site rehabilitation recommendations (refer to **Section 6.5.2** and **7.2**).

v. Biosecurity Regulations 2017

Weed species declared as pest species under the *Biosecurity Regulation 2017* are listed under Schedule 3 (cl 33), and include Asparagus weed species (*Asparagus* spp.), Lantana (*Lantana camara*) and Bitou Bush (*Chrysanthemoides monilifera*), all of which occur within the subject property. Such species are not to be imported into the state or sold.

vi. Coastal Management Act 2016

The *Coastal Management Act 2016* replaces the *Coastal Protection Act 1979*. The Act defines the coastal zone as four coast management areas, the first of which has potential relevance to the resource recovery area and subject property, viz:

1. Coastal wetlands and littoral rainforests area; areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26

The relevance of the Act to the current resource recovery is discussed in **Section 4.1.** The potential direct and indirect impacts of the proposed resource recovery on coast management areas will be discussed in **Section 6.1**

vii. Water Management Act 2000

The objects of the *Water Management Act 2000* are to provide for the sustainable and integrated management of the water sources of the state for the benefit of both present and future generations. The key regulation made under this Act is the *Water Management (General) Regulation 2018* which requires the use of the Strahler stream order method to identify whether an approval is required. Controlled activities carried out within a Vegetated Riparian Zone (VRZ) must be carried out under a 'controlled activity approval'. The VRZ includes a pre-determined buffer viz:

1. 10m each side of 1st order watercourse
2. 20m each side of 2nd order watercourses
3. 30m each side of 3rd order watercourses
4. 40m each side of 4th and greater order watercourse

As discussed in **Section 1.4.2.iii**, the streams on the subject property are first order streams and more than 10m away from the impact area, there is therefore no requirement for VRZ management.

2.3.2 Relevant Planning Instruments

i. State Environment Planning Policy (Koala Habitat Protection) 2020

In November 2020, the *NSW State Environmental Planning Policy (Koala Habitat Protection) 2020* (Koala SEPP 2020) replaced and repealed the *State Environmental Planning Policy (Koala Habitat Protection) 2019*, which in turn had repealed and replaced the *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44). Although the *NSW State Environmental Planning Policy (Koala Habitat Protection) 2021* (Koala SEPP 2021) was subsequently introduced in March 2021, under s 6 (3) (d) this SEPP does not apply to land zoned RU1 Primary Production, RU2 Rural Landscape or RU3 Forestry within the Kempsey LGA (as per sch 1 of SEPP 2021). Thus, Koala SEPP 2020 still applies to the subject property and development site.

Under s 10 of the Koala SEPP 2020, a plan of management which applies to a proposed development area must be prepared prior to Council approving the development. Under s 16 (2) of Koala SEPP 2020, further survey and identification of areas of potential or core Koala habitat is not required if Council has, prior to the commencement of Koala SEPP 2020, already undertaken this assessment process. Under Pt 5, s 19 of the SEPP, a plan of management is taken to include:

> *(a) a plan of management approved under State Environmental Planning Policy No 44—Koala Habitat Protection that was kept in force by clause 16 of State Environmental Planning Policy (Koala Habitat Protection) 2019.*

A Comprehensive Koala Plan of Management (CKPoM) was prepared for the eastern portion of the Kempsey LGA in 2011. This CKPoM covers the proposed development site and subject property, and thus the provisions of the CKPoM apply to the development and DA.

ii. State Environmental Planning Policy (Coastal Management) 2018

The *State Environmental Planning Policy (Coastal Management) 2018* (CM SEPP) identifies and maps the coastal zone according to definitions in the Coastal Management Act. The CM SEPP streamlines coastal development assessment requirements, identifies development controls for consent authorities to apply to each coastal management area and establishes the approval pathway for coastal protection works.

Statewide mapping is available for coastal wetlands and littoral rainforest area, coastal environment area and coastal use area. This mapping is addressed in **Section 1.4.4** (Wetlands) but is not relevant for the subject property in terms of Littoral Rainforest mapping (DPIE, 2019a).

2.3.3 Local Environmental Plans, Policies and Strategies

i. Kempsey Shire Comprehensive Koala Plan of Management (CKPoM) (2011)

The Kempsey Shire Council CKPoM is consistent with the State Recovery Plan for the Koala (2008) and was prepared in accordance with *State Environmental Planning Policy No 44 (Koala Habitat Protection).* The primary aim of the CKPoM is to contribute to "...the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline" (Kempsey Shire Council 2011). The KPoM focuses its efforts on reducing the impact of development in areas of preferred and core koala habitat through the protection of preferred koala food trees (PKFTs) where possible, or by the imposition of requirements to replace PKFTs, and in some instances the requirement to provide Habitat Compensation where removal of PKFTs exceeds certain thresholds (Phillips & Hopkins, 2009).

The key provisions of the KPoM relevant to the project are:

1. Development Applications (DA's) for land mapped as Preferred Koala Habitat (PKH) must undertake a Koala Habitat Assessment in accordance with the methodology outlined in Box 1 (i.e. SAT method);
2. A stadia survey of PKH food trees that may be impacted by the proposed DA must be undertaken and submitted with the DA;
3. If retention of Preferred Koala Food Trees (PKFT) greater than or equal to 250mm at dbhob is proposed, the nominated Performance Criteria in Section 4.10 of this plan are to be applied and consent may be granted with or without conditions where said criteria are met viz:
    - maximise retention and minimise degradation of native vegetation across the subject land;
    - minimise the removal of any identified PKFT where they occur across the subject land;
    - ensure such trees will not be negatively impacted by subsequent development works including the construction of buildings/infrastructure/public utilities;
    - maintain key linkages across the landscape, where they occur, to reduce the effects of habitat fragmentation;
    - where koala habitat and associated linkages are proposed to be retained to mitigate impacts, measures to ensure the protection of those areas in the long term;
    - measures (i.e. erection of exclusion fencing) to be in place to ensure koalas are protected during site construction works. Should koalas be found on site during clearing or site works, Section 4.11 (i) and (j) apply (koala specialist to inspect, clearing to be suspended within 25m of a tree occupied by koala, until koala has moved of its own accord.

ii. Kempsey Local Environmental Plan (LEP) 2013

Kempsey LEP 2013 provides the statutory framework for land use management in the Kempsey Shire local government area, subject to overriding planning controls in State Environmental Planning Policies and other State legislation (KSC, 2017). The *Kempsey LEP 2013* details land uses permitted with and without development consent within zones identified by the LEP, and states the requirement for developments within the CKPoM application area to address the development control provisions in the CKPoM (Phillips & Hopkins, 2009). As mentioned in **Section 1.4.3,** the subject property is zoned Rural Landscape (RU2), the objectives of which include "sustainable primary industry production by maintaining and enhancing the natural resource base, maintain the rural landscape character and provide for compatible land uses Activities permitted without consent include environmental protection works, extensive agriculture and forestry" (PS, 2019).

iii. Kempsey Development Control Plan (DCP) 2013

The *Kempsey DCP 2013 s*upports and expands upon the aims, objectives and other provisions of the LEP (KSC, 2017), inter alia:

1. To maintain the natural setting of the Kempsey Shire local government area.
2. To ensure that development protects and maintains high value vegetation, natural bushland and native habitats.

Tree preservation controls do not apply within Zone RU2.

3 Assessment Methods

3.1 GENERAL APPROACH TO THE SITE ASSESSMENT PROCESS

The aim of this section is to provide relevant details on the procedures undertaken for the BDAR, with the aim of such procedures being both to obtain appropriate data for the impact assessment process, and to comply with the BAM requirements (refer to **Appendix A** for compliance details). Integral to the assessment process has been the due consideration of relevant procedures as required under the BAM, whilst also taking into account the limited nature of the proposed resource recovery and specific site attributes. Thus there has been a robust desktop assessment process, in conjunction with site-specific surveys, the latter focusing primarily on vegetation community attributes via plot sampling, general and threatened plant species surveys and target threatened fauna species surveys. Further details on the specific procedures employed are provided in **Section 3.1, Section 3.2** and **Section 3.3**.

3.2 DESKTOP ASSESSMENTS AND METHODS

3.2.1 Desktop review

Desktop reviews were undertaken for the purpose of identifying the potential occurrence of threatened flora and fauna species, populations and/or ecological communities in the vicinity of the subject property and proposed resource recovery area. The desktop review process incorporated the following:

- A search of the NSW OEH Bionet data, including the Bionet Atlas and Vegetation Information System Datasets, the BV Map and threatened species and ecological communities distribution maps;
- A search using the EPBC Act Protected Matters Search Tool for any threatened species, ecological communities, RAMSAR sites and/or migratory species listed under the Act that have been detected, and/or considered to have likely habitat, within the subregion and particularly within the locality;
- Searches on the **S**haring and **E**nabling **E**nvironmental **D**ata (SEED) Portal for relevant background mapping;
- Reviews of available background information on individual threatened species and communities;
- Review of available aerial images of the subject property and environs;
- Searches of Council's website for relevant documents and mapping, plus direct liaison with Council regarding vegetation mapping;
- Direct liaison with Council to obtain spatial data representing the Koala Plan of Management Preferred Koala Habitat mapping
- Reviews of relevant legislation and planning documents as documented in **Chapter 2;**
- Detailed reviews of Plant Community Types (PCTs), threatened species profiles and relevant background information; and
- Reviews of any reports prepared in relation to ecological attributes of the general locality of the project (refer to **Section 1.1**)

3.2.2. Methods

i. Native Vegetation Percentage Cover

Relevant desktop information and QGIS 3.8.1 were used to determine the percentage cover of native vegetation within the 1500m buffer area for the subject property. Vegetation cover was determined as defined in s 3.2 of the BAM and s 2.3, pp 12 and 13 of the BAM Operational Manual and the following procedures applied:

- QGIS 3.8.1 was used to assess the vegetation cover based on imagery sourced from ArcGIS REST Services Directory WMS server provided by Spatial Services, NSW Department of Finance and Services (public/NSW Imagery) and to apply a 1500m buffer using the Offset Curve tool. The resulting layer was inclusive of the study site. The buffer area was calculated within QGIS using $area geometry (986ha).
- The ocean and estuarine (Killock Creek) areas were subtracted from the buffer area (986 less 374.59ha) to produce a net buffer area of 611.41ha.
- Ten polygons were created in QGIS to represent the native vegetation as determined by the assessor, based on aerial imagery and field assessments. The area of each polygon was calculated within QGIS using $area geometry.
- The gross area of four of the polygons was reduced by a percentage as determined appropriate by the assessor. This was to reflect the sparseness of the vegetation in these polygons (refer to **Table 3.1**) compared with other polygons, and was considered a conservative approach.
- Urban areas and infrastructure, estuarine and ocean areas and grassy patches were excluded. Grassy patches were conservatively considered to be dominated by exotic pasture species.
- Percentage cover was calculated by dividing the sum of the vegetation polygons net area by the net buffer area (refer to **Table 3.1**).

Native vegetation cover was calculated at 62% and is assigned to the 30 - 70% class.

ii. Patch size

The calculation of the patch size was determined using QGIS 3.8.1 according to the definition described in s 3.3.3, p 27 of the 'manual' (BAM Operational Manual) and s 4.3.2 of the BAM. The method was applied as follows:

> The patch is an area of intact native vegetation occurring on the subject land and beyond and includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤ than 30m for non-woody ecosystems).

- The boundary of the patch was determined to be equivalent to that of the polygons used to calculate native vegetation extent using the method outlined above.
- The contiguous nature of the vegetation resulted in one patch of approximately 380ha within the buffer (refer to **Figure 13, Section 3.2** and **Table 3.1**). All vegetation zones on the site are included in the same patch.
- As the one patch exceeds the maximum patch class size of >100ha, there is no requirement for the calculation of patch size to include areas outside the buffer in order to allocate each PCT and vegetation zone to the maximum patch size class.

The one patch of approximately 380ha was assigned to the maximum patch size class size of > 100ha.

Table 3-1 Summary of Vegetation Polygons used to calculate Native Vegetation Extent

% native veg cover within 1500m buffer			
Polygon	gross area (ha)	%	net area (ha)
veg 1	197.90	100%	197.90
veg 2	15.57	100%	15.57
veg 3	10.91	70%	7.64
veg 4	5.92	80%	4.74
veg 5	46.66	100%	46.66
veg 6	67.40	100%	67.40
veg 7	12.74	100%	12.74
veg 8	0.93	100%	0.93
veg 9	3.35	30%	1.01
veg 10	31.85	80%	25.48
total	393.23		380.06
Gross buffer area			986.00
less ocean & creek			- 374.59
Net buffer area			611.41
Vegetation cover			**62%**

iii. GIS Methods and Spatial Data Sources

QGIS 3.8.1 (Zanzibar) was used to prepare all mapping presented within the BDAR. Primary data sources comprised:

- Resource recovery site (stockpile) boundary and stockpile topography spatial data supplied by Pandanus Solutions.
- Koala mapping (CKPoM Preferred Koala Habitat) shapefile supplied by GIS Department, Kempsey Shire Council 12/2/2020.
- Base imagery/cadastral data from Web Map Service (WMS) Directory provided by NSW Spatial Services, (division of the Department of Finance, Service and Innovation (DFSI). Accessed from https://mapprod3.environment.nsw.gov.au/arcgis/services/Planning/EPI_PrimaryPlanning_Layers/MapServer/WMSServer?request=GetCapabilities&service=WMS

The following spatial datasets were used to prepare maps in this BDAR and/or identify relevant information used in this BDAR:

- Mitchell landscapes Version V3.1 obtained 15/1/2020 from https://datasets.seed.nsw.gov.au/dataset/7a1658be-a632-4d4c-8e94-5f9b3be31055 .
- Biodiversity Values Map accessed 16/1/20 (and 26/2/20 post BV Map update) from (https://www.environment.nsw.gov.au/biodiversity/biodiversity-values-map.htm)
    - Interim Biogeographic Regionalisation (IBRA) Regions and Subregions zip files obtained from Department of Agriculture, Water & Environment May/ August 2019:

https://www.environment.gov.au/fed/catalog/search/resource/downloadData.page?uuid=%7B8B9E3F42-9856-4487-AE9E-C76A322809A1%7D and https://www.environment.gov.au/fed/catalog/search/resource/downloadData.page?uuid=%7B4A2321F0-DD57-454E-BE34-6FD4BDE64703%7D

- Geology Map: Kempsey Area Coastal Quaternary Geological Map (2008) M258 accessed 16/1/20 from https://search.geoscience.nsw.gov.au/product/36
- Acid Sulfate Risk Map accessed from SEED via WMS service https://mapprod1.environment.nsw.gov.au/arcgis/services/Soil/AcidSulfateSoilRisk_EDP/MapServer/WMSServer?request=GetCapabilities&service=WMS
- SEPP (Coastal Management) 2018 accessed from SEED via WMS service https://mapprod3.environment.nsw.gov.au/arcgis/services/Planning/SEPP_Coastal_Management_2018/MapServer/WMSServer?request=GetCapabilities&service=WMS
- Directory of Important Wetlands (DIWA) Third Edition (EA, 2001) accessed from Department of the Environment (2015) DIWA Spatial Database (Public) https://data.gov.au/data/dataset/6636846e-e330-4110-afbb-7b89491fe567
- Hydrology: Surface Hydro Lines Regional https://www.ga.gov.au/scientific-topics/national-location-information/national-surface-water-information
- Connectivity: NSW Department of Planning, Industry and Environment" (2020) Fauna Corridors for NE NSW. Bioregional Assessment accessed 20/1/20 https://datasets.seed.nsw.gov.au/dataset/fauna-corridors-for-north-east-nsw
- National Parks & Wildlife Service Estate Accessed 9/1/2020 from https://mapprod.environment.nsw.gov.au/arcgis/services/EDP/Estate/MapServer/WFSServer?request=GetCapabilities&service=WFS
- Existing vegetation mapping: Kempsey LGA (Eastern Portion) Vegetation. VIS_ID 243 A polygon shapefile 1:25,000 vegetation mapping dataset combining 1999 CRAFTI and Forest Ecosystem mapping undertaken by Kendall and Kendall Ecological Consultants and GECO Environmental for Kempsey Shire Council. Revised 4/8/2011. Accessed 10/2/20 from https://datasets.seed.nsw.gov.au/dataset/kempsey-lga-eastern-portion-vegetation-vis_id-243ebc18/resource/b08e33f0-88ec-456a-a474-4b0dd85f0892.
- Land tenure: accessed 20/2/20 NSW Department of Planning ArcGIS REST Services Directory https://mapprod3.environment.nsw.gov.au/arcgis/services/Planning/EPI_Primary_Planning_Layers/MapServer/WMSServer?request=GetCapabilities&service=WMS
- Elevation data: Geoscience Australia ELVIS - Elevation and Depth - Foundation Spatial Data (Version 0.6.5) accessed 14/2/20 from https://elevation.fsdf.org.au/. The DEM dataset was converted in QGIS to contours.
- BAM - Important Areas for a small number of species of threatened fauna: NSW Department of Planning, Industry & Environment Map viewer accessed 27/3/20 at https://webmap.environment.nsw.gov.au/Html5Viewer291/index.html?viewer=BAM_ImportantAreas

3.3 FIELD SURVEYS

3.3.1 Timing of surveys

Following preliminary desktop assessments, an initial site inspection was undertaken on the 1st of September 2019 in order to gain a background understanding of the resource recovery area, subject property and the nature of the proposed resource recovery per se. Subsequent to follow-up comprehensive desktop assessments, encompassing preliminary identification of potential PCTs and vegetation zones, field surveys were undertaken on the 1st to the 3rd of September 2019. These surveys were focused on vegetation plot sampling and plant species identification, both these tasks contributing to the compilation of a flora species list for the resource recovery area and subject property. Subsequent site inspections were undertaken on the 2nd to the 5th of December 2019 primarily to conduct fauna surveys but also to complete BAM flora plots. In order to address the requirements of the CKPoM, a SAT survey was undertaken on the 7th February 2020, in addition to vegetation zone boundary waypoint descriptions.

Owing to the delay in the development approval process, it was considered appropriate to carry out an additional site inspection on the 10th of January, 2022. The primary aim of this inspection was to investigate whether there had been any substantial changes to the site vegetation and habitats since the last site surveys in 2020.

3.3.2 Native Vegetation Communities and Target Threatened Plant Species

i. Determination of Vegetation Zones and Extent of Vegetation Plot Sampling

The results from desktop assessments and the initial site inspection were used to determine the likely vegetation zones for the subject property. The key criteria for determining zones were native vegetation cover, the extent of existing clearing and observed/previously recorded tree species. The results from the plot sampling data subsequently were used to confirm and amend as appropriate, the boundaries of vegetation zones.

The extent of vegetation plot sampling required was determined according to the identification of the vegetation zones as described above and the size of these zones, with the number of plots sampled in accordance with the criteria provided in Table 3 of the BAM 2020.

ii. Plot Sampling and Target Threatened Plant Species Surveys

Six sample plots, comprising a 20 x 20 m quadrat within a 20 x 50 m plot, initially were established as per the procedures prescribed by the BAM. These plots included two plots beyond the stockpile and/or impact area, surveyed in part for the purpose of comparing the respective vegetation types with the vegetation within the impact area and/or stockpile area. An additional purpose was to allow for the potential for indirect impacts on these vegetation communities/habitats. Descriptions of each vegetation zone are provided in **Section 4.2.2**.

The full criteria considered in the placement of the sample plots comprised the following:

- In general, the areas surrounding the stockpile were proposed for retention;
- In general, the proposed resource recovery /impact area was limited to the stockpile;
- The stockpile contained patches in the north and a small patch in the south of vegetation supporting preferred Koala Food Trees and old growth/large mature trees;
- Potential TEC's existed in the areas beyond the stockpile; and

The area of the access track could require very limited impacts comprising primarily clearing of Lantana and possibly lopping of overhanging branches, within three very small patches. Given the size and disjunct nature of these patches however, establishing a plot within this zone was considered impractical.

Based on the above factors, Plots 1, and 3 were placed within the main stockpile regrowth area of low condition, but varying in the extent of regenerating vegetation present (refer to **Section 4.2.2** for further details). Plot 2 was placed in close proximity to Plot 1, but within the larger patch of remnant vegetation supporting preferred Koala Food Trees and old growth trees in the north of the stockpile, whilst Plot 4 was located to sample a patch of regenerating Swamp Oak (*Casuarina glauca*) occurring on the stockpile. Plot 5 and 6 were placed outside the impact area to survey more naturally occurring communities within the subject property. The locations of Plots 1 to 6 in relation to the impact area, are indicated on **Figure 14.**

In conjunction with the vegetation plot sampling procedures, general walking transects and fauna surveys (refer to **Section 3.3.3**), target searches were undertaken for threatened plant species potentially occurring on the subject property, and particularly within the impact area. These searches followed grid transect lines (as per the NSW Guide to Surveying Threatened Plants, Office of Environment and Heritage 2016), although both within and outside the impact area, minor deviations from transect alignments were necessary at times, owing to substantial physical constraints from dense weed infestations (refer to photographs in **Appendix B**). The identified candidate threatened species, as determined by the initial desktop assessment process, plus subsequent data entry to the BAM Calculator, are discussed further in **Section 4.1.1**. The general locations of survey transects for threatened flora are indicated on **Figure 14**, but the actual extent of surveying over the impact area and subject property is greater than could be clearly shown, given the extent of intersecting/criss-crossing movements undertaken.

Additional procedures for vegetation surveys including the following:

- Documentation of all plant species observed, both within plots, within the impact area and within the subject property as a whole;
- Collection of a small number of plant specimens for subsequent taxonomic confirmation; and
- Photographing of representative areas of the vegetation zones and of the vegetation plots.

3.3.3 Native Fauna

i. General Approach to Surveys

On the basis of the desktop review process, encompassing consideration of the habitats present, threatened species records for the IBRA Subregion, and the potential for threatened species to utilise the stockpile habitats, fauna surveys were undertaken based on the following factors:

- The stockpile area per se had been both cleared and substantially altered in landform structure some decades previously;
- There has been varying degrees of natural regeneration of native plant species on the stockpile, in combination with varying extents of exotic weed infestation; and
- The stockpile is bounded to the south/south-east by relatively natural vegetation communities, and to the north/north-east/east by relatively advanced regeneration of post-mining native vegetation communities (refer to **Figure 11**), albeit supporting varying extents of exotic weed infestation. These communities represent suitable, although not necessarily high quality habitat for a range of fauna species.

For some species to be considered as candidate species for assessment according to BAM 2020 requirements, potentially suitable habitat was either absent or too highly degraded or marginal to render it likely to support the threatened species in question. Consideration of this aspect also took into account amendments made to the extent of the proposed impact area, based on the identification of higher habitat values for some sectors. This applied particularly to areas supporting both KFTs and old growth and/or large mature trees. The reasons for removing candidate species from the list of species requiring further assessment/surveys are provided for each species in **Section 5.2.4**.

Details on specific fauna survey procedures undertaken in 2019/2020 are provided below and the locations of surveys are indicated on **Figure 14**. The majority of specific surveys were undertaken in December 2019, but additional Koala surveys were undertaken in February 2020 and general observations and some opportunistic bird surveys were undertaken during all survey sessions.

ii. Habitat Assessments

Site habitats were assessed generally to determine their value for native fauna species, the assessment process being undertaken on an ongoing basis through the study period in conjunction with both flora and target fauna surveys. Key habitat features, for both threatened species and other native fauna groups, considered for the assessment process included:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;
- Presence of old growth trees/large mature trees;
- The presence of KFTs;
- The presence of preferred Glossy Black Cockatoo feed trees (Forest oak and/or Black she-oak);
- Areas of dense vegetation;
- Presence of hollow logs/debris and areas of dense leaf litter;
- Presence of drainage lines/swampy areas;
- Presence of fruiting flora species;
- Presence of blossoming flora species, particularly winter-flowering species;
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- Presence of any man-made structures suitable as microchiropteran bat roost sites.

The locations of a number of specific habitat features, such as native figs representing a food resource, were recorded previously (Pandanus Solutions, 2018), using a hand held GPS unit and subsequently mapped.

iii. Small Mammal Trapping

Trapping surveys, using Elliott Type A traps, were undertaken in order to target any small mammals utilising the stockpile and adjoining habitats, and particularly the threatened species, the Common Planigale (*Planigale maculata*) and Eastern Pygmy Possum (*Cercartetus nanus*), both of which have been trapped previously in Elliott traps (A. Martin, 1995, 1996 unpubl. data). Although pitfall traps ideally would be used in addition to Elliott traps, the very dense, soft nature of the ilmenite substrate severely hindered the installation of effective pitfall traps. The traps for this survey also were set on a very fine trigger level to maximise the chances of capture of small fauna species.

A total of 450 trap nights was sampled along two trap lines, with the location of each trap lines designed to sample habitats both on and off the stockpile. Traps were set with a standard bait mixture of peanut butter, rolled oats, honey and vanilla, checked each morning and rebaited if the bait had

been eaten or soiled by a captured animal. All trap locations were marked with labelled flagging tape in the field.

iv. Hair Tube Trapping

Hair tube trapping was conducted in conjunction with Elliott trapping, with hair tube traps set along portions of each Elliott trap line. This trapping procedure was aimed at both small mammals, which have been effectively sampled using this method during long term monitoring programmes (Greenloaning Biostudies 2003), and medium weight range species (e.g bandicoots, Rufous Bettong [*Aepyprymnus reufescens*). A total of 120 hair tube trap nights was sampled. Hair specimen analysis was conducted Dr David Read.

v. Camera Trapping

Three Browning 'no-glow' infrared Trail Cameras (BTC 6HDE) were set at strategic locations within the subject property, one each near the start of each trap line and one to the north of the stockpile directed along a drainage line and potential movement corridor. A total of 27 camera trap nights was sampled, with all images checked once by an ecologist and re-checked by the principal ecologist for any signs of fauna activity. The locations of the camera traps are indicated on **Figure 14**.

vi. Koala SAT Plot Surveys

Although it was determined during the course of the project studies that the areas supporting KFTs were potentially to be retained, in the absence of complete certainty, initial checks of such areas were undertaken in December 2019 for signs of Koalas in the form of pellets at the base of trees. Spotlighting surveys also were undertaken over two nights in December 2019 (see **Section 3.3.3.iv**). A formal SAT Plot survey according to the procedures detailed in Phillips and Callaghan (2011) subsequently was undertaken in February 2020, focusing on the northern remnant[1] forest/woodland vegetation supporting the majority of KFTs within the stockpile area.[2] The location of the central tree for the SAT Plot and spotlighting transects are indicated on **Figure 14**.

vii. Spotlighting Surveys

Spotlighting surveys were undertaken by two personnel on two nights in December 2019, with two spotlighting transects sampled each night. The conditions on each night were fine and mild to warm. The primary aim of these surveys was to target nocturnal arboreal species, including the Koala, as well as any other nocturnal ground fauna or bird species. A total of approximately eight person hours was spent spotlighting. Opportunistic spotlighting also was undertaken within the stockpile area during the course of checking harp nets after dusk (refer to **Section 3.3.3.viii** below).

viii. Microbat Surveys

Microbats were surveyed using two harp nets, located at two suitable flyways within the stockpile area, as shown on **Figure 14**. One species credit species requiring surveys under the BAM is the Southern Myotis (*Myotis macropus*), although the potential for occurrence of the species on the site was considered to be low. However, from a precautionary perspective, considering there was potential for roosting habitat in habitat adjacent to the impact area (the site) three harp nets were set at each location over three nights, total trap nights equalling nine. Two bat detectors also were set at

[1] Although this remnant occurs within the mapped boundaries of the stockpile, the age of some trees also exhibiting tree hollows suggests the stockpile material was built up around the old growth trees present.

the same locations, with sampling continued over nine consecutive nights. Call analysis was carried out by specialist Greg Ford from Balance Environmental.

ix. Opportunistic Sightings

All observations of fauna species observed during the course of flora surveys and other fauna survey procedures were recorded. Any locations of threatened or migratory species were documented separately and the GPS coordinates recorded.

x. Active Searching

Active searches for reptiles were undertaken whilst traversing the site, with logs, or any potential shelter site overturned as part of the search process. Any diggings, scats and bones observed during these searches also were recorded. Theses searches generally were opportunistic as logs and suitable shelter habitat were poorly represented over most of the stockpile habitats.

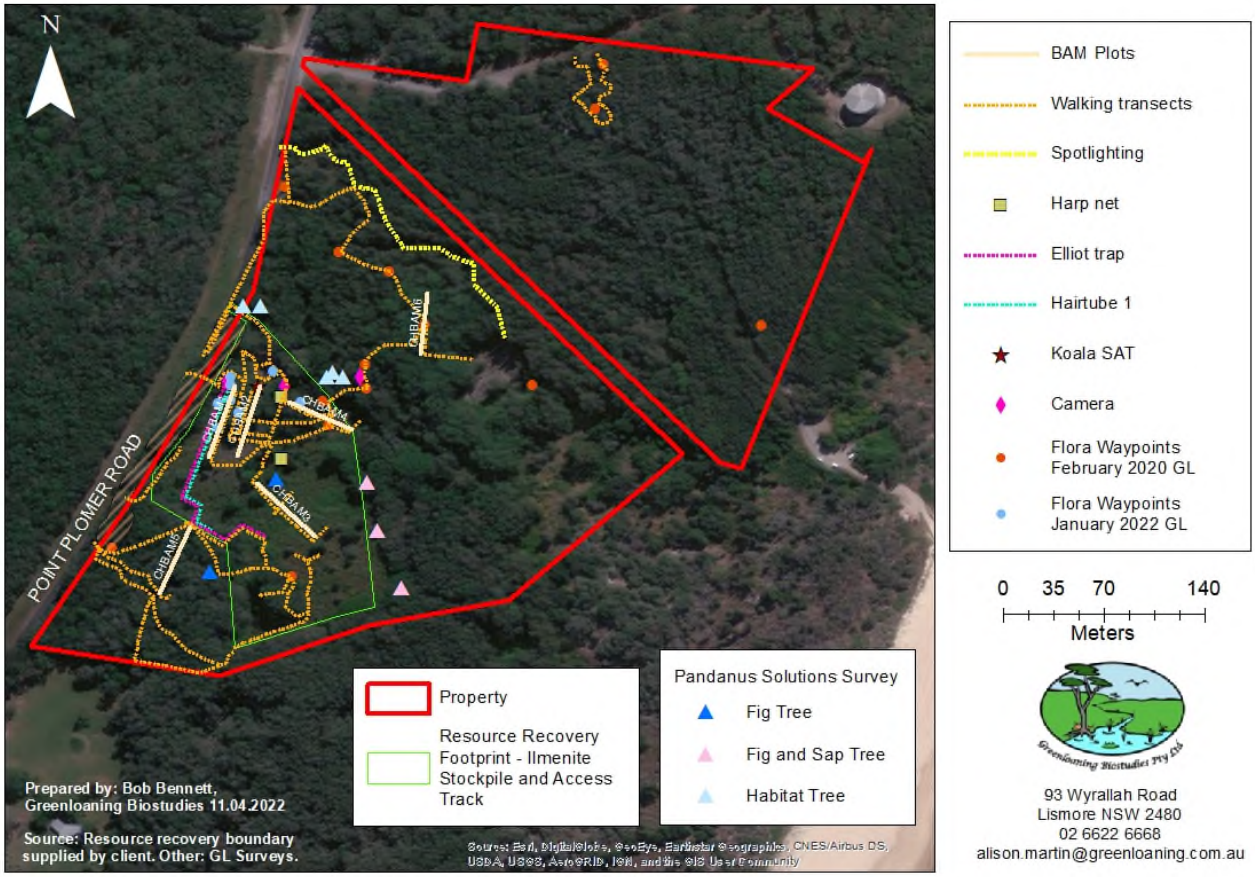

Figure 13 ***Flora and fauna surveys conducted at the subject property by Greenloaning Biostudies and Pandanus Solutions, 2019-2020***

3.3.4 Limitations to the Survey procedures and Assessment process

It is recognised that, as with all surveys, the survey process for the project had some limitations, viz:

- The identification of the PCTs occurring on the stockpile was not straightforward, this situation exacerbated by the highly disturbed nature of the stockpile per se and the regenerating vegetation not necessarily representing completely natural systems. This subsequently affected the listing of potential candidate species (refer to **Section 4.2.5** and **5.2.4** for further details).
- Field surveys in September were curtailed by severe weather conditions, with gale force winds prevailing on the third planned survey day;
- The timing of site inspections and surveys in 2019/2020coincided primarily with severe drought conditions in many areas and severe bush fires to the west during, or immediately prior to survey periods. Blackened leaves were commonly observed for instance during the December 2020 surveys. Conditions for nomadic/seasonal/migratory species therefore were not optimal;
- The main target surveys for fauna species were limited to one seasonal session, although the intent of the timing was to maximise the number of species that could be sampled in accordance with required survey periods under the BAM; and
- Although stratification of survey sites is generally undertaken and recommended under survey guidelines (NSW Government n.d), the small size of the impact area and low topographical relief precluded the practicality of survey site stratification.

Nonetheless, the field data obtained, together with the comprehensive desktop assessment process and the extensive experience of the author of this report, provide a meaningful ecological basis for the subsequent assessment process for the preparation of this BDAR. This is particularly the case in the context of the highly modified nature of the impact area and the very small extent of proposed disturbance.

3.3.5 Qualifications and Experience of Key Personnel

i. Alison Martin – Principal Ecologist/Accredited Assessor

Alison has extensive experience in ecological surveys spanning over 40 years, encompassing numerous projects large and small scale from the late 1970's. She has worked extensively with threatened species and has undertaken and managed a range of threatened species'/ecological communities' surveys, developed threatened species management protocols and subsequent monitoring programmes. As an accredited BAM Assessor, Alison has prepared a number of BDARs, as well as carrying out studies for potential Biodiversity Stewardship Sites and providing advice on the BAM process to government agencies and private landholders.

ii. Fiona Dawson – Senior Ecologist/Accredited Assessor

Fiona is an ecologist with a strong combined background of field and desktop analytical/reporting/GIS skills. She has developed expertise in plant identification through over ten years of bush regeneration, Koala surveys with NPW and Biolink Ecological Consultants (including SAT training certificate), intensive field surveys with Greenloaning identifying and mapping PCTs and TECs over 20, 000 ha of private lands, and sampling BAM vegetation plots in the Lismore, Ballina and Crescent Head areas. Fiona has gained additional identification skills and knowledge of preferred Koala food trees through her work with Koalas, enhanced by her Leaf Coordinator volunteering role with Friends of the Koala.

iii. Bob Bennett – Senior Researcher and GIS Operator

Bob draws on over twenty years' experience in Natural Resource Management to contribute to Greenloaning Biostudies projects. He has lead NSW Agriculture salinity, agronomy and soil science projects, on the Liverpool Plains (NSW) and major projects in Queensland including research into rising groundwater in the Burdekin River Irrigation Area, and water planning for the Atherton Tablelands region, in Far North Queensland. At a State level, he has played a key role in policy research, and the development of legislation for improved water and native vegetation management. Bob is a competent and experienced project manager. His current roles with Greenloaning Biostudies include the design and implementation of ecological survey work, data analysis and interpretation, and the production of detailed, high quality mapping of ecological features using ArcGIS and other platforms.

4 Results – Flora

4.1 RESULTS FROM DESKTOP ASSESSMENTS

4.1.1 Threatened Species, Populations and /or Ecological Communities with Potential to Occur on the subject property

The initial desktop assessment process yielded a total of 38 threatened species and nine threatened ecological communities (TECs) listed under the BC Act and occurring within the IBRA subregion. Of the total threatened flora species listed, 18 also are listed as threatened under the EPBC Act. Refinement of the list of potential threatened species and communities subsequently was undertaken, following a preliminary site inspection and detailed consideration of the ecological data on threatened species provided in BioNet 2019/2020. This process reduced the list of candidate 'species credit species' to a total of 8 threatened flora species. However, species such as those associated with estuarine or wetland habitats, which could not be expected to occur on the stockpile/impact area habitats, were excluded from the final candidate species list. The total list of threatened species, and potential candidate species, was confirmed for the 2020 updates to the BDAR.

Four TECs also were considered likely or potentially to occur, these being:

1) Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions;
2) Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions;
3) Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion; and
4) Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions;

Community 1 and 2) above are also listed under the EPBC Act as Critically Endangered Ecological Communities (CEECs), viz:

1) Littoral Rainforest and Coastal Vine Thickets of Eastern Australia; and
2) Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community

It is noted that desktop studies indicated that the Goolawah National Parks contains a number of communities with potential relevance to the project site and stockpile environs. These communities include:

- Coastal swamp forests (including three different Broad-Leaved Paperbark (*Melaleuca quinquenervia*) communities;
- Wallum sand heaths, dominated by coastal wattle (*Acacia longifolia* ssp. *sophorae*);
- Coastal dune dry sclerophyll forests dominated by Pink Bloodwood (*Corymbia intermedia*) and Coast Banksia (*Banksia integrifolia* ssp. *integrifolia*), found on sandy dunes and coastal plains;
- Two distinct littoral rainforest communities, one dominated by Coast Banksia and Tuckeroo (*Cupaniopsis anacardioides*), found in the more protected fore dune areas, and another, more diverse community occurring on Racecourse Headland (DPIE, 2014).

Two threatened plant species also have been recorded from the national park: Austral Toadflax (*Thesium australe*) and White-flowered Wax Plant (*Cynanchum elegans*). An additional three threatened plant species have been recorded in the locality, these being:

- Scented Acronychia (*Acronychia littoralis*),
- Dwarf Heath Casuarina (*Allocasuarina defungens*) and
- Milky Silkpod (*Parsonsia dorrigoensis*) (DPIE, 2014).

The park contains three endangered ecological communities:

- *Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions;*
- *Themeda Grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*; and
- *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (DPIE, 2014).

The full lists of threatened species and communities generated from the database searches are provided in Appendix C and Appendix D. Preliminary comments on the likelihood of occurrence of species within the Impact Area also are provided in Appendix C. Candidate species determined to require surveys are provided in Table 4.1. Reasons for removing a species from the final candidate species list are detailed in Section 4.2.5. No additional species listed under the EPBC Act were considered likley to occur.

Table 4-1 Candidate Threatened Flora Species for which Survey was Required, Extent of Potential Habitat and Biodiversity Risk Weighting

Species		**Habitat Features Suitable for the Species and Present on the subject property***	**Feature Present in Impact Area**	**Extent of Potential Habitat within Impact Area (ha)**	**Biodiversity Weighting Risk**
Scientific Name	**Common Name**				
Acronychia littoralis	Scented Acronychia	Regenerating Littoral Rainforest	Some elements	0	3
Alexfloydia repens	Floyd's Grass	Moist understorey of Swamp Oak Forest	Regenerating patch of Swamp Oak	0.08	3
Allocasuarina defungens	Dwarf Heath Casuarina	Tall heath on sands – also on clay soils and sandstone, coastal hills/headlands	Regenerating dry woodland areas with some heath elements	1.28	2
Dendrobium melaleucaphilum	Spider Orchid	Grows commonly on *Melaleuca styphelioides* and sometimes on rainforest trees	Very scattered rainforest Trees	Scattered Trees only within Zone 3c (Total zone - 1.14 ha)	2
Melaleuca biconvexa	Biconvex Paperbark	Damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Minimal – one small ditch within PCT 1235	Approx. 150 sq. m	2
Peristeranthus hillii	Brown Fairy-chain Orchid	Rainforest trees and occasional vines in Littoral Rainforest and t Lowland Rainforest on Floodplain	Only very scattered Littoral Rainforest trees	Scattered Trees only within Zone 3c (Total zone - 1.14 ha)	3
Eucalyptus seeana – endangered population	Eucalyptus seeana population in the Greater Taree local government area	Occurs as scattered individuals in woodlands and open forests on low, often swampy, sandy soils.	Slight possibility of an isolated specimen	If any mature specimens are present in forest/woodland habitats, an young seedling/sapling could occur in regenerating areas, mainly zone 2c (0.14 ha)	2

*Office of Environment and Heritage 2017a, 2017b, 2017c, 2018a, 2018b, 2019a, 2019b

4.1.2 Vegetation Cover and Communities

As stated in Section 1.4.6 and described in 3.2.2.i and 3.2.2.ii, desktop assessments determined that the percentage cover of native vegetation within the 1500m buffer zone was 62%, whilst the patch size was 380 ha. The extent of the native vegetation within the buffer zone and the size and extent of the defined 'patch' are shown on **Figure 13**.

The extent and broad type of existing vegetation mapping depicted in **Figure 15** is based on Kempsey LGA (Eastern Portion) Vegetation VIS_243, a polygon shapefile 1:25,000 vegetation mapping dataset combining 1999 CRAFTI and Forest Ecosystem mapping undertaken by Kendall and Kendall Ecological Consultants and GECO Environmental for Kempsey Shire Council. This mapping encompasses the resource recovery area and subject property. The existing mapping, as shown on **Figure 15,** is very broad scale and as confirmed by the report authors, was not subject to further ground truthing. Limited ground truthing was conducted along roads providing access to the study area and no systematic flora survey was undertaken" (Telfer & Kendall, 2006). Therefore, vegetation communities within the resource recovery /impact area and subject property were subsequently refined for the purposes of this BDAR (refer to **Section 4.2**).

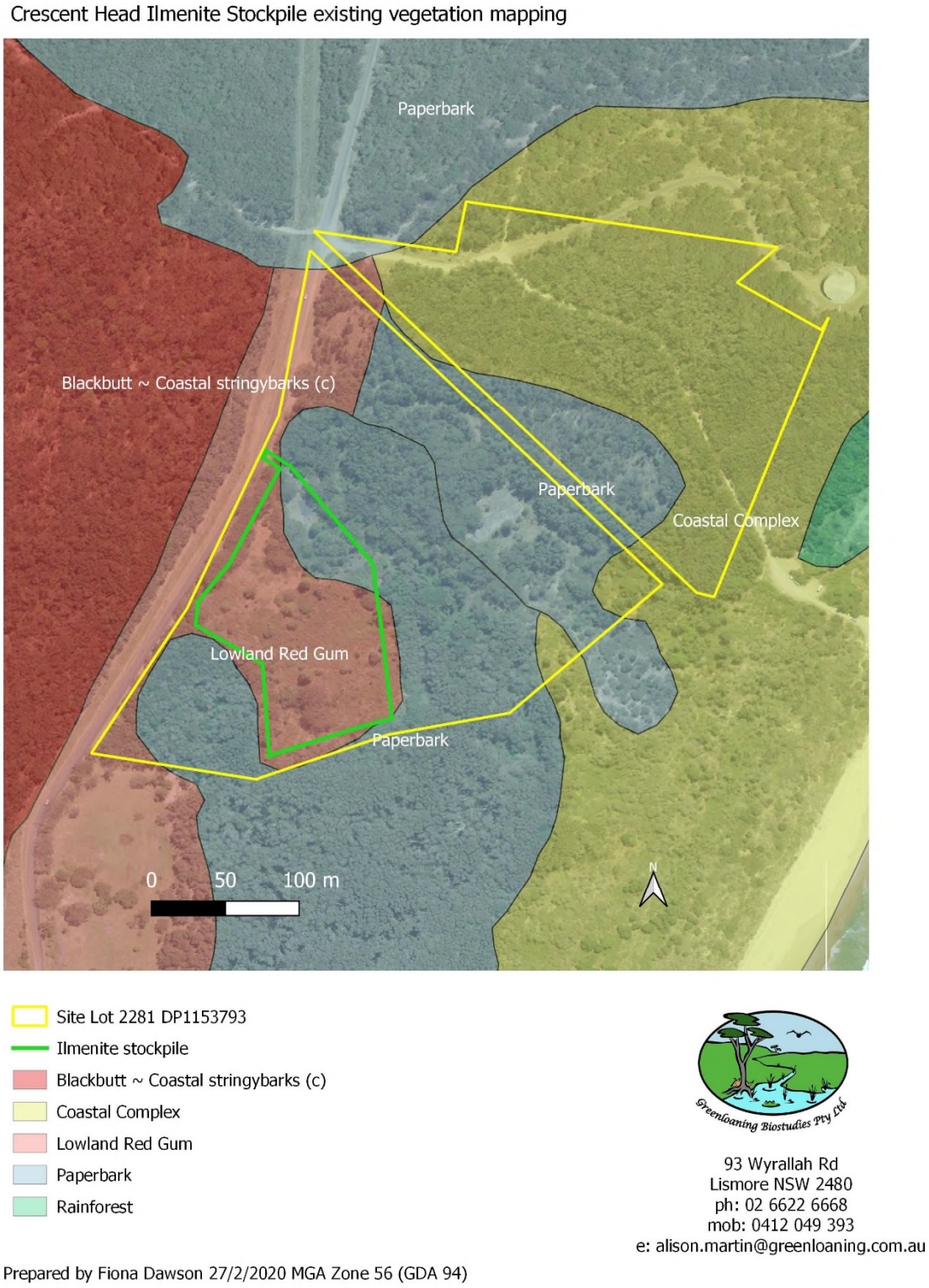

Figure 14 Existing vegetation mapping. Source Kempsey LGA (Eastern Portion) Vegetation. VIS_ID 243 (Telfer & Kendall (2006).

4.2 RESULTS FROM FLORA SURVEYS

4.2.1 Vegetation Communities and PCTs

The 2019/20 field inspections and surveys, in conjunction with the desktop assessment processes, yielded the following key findings in relation to the occurrence and distribution of vegetation communities and PCTs occurring on the resource recovery area and subject property:

- The stockpile/impact area which was abandoned and left to regenerate naturally and is generally in low condition with infestations of Lantana, was determined to best fit PCT 1230 *Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion*, although the PCT classification confidence level is very low (OEH, 2020b). This community as it occurs on the stockpile is not considered to be a TEC (refer below for further details);
- Patches of vegetation in the north and a small patch in the south of the stockpile containing old-growth and/or Koala food trees within the same community are to be retained;
- In addition, PCT 1230 fringes the stockpile/Point Plomer Road margins and the northern perimeter of the subject property and is conservatively considered a TEC in sectors that may conform to the TEC definition of occurrence on a floodplain (refer below for further details);
- The low lying areas south, south west and south east of the stockpile dominated by Broad-leaved Paperbark (*Melaleuca quinquenervia*) were classified as PCT 1064 *Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion*. This community represents a modified and regenerating form of TEC (refer below for further details);
- A small area on the northeast margin of the stockpile and a more extensive area north east of the stockpile on the western subject property boundary dominated by Swamp Oak (*Casuarina glauca*) was determined to fit PCT 1235 *Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion* and also represents a modified and regenerating form of TEC off the stockpile only (refer below for further details);
- The subject property to the east of the aforementioned communities comprises PCT 686 Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion, not considered to be a TEC (refer below for further details) and PCT 1536 Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest which is a modified and regenerating form of TEC (refer below for further details);

The distribution of the vegetation communities within the subject property and on the resource recovery area, is indicated on **Figure 16.** Descriptions of the five PCTs referred to above are provided below;

i. Community 1 - PCT 686 - Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion

a. *Community Attributes and Condition*

Vegetation Class: North Coast Wet Sclerophyll Forests
Percentage Cleared: 50%

The vegetation description of this PCT is "Other Diagnostics Features: Tall to very tall open forest (12 – 35m). Landscape Position: In low lying areas on the coast from Kendall north to Coffs Harbour. Upper Stratum Species: *Eucalyptus pilularis; Corymbia intermedia*; Mid Stratum Species: *Breynia oblongifolia; Callistemon salignus; Glochidion ferdinandi; Melaleuca linariifolia; Rubus hillii;* Ground Stratum Species: *Entolasia marginata; Eustrephus latifolius; Lomandra longifolia; Oplismenus imbecillis; Pratia purpurascens; Pseuderanthemum variabile; Pteridium esculentum; Imperata cylindrica var. major "*(OEH, 2020b).

The determination of this community as Wet Sclerophyll Forest and PCT 686 has been based on the following key attributes and as evidenced by Plot CHBAM6:

- The occurrence in the upper stratum of *Eucalyptus pilularis* and *Corymbia intermedia*, in the mid stratum *Breynia oblongifolia* and *Glochidion* spp. and in the ground stratum *Lomandra longifolia* and *Imperata cylindrica,* which are species characteristic of this PCT;
- The location of the community in low lying areas on the coast from Kendall north to Coffs Harbour.

As stated in the VIS Classification - Community Profile Report (OEH, 2020b) the classification confidence of this PCT is very low with neither the lithology or landform patterns having been assessed.

The data from Plot CHBAM6, presented in **Appendix F**, and provided as fully formatted tables separately in excel format, provides an example of the variation in composition and structure of the community. The presence of other species not occurring in the PCT description, such as *Casuarina glauca*, *E. robusta, Melaleuca quinquenervia* and vines including *Parsonsia spp.*, *Smilax australis and Geitonoplesium cymosum* indicate the transitional or ecotonal nature of the community, as could be expected when considering the community is surrounded by other PCTs (refer to **Figure 15)**.

The photographs provided in **Appendix B** also illustrate the nature of this area and the level of disturbance. A comparison of the benchmark conditions for the PCT and the condition of the representations of the PCT within the resource recovery /impact area and subject property is provided in **Table 4.1**. A full list of flora species recorded in the community is provided in **Table E1**, **Appendix E.**

b. *Status*

Plant Community Type 686 is associated with the following TECs, which are listed as Endangered under the BC Act: *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Part) and the *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion* (Part).

This PCT does not appear to conform to the listing advice for the first TEC as "The combination of features that distinguish River-Flat Eucalypt Forest on Coastal Floodplains from other endangered communities on the coastal floodplains include its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus *Angophora* or the

sections *Exsertaria* or *Transversaria* of the genus *Eucalyptus* (Hill 2002); the relatively low abundance or sub-dominance of *Casuarina* and *Melaleuca* species; the relatively low abundance of *Eucalyptus robusta*; and the prominent groundcover of soft-leaved forbs and grasses. It generally occupies central parts of floodplains and raised levees; habitats where flooding is periodic and soils are rich in silt, without deep humic horizons and show little or no influence of saline ground water" (NSWSC 2011-2012a).

There were no Angophora or Red Gum (Exsertaria) species recorded in this community and only one recording of Transversaria (*E. robusta*) at the BAM Plot. In addition, the soils were sandy, rather than soils rich in silt as described in the listing advice.

ii. Community 2 - PCT 1064 - Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion

a. *Community Attributes and Condition*

Vegetation Class: Coastal Swamp Forests
Percentage Cleared: 75%

This PCT is described in the VIS Classification - Community Profile Report (OEH, 2020b) as "Low to very tall woodland and forest in which Broad-leaved Paperbark (*Melaleuca quinquenervia*) commonly dominates the overstorey, or occasionally another paperbark (e.g. *M. alternifolia, M. sieberi, M. linariifolia, M. styphelioides*). Associates include Swamp Mahogany (*Eucalyptus robusta*), Swamp Oak (*Casuarina glauca*) and Swamp Box (*Lophostemon suaveolens*). Understorey and ground layer composition varies with substrate, depth and extent of waterlogging, and water quality. Sawsedges (*Gahnia spp*.), twig-rushes (*Baumea spp*.), Carex spp., Bungwahl Fern (*Blechnum indicum*), Feather Plant (*Baloskion tetraphyllum*), Tea-tree (e.g. *Leptospermum juniperinum*), Bottlebrush (e.g. *Callistemon pachyphyllus*) and certain grasses (e.g. *Hemarthria uncinata, Ischaemum australe*) may dominate, or alternatively rainforest trees, shrubs and vines such as Cabbage Tree Palm (*Livistona australis*), Cheese Tree (*Glochidion ferdinandi*) and Common Silkpod (*Parsonsia straminea*) can be common. This ecosystem is widespread on the coastal lowlands". Additional species such as Forest Red Gum (*E. tereticornis*) are listed in the Species per Stratum section of the Profile.

The determination of this community as PCT 1064 has been based on the following key attributes as evidenced by Plot CHBAM5:

- The dominance of *M.quinquenervia* in the upper stratum and presence of *E. tereticornis* and *Glochidion spp.* in the upper and mid stratum;
- The dominance of the ground stratum by *Gahnia sieberiana* and occurrence of other species characteristic of this PCT including *Parsonsia* spp. and Fern species.

As stated in the VIS Classification - Community Profile Report (OEH, 2020b) the classification confidence of this PCT is medium, however neither the lithology or landform patterns have been assessed.

The data from Plot CHBAM5, presented in **Appendix F** and provided as fully formatted tables separately in excel format, provides an example of the variation in composition and structure of the community, with the presence of other species not occurring in the PCT description such as *Ficus spp*., *Corymbia intermedia, Guioa semiglauca* and vines *Smilax australis* being indicative of the influence of adjoining PCTs (refer to **Figure 15**).

The photographs provided in **Appendix B** also illustrate the nature of this area and the level of disturbance. A comparison of the benchmark conditions for the PCT and the condition of the representations of the PCT within the resource recovery /impact area and subject property is provided in **Table 4.1**. A full list of flora species recorded in the community is provided in **Table E1**, **Appendix E.**

b. *Status*

Plant Community Type 1064 is associated with the following TECs, which are listed as Endangered under the BC Act: *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Part) partially subset of and the *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Equivalent) wholly subset of

This PCT does not conform to the listing advice (see PCT 686 for description) for the *River-Flat Eucalypt Forest* TEC as it is dominated by Paperbark.

It does appear to conform to the listing advice for Swamp Sclerophyll Forest on Coastal Floodplains which is "associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains, generally below 20m"(NSWSC 2011-2012b). This BAM plot occurs on alluvial soils as indicated by **Figure 5** at an elevation of < 20m and includes "areas of fernland and tall reedland or sedgeland" (NSWSC 2011-2012b). The presence of *Ficus spp.* (eg Sandpaper Fig) at the plot also conforms to the determination as does the "relatively infrequent occurrence of other eucalypts, *Casuarina glauca* or *Lophostemon suaveolen"* (NSWSC 2011-2012b).

iii. Community 3 - PCT 1230 - Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

a. *Community Attributes and Condition*

Vegetation Class: Coastal Swamp Forests
Percentage Cleared: 75%

This PCT is described in the VIS Classification - Community Profile Report (OEH, 2020b) as "Mid-high (rarely low) to very tall woodland and forest; Landscape Position: In drainage lines and open depressions mainly on the coastal lowlands, but occasionally further inland. Upper Stratum Species: *Eucalyptus robusta; Melaleuca quinquenervia; Casuarina glauca; Eucalyptus resinifera; Eucalyptus tereticornis; Corymbia intermedia; Lophostemon suaveolens*; Mid Stratum Species*: Acacia maidenii; Baeckea frutescens; Callistemon pachyphyllus; Cordyline stricta; Glochidion ferdinandi; Leptospermum juniperinum; Livistona australis; Melaleuca spp.; Melicope elleryana; Parsonsia straminea*; Ground Stratum Species*: Baloskion tetraphyllum; Blechnum camfieldii; Blechnum indicum; Gahnia spp.; Hypolepis muelleri; Ischaemum australe; Sporadanthus interruptus; Xanthorrhoea fulva;*

The determination of this community as PCT 1230 has been based on the following key attributes as evidenced by Plot CHBAM1, 2 and 3 and additional waypoint descriptions CHF1, 6, 7, 8, 13, 14:

- The dominance of old growth *E. tereticornis* in the upper stratum with *C. intermedia* at Plot 2 which must have already been in existence but was partially buried by the stockpile in the north of the stockpile. The presence of old growth *E. robusta* and *E. tereticornis* in a patch on the south of the stockpile (CHF14);
- The presence of E. tereticornis, C. intermedia , M. quinquenervia , C. glauca at CHF1, 6, 7, 8, 13, 14;

- Despite the dominance by regenerating pioneer species in Plot 1 and 3 which are effectively cleared areas created by the stockpile, in particular, *Pteridium esculentum* at Plot 3 and *Imperata cylindrica* at Plot 1, species characteristic of this PCT were recorded at Plot 1 (*E. tereticornis* and *Glochidion ferdinandi*) and therefore was considered to be part of this PCT;
- PCT 1230 was considered the best match for Plot 3 owing to the occasional occurrence of *C. intermedia* as an emergent above the dense *Pteridium esculentum/Lantana* dominating the lower stratum, as well as isolated *Glochidion ferdinandi* and *Leptospermum juniperinum* small trees/shrubs.

As stated in the VIS Classification - Community Profile Report (OEH, 2020b) the classification confidence of this PCT is very low with neither the lithology or landform patterns having been assessed. The community as it occurs on the stockpile has been substantially disturbed from past clearing and the regenerating areas have developed on a totally man-modified substrate of ilmenite. The designation of this community thus is quite problematic and the confidence level for PCT determination is very low. Weed infestations have further influenced the regenerating areas and there is considerable variation in species composition, canopy cover and extent of weed cover over the subject property. This variation has led to the designation of vegetation zones as shown on **Figure 15**, varying in overall condition, as described in **Section 4.2.2**.

The data from Plot CHBAM1, 2 and 3 are presented in **Appendix F** and provided as fully formatted tables separately in excel format, and provide examples of the variation in composition and structure of the community, with the presence of other species not occurring in the PCT description such as *Pteridium esculentum, Imperata cylindrica* and *Banksia integrifolia* due to the anthropogenic nature of the stockpile.

The photographs provided in **Appendix B** also illustrate the nature of this area and the level of disturbance. A comparison of the benchmark conditions for the PCT and the condition of the representations of the PCT within the resource recovery /impact area and subject property is provided in **Table 4.1**. A full list of flora species recorded in the community is provided in **Table E1**, **Appendix E.**

b. *Status*

Plant Community Type 1230 is associated with the following TECs, which are listed as Endangered under the BC Act: *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion* (Part); *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Part); *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Part)

The communities on the stockpile do not meet the criteria for any of these TECs due to the geomorphological nonconformity of the stockpile. All of these TECs require the communities to reside on coastal floodplains and associated soils (NSWSC 2011-2012b, c) whereas the stockpile is anthropogenic and composed of black ilmenite sand.

While the communities adjacent to the stockpile may comply with the vegetation descriptions, there is doubt regarding the floodplain status of the lower-lying land surrounding the stockpile, however from a precautionary approach, they would be considered as TECs.

iv. Community 4 - PCT 1235 - Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion

a. *Community Attributes and Condition*

Vegetation Class: Coastal Swamp Forests
Percentage Cleared: 75%

This PCT is described in the VIS Classification - Community Profile Report (OEH, 2020b) as "Low to very tall woodland and forest. Widespread on poorly drained sites in coastal areas. Upper Stratum Species comprise*: Casuarina glauca; Melaleuca quinquenervia; Eucalyptus tereticornis;* Mid Stratum Species: *Goodenia ovata; Hibiscus diversifolius; Melaleuca ericifolia; Melaleuca styphelioides; Parsonsia straminea;* Ground Stratum Species: *Baumea juncea; Enydra fluctuans; Fimbristylis ferruginea; Gahnia clarkei; Ischaemum australe; Juncus kraussii;*

The determination of this community as PCT 1235 has been based on the following key attributes as evidenced by Plot CHBAM4 and additional waypoint descriptions CHF4, 9 and 12:

- The dominance of old growth *C. glauca* in all stratums with *E. tereticornis* also present in the upper stratum.

This community also occurs off the stockpile to the east (**Figure 16**) as documented by waypoint descriptions CHF4, 9 and 12. As stated in the VIS Classification - Community Profile Report (OEH, 2020b) the classification confidence of this PCT is very low with neither the lithology or landform patterns having been assessed.

Plot CHBAM4 is presented in **Appendix F,** and provided as fully formatted tables separately in excel format and provides an example of the variation in composition and structure of the community, with the presence of other species not occurring in the PCT description such as *Corymbia intermedia* and *Imperata cylindrica* indicating an ecotonal area . The varied elevation drops down into dense *Smilax australis* and *Hibbertia scandens* at the eastern end indicating a more recently cleared and disturbed area.

The photographs provided in **Appendix B** also illustrate the nature of this area and the level of disturbance. A comparison of the benchmark conditions for the PCT and the condition of the representations of the PCT within the resource recovery /impact area and subject property is provided in **Table 4.1**. A full list of flora species recorded in the community is provided in **Table E1**, **Appendix E.**

b. *Status*

Plant Community Type 1235 is associated with the following TECs, which are listed as Endangered under the BC Act: Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Part); Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Part); Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Part).

The communities on the stockpile do not meet the criteria for any of these TECs due to the geomorphological nonconformity of the stockpile. These TECs require the communities to reside on coastal floodplains and associated soils (NSWSC 2011-2012b, c), whereas the stockpile is anthropogenic and composed of black ilmenite sand. However the patch situated to the east of the

stockpile does conform to the Swamp Oak listing with regard to both vegetation and soils which are mapped as alluvial (**Figure 5**) and is therefore considered to be a TEC.

This community also is listed as Vulnerable under the EPBC Act, and occurrences of the community on the low-lying areas surrounding the stockpile are likely to conform to the definition of *Coastal Swamp Oak* (Casuarina glauca) *Forest of New South Wales and South East Queensland ecological community*. Under this definition however, the community is associated with such landscape features as low-lying alluvial plains and unconsolidated sediments and 'occurrences of swamp oak trees on rocky headlands or other consolidated substrates are not considered to be a part of the ecological community' (Department of the Environment and Energy 2018) The small pocket of regenerating Swamp Oak Forest occurring within the Impact Area on a dry man-modified stockpile of ilmenite thus does not conform to the definition of the community.

v. Community 5 - PCT 1536 - Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest

a. *Community Attributes and Condition*

Vegetation Class: Littoral Rainforest
Percentage Cleared: 78%

The vegetation description of this PCT is "Low open forest to closed forest with a canopy characterised by *Cupaniopsis anacardioides* and *Banksia integrifolia*. The mid-storey is composed mainly of shrubs and climbers. The ground layer consists of ferns; graminoids and scattered forbs. Near coastal areas on coastal lowlands of the lower North coast and Central Coast mainly on sands. Upper Stratum Species comprise: *Cupaniopsis anacardioides; Acmena smithii; Banksia integrifolia;* Mid Stratum Species: *Myrsine variabilis; Breynia oblongifolia; Pittosporum revolutum; Polyscias elegans; Notelaea longifolia; Glochidion ferdinandi; Smilax australis; Marsdenia rostrata; Pandorea pandorana; Cissus hypoglauca; Cissus antarctica;* Ground Stratum Species: *Pteridium esculentum; Lomandra longifolia; Viola hederacea; Oplismenus imbecillis* " (OEH, 2020b).

The determination of this community as PCT 1536 has been based on the following key attributes (recorded at waypoint description CHF2, CHF3, CHD16):

- The occurrence of species characteristic of this PCT, viz: Cupaniopsis anacardioides, Notelaea spp., Persoonia spp., Guioa semiglauca, Glochidion ferdinandi, Acmena smithii (var. major), Lomandra longifolia, Geitonoplesium spp., Imperata cylindrical, Breynia oblongifolia, *Monotoca elliptica, Melaleuca quinquenervia, Eucalyptus tereticornis, Corymbia intermedia*;
- The location of the community within 2 km from the ocean;
- The presence of salt tolerant species such as Tuckeroo; and
- The sandy nature of the topsoil.

As stated in the VIS Classification - Community Profile Report (OEH, 2020b) the classification confidence of this PCT is high, with lithology described as Mudstone and Sandstone but landform patterns not having been assessed.

The photographs provided in **Appendix B** also illustrate the nature of this area and the level of disturbance. A comparison of the benchmark conditions for the PCT and the condition of the representations of the PCT within the resource recovery /impact area and subject property is provided in **Table 4.2**. A full list of flora species recorded in the community is provided in **Table E1**, **Appendix E.**

b. *Status*

Plant Community Type 1536 is associated with the following TEC which is listed as Endangered under the BC Act: *Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Part)*.

This community conforms to the determination with regard to both vegetation and soils (NSWSC 2011-2012d). It should be noted that although this site is not mapped as Littoral Rainforest in the recent Coastal SEPP (which amalgamates SEPP 26 Littoral Rainforest), the determination states "The areas mapped for inclusion in SEPP 26 Littoral Rainforest are examples of the ecological community, but the mapping is not exhaustive and stands of this community occur at locations not mapped under SEPP 26. Some stands may be regrowth or in the process of regenerating".

PCT 1536 also conforms to the Commonwealth *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia*, listed as Critically Endangered under the EPBC Act, as the representation of the PCT within the subject property meets all of condition thresholds prescribed by the Listing Advice for the community (DAWE, 2015), including:

• The patch must have:

1) at least 25% of the native plant species diversity characteristic of this ecological community in that bioregion (Attachment A) [of the Listing Advice];

OR

2) at least 30% canopy cover of one rainforest canopy (either tree or shrub) species (Attachment A, excluding Banksia and Eucalyptus species that may be part of the ecological community).

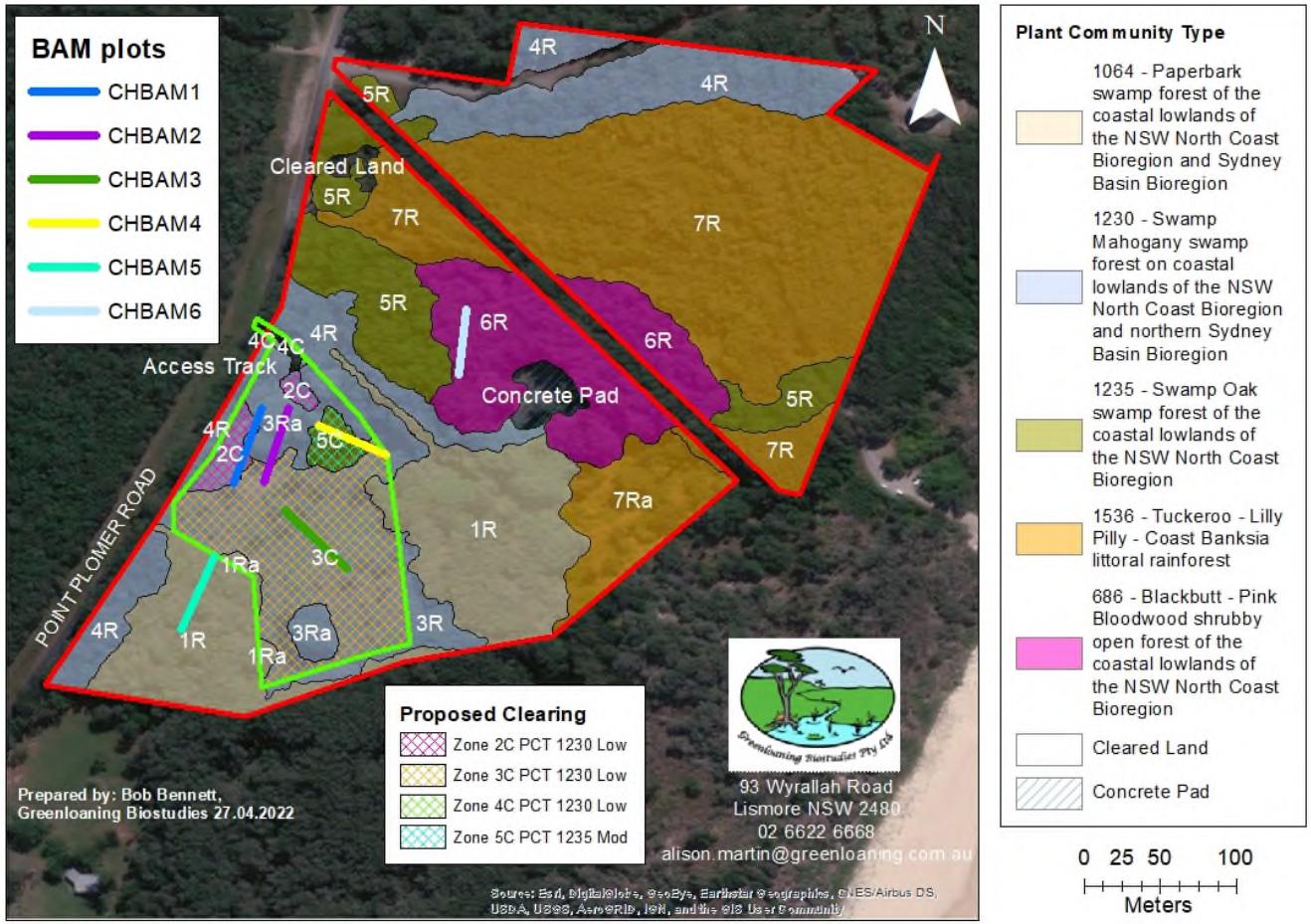

Figure 15 BAM Plot locations, PCT's and vegetation zones subdivided by condition, intent and TEC status on the subject property.

Table 4-2 Comparison of On-site Vegetation Community Condition with Community Benchmark Condition

IBRA	PCT1230				1235*	
NSW North Coast	**Benchmark Values**	**On-site Community 3 Zone 2c**	**On-site Community 3 Zone 3c**	**On-site Community 3 Zone 4c***	**Benchmark Values**	**On-site Community 4 Zone 5c**
Tree Richness	5	6	3		4	4
Shrub Richness	7	4	0		7	1
Grass and Grass Like Richness	7	4	1		7	1
Forb Richness	6	0	0		7	0
Fern Richness	2	0	1		2	0
Other Richness	5	4	2		4	4
Tree Cover	36.0	6.21	6.01		28.0	63.1
Shrub Cover	13.0	1.13	0		15.0	0.01
Grass and Grass Like Cover	75.0	25.03	0.01		102.0	1
Forb Cover	3.0	0	0		3.0	0
Fern Cover	2/0	0	70		1.0	0
Other Cover	40	3.6	0.02		2.0	1.12
Total length of fallen logs	43	1	0		12	0
Litter Cover	41	61	72		40	75
Number of Large Trees	5	0	0	0	1	0
Large Tree Threshold Size	50				50	

*Area of Zone 4c was too small and fragmented for establishment of a plot to be practical. No clearing of trees is proposed and clearing operations will be limited primarily to Lantana and lopping of overhanging branches

4.2.2 Vegetation Zones

In order to facilitate the assessment process, the PCTs identified in 4.2.1 above were subdivided according to condition, intent (whether the zone is proposed to be cleared, denoted by 'C,' or retained, denoted by 'R') and TEC status. Based on the desktop mapping processes and field survey data, five PCTS were split into seven zones of varying condition and intent on the subject property as summarised below: The zones are indicated on **Figure 16** and summarised in **Table 4.3.**

Details on the current vegetation integrity score for the resource recovery /Impact Area are provided in **Table 4.4** and a Vegetation Zone Report for the impact area is provided in **Appendix G**

Table 4-3 Vegetation Zone Attributes

Zone	PCT	Condition	Intent	Area (ha)	TEC	PCT description
1R	1064	Mod-Good	R	1.15	TEC	Paperbark swamp forest of the coastal lowlands
1R	1064	Mod-Good	R	0.8	TEC	Paperbark swamp forest of the coastal lowlands
1Ra	1064	Mod	R	0.04		Paperbark swamp forest of the coastal lowlands (on edge of stockpile)
2C	1230	Low	C	0.03		Swamp Mahogany swamp forest on coastal lowlands (poor representation)
2C	1230	Low	C	0.11		Swamp Mahogany swamp forest on coastal lowlands (poor representation)
3C	1230	Low	C	1.14		Swamp Mahogany swamp forest on coastal lowlands (poor representation)
3R	1230	Low	R	0.19		Swamp Mahogany swamp forest on coastal lowlands (poor representation)
3Ra	1230	Mod	R	0.23		Swamp Mahogany swamp forest on coastal lowlands
3Ra	1230	Mod	R	0.07		Swamp Mahogany swamp forest on coastal lowlands
4C	1230	Low	C	0.013		Swamp Mahogany swamp forest on coastal lowlands (access track)
4R	1230	Mod-Good	R	0.65		Swamp Mahogany swamp forest on coastal lowlands
4R	1230	Mod-Good	R	0.83		Swamp Mahogany swamp forest on coastal lowlands
4R	1230	Mod-Good	R	0.25		Swamp Mahogany swamp forest on coastal lowlands
4R	1230	Mod-Good	R	0.19		Swamp Mahogany swamp forest on coastal lowlands
5C	1235	Mod	C	0.08		Swamp Oak swamp forest of the coastal lowlands (regenerating on stockpile)
5R	1235	Mod-Good	R	0.55	TEC	Swamp Oak swamp forest of the coastal lowlands
5R	1235	Mod-Good	R	0.15	TEC	Swamp Oak swamp forest of the coastal lowlands
5R	1235	Mod-Good	R	0.07	TEC	Swamp Oak swamp forest of the coastal lowlands
5R	1235	Mod-Good	R	0.2	TEC	Swamp Oak swamp forest of the coastal lowlands
6R	686	Mod-Good	R	1.24		Blackbutt - Pink Bloodwood shrubby open forest
7R	1536	Good	R	3.49	TEC	Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest
7R	1536	Good	R	0.19	TEC	Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest
7Ra	1536	Low	R	0.58	TEC	Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest
				0.05		Existing cleared area
				0.014		Access track
				0.12		Concrete pad
				12.37		**Total**
				11.02		**Total retained**
				1.35		**Total proposed to be cleared**

Table 4-4 Vegetation Integrity Scores for Vegetation Zone 5 Subject to Impacts

PCT	Zone	Composition Condition Score	Structure Condition Score	Function Condition Score	Current Vegetation Integrity Score	Future Vegetation Integrity Score
1230	2c	55	21.3	38.9	35.7	0
	3c	19.8	3.3	4.5	14.3	0
	4c				n/d (very small disjunct fringes –too small to sample)	0
1235	5c	26.4	18.3	45	27.9	0

4.2.3 Native Plant Species Occurrence

i. General Species Occurrence

A full list of flora species recorded on the subject property is provided in **Table E1**, **Appendix E**, including species listed as High Threat Weeds (HTWs) under the BAM (referred to as 'Transformer Weeds' under the Commonwealth). A total of 78 flora species has been recorded, with the majority occurring within the resource recovery /impact area, and Subject Property as a whole, being native species (90%). The proportion of HTWs and other weed species however, in terms of cover, is quite high. Plot data suggests that even within the moderate condition vegetation in Zone 3R for instance, weed species can represent up to almost 50% of the total species richness. In the low condition vegetation sampled in Zones 3c, weed/exotic species outnumber native species and also provide the majority of cover (refer to plot data in **Appendix F** for zone 3c data and Section 4.2.5 for further details on weed species).

ii. Threatened Plant Species Occurrence

No threatened species have been recorded on the subject property to date, and particularly within the resource recovery/impact area. It is always possible however, that an occasional specimen of a threatened plant species may occur, particularly in the areas of the property as a whole that are beyond the impact area and were not subject to detailed surveys and plot sampling. The likelihood of such occurrences also would be expected to increase as the natural regeneration process continues. The likelihood of occurrence of threatened species within the resource recovery /impact area is very low, given the level of existing clearing and extent of weed cover.

4.2.4 Justification for Threatened Flora Species Determined to be Unlikely to Occur within the Impact Area

The species considered in this section, although known to be associated with PCT 1230 and/or PCT 1235, have been discounted from the candidate species list for reasons specified under each species heading. The justification for exclusion is based on the provisions of the BAM 2020, viz:

s 5.2.2 (2) The assessor may consider that a threatened species is unlikely to occur on the subject land or in a vegetation zone if:

a the assessor determines that none of the habitat constraints for the species are present in a vegetation zone. No further assessment is required for that species in that vegetation zone. The assessor must record their reasoning for this determination in the BAR, or

b the assessor determines that none of the habitat constraints for the species are present on the entire subject land. No further assessment is required for that species. The assessor must record their reasoning for this determination in the BAR, or

c the species is a vagrant in the IBRA subregion. No further assessment is required. The assessor must record their reasoning for this determination in the BAR.

i. Asperula asthenes Trailing Woodruff

The Trailing Woodruff is a 'low trailing perennial herb' that 'occurs in damp site, often along river banks (Office of Environment and Heritage 2019c/2021). Potential habitat for this species within the Impact Area is highly marginal and degraded and the species is considered 'unlikely to occur on the subject land' comprising the Impact Area vegetation zones. further assessment for this species was not required.

ii. Lindernia alsinoides Noah's False Chickweed

This species is a delicate wetland fringe herb known from only a few locations in NSW, one of which has been subject to long term monitoring by one of the authors of this report (Cumberland Ecology and Greenloaning Biostudies 2014). The species also has recently been subject to further monitoring by Greenloaning Biostudies under the 'Saving our Species Program' (SOS). Given the man-modified status and elevated topography of the Impact Area, there is minimal to no suitable habitat occurring for *L. alsinoides* on the stockpile, the habitat constraint listed as '][d]amp areas or adjacent to riparian areas (including disturbed areas)'(BioNet Threatened Biodiversity Database 2022). The species therefore is considered unlikely to occur the subject land comprising the Impact Area and further assessment was not required.

iii. Maundia triglochinoides

Maundia triglochinoides is found 'in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients' (Office of Environment and Heritage 2019d). The habitat constraints listed in BioNet also comprise '[r]iparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep' (Bionet Threatened Species Database 2022). Considering that these types of habitats are not characteristic of the Impact Area (there is only one small ditch within the Impact Area, which was dry during field surveys), the habitat constraint for the species is not present. The species therefore is considered unlikely to occur the subject land comprising the Impact Area and further assessment was not required.

iv. Oberonia titania Red-flowered King of the Fairies

This orchid species 'occurs in littoral and subtropical rainforest and paperbark swamps Office of Environment and Heritage (2017c), true representations of which do not occur within the Impact Area (refer to **Section 4.2.2)**. Additionally, there are no records for this species in the Macleay Hastings IBRA Subregion (BioNet Atlas, 2020). The species therefore is unlikely to utilise the subject land' comprising the Impact Area and further assessment was not required.

v. Phaius australis Southern Swamp Orchid

Phaius australis is a large terrestrial orchid that typically is associated with swampy grassland or swampy forest (Office of Environment and Heritage 2018c). Given the man-modified status and elevated topography of the Impact Area, with associated communities not representing swampy conditions, there is no suitable habitat occurring for *Phaius australis* on the stockpile, the species is unlikely to utilise the subject land' comprising the Impact Area and further assessment was not required.

On the basis of the above factors and consistent with section 5.2.2 (2) of the BAM 2020, it was determined that, for all of the above species, the habitat constraints for the species were absent or so degraded that the species is unlikely to occur on the subject land' comprising the Impact Area.

4.2.5 Weed Species

A total of 10 exotic species has been recorded within the subject property, with five of these species known to occur on the proposed resource recovery area (refer to **Table F4, Appendix F**). Of the total weed species recorded, seven are listed as HTWs under the BAM. The most dominant species in terms of cover and general representation through all vegetation zones comprises Lantana (*Lantana camera*). The species is most consistently prevalent within the regenerating Zone 3c, which visually is dominated by Bracken Fern, but has Lantana distributed throughout with varying levels of cover. Thickets of Lantana also tend to occur around much of the edges of the stockpile, such as at the eastern end of Plot BAM4, and beside the existing access track to the site in the north.

Another HTW, the Slash Pine (*Pinus elliotii,* only occurs as scattered individuals, but a small number of specimens in the southeastern sector are very large trees, representing an ongoing seed source. Bitou Bush (*Chrysanthemoides monilifera*), also listed as a HTW, occurs in scattered clumps, particularly in regenerating areas. Other HTWs recorded tend to be represented as scattered individuals, clusters

Additionally, it was observed during the January 2022 site inspection, that the density of weed growth had increased noticeably in the two-year period since any surveys or site visits had been undertaken. This increase in weed cover can be attributed to the high rainfall and exceptional growing season experienced in spring/summer 2022, in combination with the absence of any active land management actions. Lantana infestations for instance, within the small forest remnant in the north of the stockpile (Zone 3Ra – refer to **Figure 16**) had increased to a density in the understorey of 80-90% (previously estimated in 2019 within BAM Plot 2 as 40%). This infestation has also encroached further into the regenerating area (Zone 2C), and weed cover in Zone 3C and Zone 4R also had increased.

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5 Results – Fauna

5.1 RESULTS FROM DESKTOP ASSESSMENTS

The initial desktop assessment process yielded a total of 98 threatened species listed under the BC Act and occurring, or predicted to occur within the subregion. Of the total threatened fauna species listed, 29 are also listed as threatened and/or migratory under the EPBC Act. Refinement of the list of potential threatened species subsequently was undertaken, in conjunction with detailed consideration of the ecological data on threatened species provided in BioNet 2019/2022. Species such as those reliant on marine, estuarine or wetland habitats, which could not be expected to have any reliance on the subject property habitats, were excluded from the candidate species list. Whilst recognising that some marine species are known to use Littoral Rainforest for shelter, it was considered that the likelihood of the resource recovery area and subject property being used for this purpose was very low, based on the following factors:

- The location being somewhat removed from the vegetation immediately adjacent to the ocean; and
- The disturbed nature of the subject vegetation and associated interrupted canopy cover.

The full lists of threatened species generated from the database searches are provided in Appendix C and Appendix D. The list of candidate species requiring survey is provided in Table 5.1. Preliminary comments on the likelihood of occurrence also are provided in Appendix C. The justification for discounting 'ecosystem credit species' from the list of species predicted to occur, and 'species credit species' from the candidate species list is provided in Section 5.2.4 and Appendix C. No additional species listed under the EPBC Act were considered likley to occur.

Table 5-1 Candidate Threatened Fauna Species for which Survey was Required, or were Excluded from Further Assessment, Extent of Potential Habitat and Biodiversity Risk Weightings

Species		**Habitat Features Suitable for the Species and Present on the subject property***	**Feature present in Impact Area**	**Extent of Potential Habitat within resource recovery area (ha)**	**Biodiversity Risk Weighting**
Scientific Name	**Common Name**				
Burhinus grallarius	Bush-stone Curlew	Occurs in open forests and woodlands with a sparse grassy ground layer and fallen timber	Small areas of grassy groundcover	0.19	2
Cercartetus nanus	Eastern Pygmy Possum	Generally prefer woodlands and heath except in NE NSW where mostly in rainforest. Feeds largely on nectar and pollen from Banksias, eucalypts and bottlebrushes	Very scattered food resources in Zones 2c and 3c	Total zones area 1.28 ha, but very little food resources in zone 3c.	2
Lichenostomus fasciogularis	Mangrove Honeyeater	Mangrove woodlands and shrublands are primary habitat - also range into adjacent forests/ woodlands/ shrublands, including Casuarina and paperbark swamp forests/ associations dominated by eucalypts or banksias.	Regenerating Swamp Oak forest	0.08	2
Carterornis leucotis	White-eared Monarch	Occurs in rainforest, especially drier types, such as littoral rainforest, and wet/ dry sclerophyll forests, swamp forest and regrowth forest. - appear to prefer ecotone between rainforest and other open vegetation types/ rainforest edges, such as along roads.	Regenerating Swamp Oak forest/edges of regenerating 1230 near remnant forest/woodland	Approximately 0.1	2
Phascogale tapoatafa	Brush-tailed Phascogale	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, but also inhabits heath, swamps, rainforest and wet sclerophyll forest.	Could use Zones 2c/3c/4c and 5c for foraging	1.35	2
Phascolarctos cinereus	Koala	Known to use Forest Red Gums and Swamp Mahogany as Preferred KFTs	Known to occur in habitat adjacent to Impact Area. Potentially would move through Zone 2c, 3C and 4c to	No Preferred Habitat within Impact Area but movement area comprises 1.35 ha	2

Species		**Habitat Features Suitable for the Species and Present on the subject property***	**Feature present in Impact Area**	**Extent of Potential Habitat within resource recovery area (ha)**	**Biodiversity Risk Weighting**
Scientific Name	**Common Name**				
			Zones 1R, 3R supporting KFTs		
Planigale maculata	Common Planigale	Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	Could use Zones 2c, 3c, 4c	1.3	2

* Office of Environment and Heritage 2017d, 2017e, 2018c, 2018 d, 2018e, 2018f, 2019f, 2019 g

5.2 RESULTS FROM FAUNA SURVEYS

5.2.1 Fauna Habitats

Key habitat features of the subject property, as identified during the on-site surveys, in conjunction with desktop assessments, comprise the following (features associated specifically with the resource recovery /impact area are noted in additional comments in **bold**):

1. Good general and direct connectivity with adjoining habitat to the north, east and soutth-east, with good connectivity for more mobile species also to the west. Point Plomer Road, which is a sealed and well-used local road, represents a break in connectivity for species such as small ground mammals, whilst the gravel access tracks to the beach and reservoir in the north of the subject property would represent a more minor break in connectivity for such species. **Overstorey cover is sparse over most of the impact area, but the existing regenerating areas provide vegetated connectivity with adjoining y habitat, albeit comprising predominantly goundcover/low understorey cover**;
2. Some connectivity with habitat to the south, although the connecting habitat is somewhat fragmented immediately adjoining the subject property;
3. Scattered occurrence of rainforest fruiting tree species, particularly figs that would provide foraging resources for a range of fructivorous species. **There are occasional occurrences of such trees within the impact area, as shown on Figure 14;**
4. Occasional Banksias providing food resources for nectivorous species known to occur in the locality, such as the Common Blossom Bat (*Syconycteris australis*).
5. Very limited occurrence of small tree hollows. Trees with hollows, as well as any large native trees with potential for hollows, fissures or decorticating bark, and occurring within the stockpile area have been excluded from the Impact Area;
6. Occasional very large trees that would provide good shelter and nesting potential. Habitat supporting large trees within the stockpile area have been excluded from the Impact Area;
7. Small patches of dense understorey/grassy ground cover that would provide cover for some fauna species, such as bandicoots and the Rufous Bettong. **The majority of the regenerating vegetation within the Impact Area supports such habitats;**
8. Stands of Swamp Oak that provided potential foraging resources for the Glossy Black Cockatoo (*Calyptorhynchus lathami*). **A small patch of regenerating young mature Swamp Oak trees occurs within the Impact Area;**
9. Variable occurrence of ground debris, with very limited occurrence of hollow logs. **Ground debris is very sparse to lacking over most of the Impact Area;**
10. A variety of microhabitats likely to provided suitable foraging resources for a range of microbat species. **Some microbats would be likely to forage across sectors of the Impact Area as part of much broader foraging habitat**; and
11. A sandy loam substrate, potentially suitable for burrowing species. **The Impact Area also has sandy soils, but these primarily comprise dense, very soft ilmentite, which would be expected to have limited potential as suitable burrowing substrate.**

As part of an identified wildlife corridor and key fauna habitat area, in conjunction with the features listed above, the Subject Property habitat has recognized value to fauna, albeit the habitat being in a highly disturbed state, particularly in relation to the Impact Area.

The features of the resource recovery area per se, provide far less value to most fauna species, with minimal upper strata habitat available for arboreal species and mobile species such as many bird and microbat species that forage and/or roost/nest at higher levels. The main habitat attribute of the Impact Area is the relatively continuous ground cover, providing good shelter/foraging shelter for small ground fauna. The overall value of the resource recovery area to fauna however, is considered to be low.

5.2.2 General Fauna Species

Fauna species recorded on the subject property are listed in **Table E2, Appendix E**. As could be expected, the main species recorded were birds, with 25 species recorded to date on the subject property, with most surveys undertaken within the Impact Area. A much greater number of additional species would be expected to be recorded over time, more particularly in the adjoining swamp forest/woodland habitats. Very few reptile species were observed or captured, and the lack of ground debris within the Impact Area would be expected to limit the suitability and use of the Impact Area by this fauna group. Lace Monitors (*Varanus varius)* were observed however, on a number of occasions, both within the Impact Area and in adjoining swamp forest habitat. Consistent use of the Impact Area by any amphibian species is considered unlikely, given the very dry nature of this area in general.

Eleven native mammal species were recorded from the site surveys. Signs of bandicoots, likely to be the Norther Brown Bandicoot (*Isoodon macrouris*), were observed during site surveys within the Impact Area and two other small ground mammals, the Bush Rat (*Rattus fuscipes*) and Brown Antechinus (*Antechinus stuartii*) were recorded during both the Elliott trapping programme. The latter two species also were recorded from the hair tube trapping surveys. These species were recorded both within the Impact Area and in adjoining forested habitats.

A number of microbat species were recorded within the stockpile/resource recovery area, either through the harp trapping survey or by call detector surveys and subsequent call analysis. In total, at least five species were recorded, two species captured in harp traps and three species detected from call analysis. Calls from a sixth species potentially were recorded but the calls were not sufficiently distinctive to be confident of identification (refer to **Table E2**, **Appendix E**).

Spotlighting surveys yielded very little in the way of fauna records with only one Common Brush-tail Possum recorded on one occasion in habitat to the north of the Stockpile/resource recovery area.

Full details of fauna species recorded during all surveys are provided in **Appendix E.**

5.2.3 Threatened Fauna Species

i. Amphibians

No threatened amphibian species was considered likely to occur on the stockpile, given the lack of suitable habitat (refer to **Section 5.2.4** for further details).

ii. Reptiles

Reptile observations within the subject property and within the Impact Area were very few and potential habitat for any threatened species was very limited (refer to **Section 5.2.4** for further details).

iii. Birds

No threatened bird species was recorded using the Impact Area during site surveys, although the Little Lorikeet (*Glossopsitta pusilla*a*) was* tentatively identified flying through the subject property and other species, such as the White-breasted Sea-eagle and Little Eagle, could be expected to fly over the area

as part of their foraging range. There is no potential nesting habitat for these species within the Impact Area and no nests were observed within the small remnant forest patches occurring on the stockpile, or in the immediate vicinity.

iv. Mammals

As described in **Section 3.3.3**, a range of fauna survey procedures was undertaken to target threatened species with some potential to occur within the subject property, and particularly within the Impact Area. The majority of surveys yielded no threatened species listed under the BC Act or the EPBC Act, or migratory species listed under the EPBC Act, utilising the Impact Area. The Koala SAT Plot searches however, yielded one Koala pellet within the small pocket of remnant and regenerating woodland/forest habitat supporting KFTs in the north of the stockpile area. The sparse number of pellets detected renders the habitat as 'low use activity habitat (Phillips and Callaghan 2011).

However, a precautionary approach has been taken in the context of the potential for otherwise medium-high carrying capacity Koala habitat currently being an area of low use, potentially as a result of contemporary population dynamics, landscape configuration and/or historical disturbances including, mining. 'Such considerations should not necessarily detract from the potential importance of such habitat for longer-term conservation, particularly if preferred koala food trees are present and populations of *P. cinereus* are known to occur in the general area' (Phillips and Callaghan 2011). The Koala species was known previously to utilise the roadside KFTs and known and potential habitat for the Koala has been excluded from the Impact Area. As indicated in **Figure 17**, the subject property and stockpile have been mapped as primarily Primary and Secondary (A) Preferred Koala Habitat as mapped in the KSC KPoM. The extent of Koala habitat within the subject property and in relation to the Impact Area has been refined however, as shown on **Figure 18**.

No indications of use of Zone 5c, supporting potential Glossy Black Cockatoo food trees, were detected, with inspections of this habitat conducted in September and December 2019 and in February 2020. There is substantial habitat for the species however, within the broader subject property.

Elliott trapping did not yield any records of either the Common Planigale, Eastern Pygmy Possum or Brush-tailed Phascogale, although was very successful in capturing two other small mammal species, as described in **Section 2.2.2**. Camera trapping also did not yield any mammal species records. However, both the Common Planigale and the Brush-tailed Phascogale have been assumed to be present, given the survey methods for these species were limited, based on the latest survey requirments under the BAM.[3]

Microbat trapping surveys also did not capture any threatened fauna species, particularly neither the Eastern Cave Bat (*Vespadelus troughtoni*) nor the Southern Myotis (*Myotis macropus*), both of which are 'species credit species.' The former species has however, been recorded in the nearby Goolawah National Park, as have a number of other threatened microbat species, viz: the Eeastern/Large bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Cave Bat (*Vespadelus troughtoni*), Eastern Long-eared Bat (*Nyctophilus bifax*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Little Bent-winged Bat (*Miniopterus australis*) (DPIE, 2014).

[3] The substrate was extremely soft to install pit traps for the Common Planigale effectively and safely, and camera trapping methods for the Brush-tailed Phascogale have been updated to comprise more camera traps than deployed in 2019.

Bat call detector surveys undertaken to supplement the trapping surveys, yielded one call file for the Little Bent-winged Bat for the stockpile/resource recovery area and it could be assumed that the species would use the Impact Area habitats of Zone 2c, 3c, 4c and 5c to some extent for foraging, in conjunction with more vegetated habitats beyond the Impact Area. The species however, tends to favour more timbered habitats (Office of Environment and Heritage 2020) and foraging over the more open habitats is less likely

The Grey-headed Flying Fox (*Pteropus poliocephalus*) also has been recorded within the Goolawah National Park and would be expected to forage through the subject property as part of general potential foraging habitat. Foraging within the Impact Area however, would be expected to be limited to a very small number of individuals feeding on fruiting figs or other very scattered fruiting/flowering trees on a seasonal basis. No camps of the species occur within the subject property. This species also is listed as Vulnerable under the EPBC Act. Another mammal species, the Greater Glider (*Petauroides volans*) also is listed as Vulnerable under the EPBC Act, but not under the BC Act. The species is readily observed by spotlighting, but was not recorded in the December 2019 spotlighting surveys. It is considered unlikely to occur within the Subject Property and tends to favour tall moist montane forest. It requires large tree hollows for roosting (Threatened Species Scientific Committee 2016) and there is no suitable habitat for the species within the Impact Area.

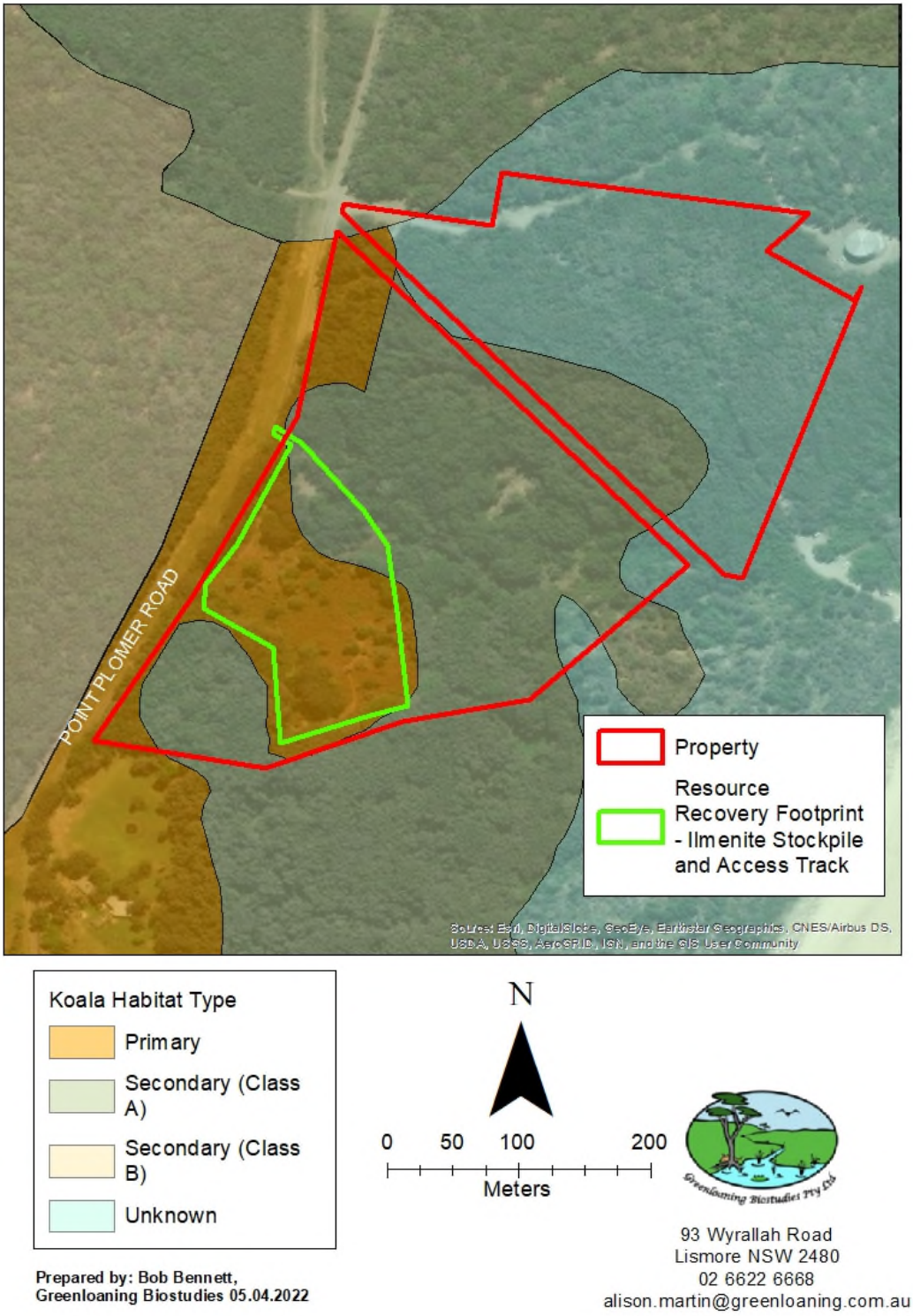


Figure 16 Preferred Koala Habitat as per the KempseyShire Coouncil KPoM (Source Kempsey Shire Council 12/2/20).

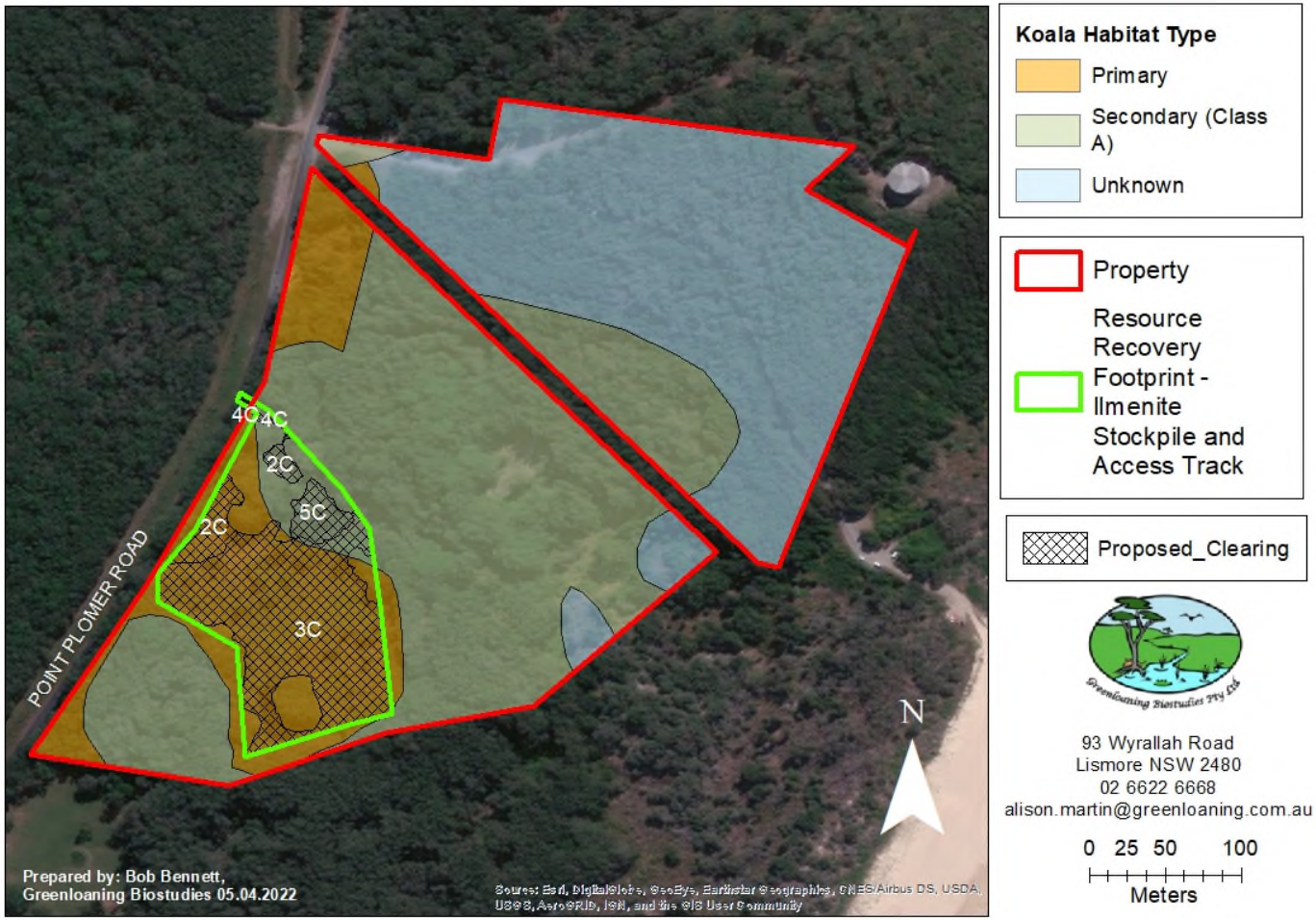


Figure 17 ***Koala habitat occurring within the subject property (based on KempseyShire Coouncil KPoM) indicating habitat to be retained or cleared***

5.2.4 Justification or Threatened Fauna Species Determined to be Unlikely to Occur within the Impact Area

The following species, although known to be associated with PCT 1230 and/or PCT 1235, have been discounted from the candidate species list for reasons specified under each species heading. The justification for exclusion is based on the provisions of the BAM 2020, viz:

s 5.2.2 (2) The assessor may consider that a threatened species is unlikely to occur on the subject land or in a vegetation zone if:

- *a the assessor determines that none of the habitat constraints for the species are present in a vegetation zone. No further assessment is required for that species in that vegetation zone. The assessor must record their reasoning for this determination in the BAR, or*
- *b the assessor determines that none of the habitat constraints for the species are present on the entire subject land. No further assessment is required for that species. The assessor must record their reasoning for this determination in the BAR, or*
- *c the species is a vagrant in the IBRA subregion. No further assessment is required. The assessor must record their reasoning for this determination in the BAR.*

i. Invertebrates

a. *Argynnis hyperbius Laced Fritillary*

The Laced Fratillary occurs in 'open swampy coastal habitat' (Office of Environment and Heritage 2017e), and relies on the presence of the food plant, the Arrowhead Violet (*Viola betonicifolia*). Neither swampy habitat, nor the Arrowhead Violet occur within the Impact Area. The original swampy habitat has been modified by the mining and associated stockpile development and it is considered that suitable habitat is not represented and no further assessment is required.

b. *Petalura gigantea Giant Dragonfly*

The Giant Dragonfly inhabits 'permanent swamps and bogs with some free water and open vegetation' (Office of Environment and Heritage 2017f). As for the Laced Fratillary, the original swampy habitat has been modified by the mining and associated stockpile development. As such, suitable habitat is not represented and no further assessment is required.

c. *Ocybadistes knightorum Black Grass-dart Butterfly*

The Black Grass-dart Butterfly is known only from an area of the mid north coast from Coffs Harbour to Scotts Head, well to the north of the subject property. Swamp sclerophyll forest, dominated by Swamp Oak and/or Broad-leaved Paperbark tends to be the most favoured habitat. The species also is associated with patches of Floyd's Grass (Office of Environment and Heritage 2017g). As the original swampy habitat has been substantially modified by the mining and associated stockpile development, it is considered that suitable habitat is not represented and no further assessment is required

ii. Amphibians

a. *Crinia tinnula Wallum Froglet*

The Wallum Froglets occur in a wide range of habitats, usually in association with acidic swamps on coastal sand plains, including sedgelands and wet heathlands. The species also can inhabit 'drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests' (Office of Environment and Heritage 2017h). There is no suitable habitat for the Wallum Froglet within the man-modified Impact Area and no further assessment is required

b. *Litoria brevipalmata Green-thighed Frog*

This species occurs in habitats ranging from rainforest and moist eucalypt forest to dry eucalypt forest and heath, favouring areas where surface water gathers following rain. ((Office of Environment and Heritage 2019g). As the Impact Area habitat represents substantially man-modified systems with no likely suitable habitat for the Green-thighed Frog, no further assessment is required.

c. *Mixophyes iteratus Giant Barred Frog*

The Giant Barred Frog occurs in association with permanent or semi-permanent streams, typically with well vegetated stream edges (Office of Environment and Heritage 2017i, A. Martin, unpubl. data)). There is no suitable habitat for the species within the man-modified Impact Area and no further assessment is required.

d. *Litoria aurea Green and Golden Bell Frog*

This species occurs in marshes, dams and stream-sides, with optimum habitat including unshaded water-bodies (Office of Environment and Heritage 2017j). There is no suitable habitat for the species within the man-modified Impact Area and no further assessment is required.

iii. Reptiles

a. *Hoplocephalus bitorquatus Pale-headed Snake*

This species is mainly found in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. The Pale-headed Snake is nocturnal and uses loose bark, tree-trunks, hollow trunks and limbs of dead trees for diurnal shelter (Office of Environment and Heritage 2017k). The only record for the species within the IBRA Subregion is in the very far north of the Subregion and the species would be considered a vagrant in the area, based on the current records.

b. *Hoplocephalus stephensii Stephens' Banded Snake*

Stephens' Banded Snake is a nocturnal species, occurring in rainforest, eucalypt forest and rocky habitat, sheltering under loose bark, amongst vines, or in hollow trunks, limbs, rock crevices or under slabs during the day shelter (Office of Environment and Heritage 2018g). The species' habitat is described under the BioNet Threatened Biodiversity Database as 'old primary forest with many large old hollow bearing trees. Habitat needs to be well connected and geographically large' (BioNet 2022). Suitable habitat for this species is minimal or absent over the Impact Area and no further assessment is required.

iv. Birds

a. Species Requiring Hollows for Breeding

Although the following species may forage to a limited extent within/over the Impact Area, there are no hollows suitable for breeding for any of these species occurring within the Impact Area:

- *Calyptorhynchus lathami* Glossy Black-Cockatoo;
- *Ninox connivens* Barking Owl;
- *Tyto novaehollandiae* Masked Owl;
- *Ninox strenua* Powerful Owl.

None of these species therefore is likely to use the Impact Area for breeding purposes. Large hollows required by these species (Office of Environment and Heritage, 2019h) also are very limited or absent from the subject property, owing to the combination of past clearing/mining disturbances and the prevalence of tree species not typically supporting many or large hollows.

b. *Regent Honeyeater (Anthochaera phrygia)*

For a small number of species, the habitat constraint information in the Threatened Biodiversity Data Collection (TBDC) refers to a mapped important area (BAM paragraph 6.3.1.4). Important areas have been determined for the Regent Honeyeater and eleven migratory shorebird species. Examination of the NSW DPIE Map viewer tool (DPIE, 2020c) determined that the subject property is not within the Important Area for the Regent Honeyeater or any migratory shorebirds.

c. *Species Nesting in Large Trees*

The following species nest in large dead and/or living trees (Office of Environment and Heritage 2017 l, 2017m, 2018g, 2019i):

- *Lophoictinia isura* Square-tailed Kite
- Hieraaetus morphnoides Little Eagle
- Haliaeetus leucogaster White-bellied Sea-Eagle
- Pandion cristatus Eastern Osprey

Such habitat has been excluded from the Impact Area, and together with no evidence of any nests in adjoining habitat, no further assessment was required.'

d. *Lathamus discolor Swift Parrot*

There is minimal foraging habitat for the Swift Parrot within the Impact Area and the species breeds in Tasmania (Office of Environment and Heritage 2019h). The species would be a vagrant in the area.

v. Mammals

a. *Petaurus norfolcensis Squirrel Glider*

The Squirrel Glider requires hollows for shelter and breeding (Office of Environment and Heritage 2017n). There is no suitable habitat for the species within the Impact Area, no evidence of the species' occurrence in adjacent habitat during spotlighting and no further assessment was required.

b. *Grey-headed Flying-fox (Pteropus poliocephalus) (breeding)*

Camps of the Grey-headed Flying-fox can sometimes contain thousands of individuals and the same sites can be used for very long periods of time (Office of Environment and Heritage 2017o). These camps are used for roosting and the annual breeding and rearing of young. Mating and conception occur within camps between January and May (DIPNR 2004). Inspection of the Impact Area and adjoining habitats did not result in any evidence of camps, either current or past and the Impact Area is not considered to represent known or potential breeding habitat by this species and no further assessment is required.

c. *Little Bent-wing-Bat (Miniopterus australis) (breeding)*

This species has been detected within the stockpile/resource recovery area, on the edge of the Impact Area, as described in **Section 5.2.3**, and the species thus can be assumed to forage in the general area. In terms of breeding habitat however, the Little Bentwing-bat requires caves or similar structures such as tunnels, mines, or culverts (Office of Environment and Heritage 2019m). The occurrence of caves or similar structures is a habitat constraint for breeding purposes for this species. There are no caves or other breeding structures located in the Impact Area, or within the immediate vicinity. Therefore, the Little Bent-wing Bat is not likely to use the Impact Area for breeding purposes and no further assessment is required.

d. *Eastern Bent-wing-Bat (Minopterus schreibersii) (breeding)*

As for the Little Bent-wing Bat, the Eastern Bent-wing Bat requires maternity and nursery caves for breeding (Office of Environment and Heritage 2019n). There are no caves within the Impact Area, nor are there any in the immediate vicinity. Therefore, the Eastern Bent-wing Bat is not likely to use the Impact Area for breeding purposes.

e. *Myotis macropus Southern Myotis*

The Southern Myotis typically roosts near water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The species also forages over water (Office of Environment and Heritage 2017p). Roosting habitat for the species within the Impact Area is minimal and there is no foraging habitat present. The species therefore is not considered likely to use the site habitats and no further assessment is required.

6 Assessment of Impacts, Avoidance and Mitigation Measures

6.1 BACKGROUND

The mitigation hierarchy of 'avoid, minimise, offset' has been adopted for the proposed resource recovery and the avoidance of impacts as much as possible has been integral to the project planning process. Key biodiversity components considered as part of this process included:

- Occurrence of remnant forest/woodland habitat;
- Occurrence of old growth/large mature trees; and
- Occurrence of Koala Food Trees (KFTs).

The BAM 2020 requires that all direct and Indirect impacts are addressed in the BDAR process. Consideration of prescribed impacts is also required under cl 6.1 of the *Biodiversity Conservation Regulation 2017*, and s 6.1 of the BAM. Further consideration of all impacts is provided in Sections 6.2, 6.3 and 6.4 of this BDAR.

6.2 POTENTIAL IMPACTS

6.2.1 Potential Direct Impacts

Sources of impacts that would have direct effects on potential threatened species' habitats and threatened ecological communities/TECs, comprise the following:

- Proposed clearing activities associated with the resource recovery process;
- Increased fragmentation of habitat to be retained within the general stockpile footprint until regeneration/rehabilitation works have progressed sufficiently to provide some cover;
- Inadvertent physical damage to habitat features/vegetation from machinery working adjacent to areas to be retained; and
- Injury to ground dwelling fauna or fauna roosting/nesting in trees to be cleared.

i. Clearing Activities

Clearing activities will be undertaken over a period of five days, as indicated in **Table 6.1** The extent of proposed clearing of native vegetation is approximately 1.35 ha, with the clearing primarily comprising the removal of 1.26 ha of low condition regenerating vegetation, with an additional 0.09 ha of moderate condition regenerating Swamp Oak forest (refer to **Table 6.2**) The outline of the resource recovery footprint (Impact Area), encompassing all of the vegetation/habitats to be cleared (Zones 2c, 3c, 4c and 5c), is indicated on **Figure 16**. The total Impact Area encompasses the majority of the identified ilmenite stockpile and access track, the latter comprising 0.01 ha, currently with a cover of exotic grasses and encroaching Lantana. The full extent of the stockpile, plus the access track area, is shown on **Figure 6**.

The extent of clearing of trees is restricted to the area of regenerating Swamp Oak forest and isolated trees occurring within Zones 2c and 3c (visible on **Figure 4**). Occasional small saplings of tree species also may be included in the clearing operations, such as along the edges of the access track. An indication of the size of trees within Zone 5c is provided in the Plot 4 data table provided in **Appendix F**, with the majority of trees within the plot less than 20 cm diameter at breast height. Two young Forest Red Gum trees (*Eucalyptus tereticornis*) occurring within Plot 4 were located on the edge of the plot and community and clearing of these trees will be avoided if possible. Scattered small trees or saplings occurring within Zones 2c and 3c also are generally less than 20 cm, two more mature trees recorded within Plot 3 being less than 30cm dbh and less than 50cm dbh respectively (refer to **Appendix F).**

The removal of the regenerating habitats within Zones 2c, 3c, 4c and 5c is highly unlikely to cause significant adverse effects on any threatened species recorded in the general stockpile area. Key factors influencing this assessment are the general absence of KFTs within the regenerating habitats, in conjunction with a lack of a tree canopy, lack of any potential breeding habitat for the Little Bent-winged Bat and minimal foraging resources for the Little Lorikeet. Thus the potential for Serious and Irreversible Impacts (SAIIs) associated with the proposed resource recovery operations seems to be minimal.

Measures provided in **Section 6.5** will be employed to ensure direct impacts from the proposed clearing for construction purposes overall are minimised.

ii. Habitat Fragmentation

The extent of increased fragmentation of habitat will be relatively minor, given that the overall Impact Area is less than 1.5 ha and both patches of PCT 1230 to be retained are less than 50 m from nearby forest vegetation to be retained. Connectivity similar to the existing level would be expected to be restored within a few years as a result of revegetation/rehabilitation processes.

iii. Inadvertent Physical Damage to Habitat Features/Vegetation during Construction

Measures provided in **Section 6.5** will be employed to ensure the potential for inadvertent direct impacts beyond the resource recovery footprint are minimised. Sources of such impacts could include machinery damage to adjoining vegetation, soil compaction around trees to be retained, spillage/placement of fuel/oil on vegetation to be retained or regular movement of resource recovery personnel outside the resource recovery footprint.

iv. Injury to Fauna

Pre-clearing surveys, as prescribed in **Section 6.5**, will be undertaken to ensure the risk of any injury to native fauna is minimised. The overall level of risk to fauna is considered to be very low, providing such surveys are undertaken.

6.2.2 Potential indirect impacts

Potential indirect impacts associated with the proposed resource recovery that could potentially adversely affect adjoining TECs and potential threatened species habitat include:

- Edge effects from clearing adjacent vegetation;
- Increased noise levels disturbing breeding/nesting activities of fauna species in adjacent habitats;
- Alteration of natural hydrology;

- Introduction of additional exotic weeds from contaminated machinery or footwear;
- Spread of weeds/disease through machinery movements; and
- Temporary increased levels of disturbance and noise associated with the resource recovery operations;

i. Edge Effects

Vegetation remnants within the Impact Area and subject site as a whole have already been subject o substantial edge effects, and there are heavy weed infestations along most vegetation boundaries, as well as within communities. The resource recovery process will not be clearing into any established remnant vegetation and the potential for increased edge effects is considered to be minor.

ii. Alteration of Natural Hydrology

The resource recovery process will not be changing the alignment of any watercourses/drainage lines, but will simply be returning the ground level to the original condition. The natural hydrology therefore is more likely to be restored than altered.

iii. Introduction of Additional Exotic Weeds

There is always the potential for additional weed species to be introduced by way of unclean vehicles, machinery or personnel clothing or footwear. It is recognised that removing all such risk is very difficult, but it will be important to minimise the potential for new weed infestations as much as possible.

iv. Spread of Weeds/Disease

Given the extent of existing weed infestation over most of the Impact Area and adjoining habitats, the potential for spreading of weeds already present is considered to be low. There are no known disease issues on site , but the provision for routine hygiene measures and general vigilance for such diseases as Myrtle Rust are outlined in Section 6.4.3 of this BDAR.

v. Temporary Increased Levels of Disturbance and Noise

There will be some increased on-site noise associated with the machinery to be used to recover the ilmenite resource. Machinery to be used will comprise a front-end loader, an excavator and three trucks and dog-trailers. Although the site is immediately adjacent to a relatively busy road with regular (but not constant) traffic, the machine activity and noise levels on the site are likely to raise the disturbance level to fauna in adjacent habitats to some extent. The duration of noise impacts however, will be limited to the timeframes shown in **Table 6.1**.

Measures provided in **Section 6.5** will be employed to ensure the potential for indirect impacts on the areas to be retained are avoided or minimised.

6.2.3 Potential for Prescribed Impacts

Prescribed impacts comprise either direct or indirect impacts, described under s 6.1 of the BAM 2020 as impacts:

a. on the habitat of threatened entities including:
i. karst, caves, crevices, cliffs, rocks and other geological features of significance, or
ii. human-made structures, or

iii. non-native vegetation

b. on areas connecting threatened species habitat, such as movement corridors

c. that affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)

d. on threatened and protected animals from turbine strikes from a wind farm

e. on threatened species or fauna that are part of a TEC from vehicle strikes.

Of the above matters, the most relevant to the subject site are impacts on non-native vegetation and on areas connecting threatened species habitat There are no karsts, cliffs, any geological features of significance or human-made structures on the site, the project does not entail any new effects on water quality etc, it is not a proposed wind farm and the extent of proposed activity on the site is not likely to increase the risk of vehicle strikes.

Measures provided in **Section 6.5** will be employed to ensure the potential for any prescribed impacts are avoided or minimised.

Table 6.1 Description and Duration of Proposed Works*

Project Component	Expected Timings
Project Establishment: Re-instate short access track to site, no clearing of established trees (some pruning of limbs may be required) Rock rubble will be placed on the existing access track to allow for all weather access Silt traps installed. Install boundary fence and gate, site office (demountable) and portable toilet.	5 days
Clearing: Demarcate works boundary and install flagging tape of trees to be retained Undertake raking of pile vegetation, with supervision of spotter catcher, remove raked weeds offsite or burn with assistance from local fire brigade	5 days
Operations: Remove pile by FEL or equivalent, and truck to port	120 days
Rehabilitation: Once pile is removed, rake and scarify old soil surface Undertake hydro mulching rehabilitation and supplementary planting as per the rehabilitation management plan Maintenance and monitoring	2-3 days, plus inspections / monitoring

*Table provided by P. Smith, Pandanus Environmental

Table 6-2 Summary of Areas to be Cleared and Areas to be Retained

Zone	PCT name	Community	TEC	Condition	Area to be Cleared	Area to be Retained
1Ra	1064	Paperbark Swamp Forest of the Coastal Lowlands (on edge of stockpile)		Mod		0.04
1R		Relatively mature Paperbark Swamp Forest of the Coastal Lowlands on waterlogged alluvial soils	X	Mod-Good		1.94
2C	1230	Swamp Mahogany Swamp Forest on Coastal Lowlands (poor representation-early regeneration)		Low	0.13	
3C		Regenerating –predominantly dense Bracken Fern with Lantana		Low	1.12	
3R		Regenerating but on edge of stockpile and weed infested		Low		0.19
3Ra		Remnant patches with old growth trees, but on stockpile and not good representations of PCT 1230		Mod		0.33
4C		Disturbed edges of access track		Low	0.01	
4R		Along roadside - ecotonal features		Mod-Good		1.9
5C	1235	Regenerating – stand of young mature trees on stockpile (not on waterlogged alluvial soils)		Mod	0.08	
5R		More mature representation of PCT 1235 on waterlogged alluvial soils	X	Mod-Good		0.97
6R	686	Blackbutt - Pink Bloodwood shrubby open forest		Mod-Good		1.25
7R	1536	Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest	X	Good		3.66
7Ra			X	Low		0.57
Access Track				Very Low	0.01	10.87
c	N/A	Already Cleared/concrete pad		N/A	0.18	
		Total Proposed to be Cleared			**1.35**	
		Total to be Retained				11.02

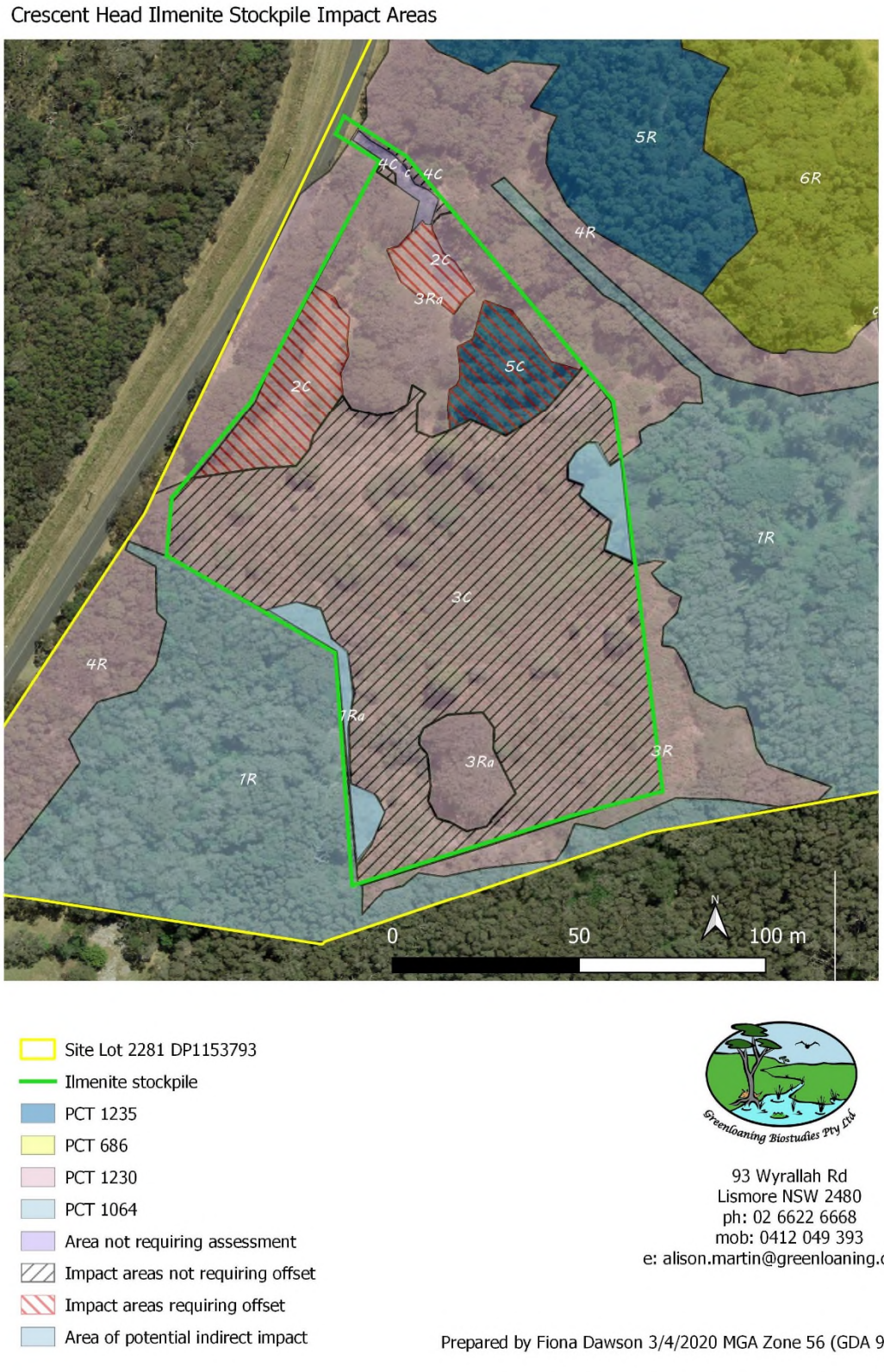


Figure 18 Resource recovery area indicating vegetation zones and direct impact areas requiring or not requiring offsets, indirect impact areas and areas not requiring assessment

6.3 AVOIDANCE OF IMPACTS

6.3.1 Avoidance of Impact on Endangered Ecological Communities and Known Potential Threatened Species Habitat

Direct impacts on TECs will be avoided by the restriction of clearing and resource recovery operations to the defined resource recovery Impact Area, as shown on **Figure 16** and the retention and protection of the remainder of the vegetation within the subject property. Although the PCTs defined as occurring within the Impact Area can represent remnant/regenerating forms of TECs, as described in **Section 4.2.1**, the representations of these PCTs within the stockpile and Impact Area do not represent TECs (refer to **Section 4.2.1.** iii and **4.2.1.**IV). No threatened flora was detected within these communities but protection of the vegetation zones adjoining the Impact Area and stockpile also will protect potential threatened flora species habitat in these areas. This also will serve to protect habitat considered to have some potential to provide temporary or occasional foraging or roosting habitat for some threatened fauna species which have been tentatively identified or assumed to occur on the subject property for the purpose of this BDAR. The total area of vegetation for which any clearing is to be avoided totals approximately 10.9 ha.

Mitigation measures to ensure that both direct and indirect impacts are avoided, or the potential for such impacts is minimised, are provided in **Section 6.5**.

6.3.2 Minimising Impacts on Biodiversity

The following procedures are proposed to ensure that all impacts, or potential impacts, as outlined in **Section 6.2**, are either avoided or minimised as much as possible and any risks to individuals of fauna species that may be present during clearing activities and subsequent resource recovery operations are minimal:

- Maintenance and protection of all vegetation outside the impact area and thus within the designated area for conservation;
- Prior to the commencement of any construction works on site, clear marking of any trees to be protected in the immediate vicinity of clearing and distinctive marking of trees to be removed, such that there is no room for confusion regarding tree removal/protection. KFTs will be a priority for this procedure;
- Clear delineation of the total Impact Area to avoid any confusion by resource recovery machinery operator/s;
- Pre-clearing checks by a suitably qualified ecologist to be undertaken immediately prior to clearing activities to ensure there are no fauna issues, such as small ground fauna sheltering in dense grass/ground cover, nesting birds, roosting microbats, requiring specific remedial actions. In the unlikely scenario of an individual Koala being located in one of the trees within Zones 2c, 3c, or 5c immediately prior to clearing, a buffer of 10m will be established around the tree and the Koala left to move on of its own accord;
- Simple management protocols to be prepared to provide standard procedures for on-site workers in the event of any issues with wildlife arising during the resource recovery operations, e.g. inadvertent injury to any fauna, observation of a Koala or other fauna showing signs of disease, or a bird establishing a nest in one of the few trees to be cleared;
- Supervision of clearing operations by a suitably qualified ecologist/fauna spotter/wildlife carer if potential fauna issues are identified;

- Ongoing restriction of resource recovery operations to daylight hours, over a maximum of five days a week, for approximately 36 weeks; and
- Ongoing maintenance of best practice on-site biosecurity hygiene measures for machinery and on-site personnel to minimise the risk of introducing or spreading exotic weeds, pests or diseases.
- Development and implementation of an approved Rehabilitation Plan, which will identify appropriate management zones for remaining vegetation on the Site and for effective rehabilitation of the areas to be cleared. The Plan will prescribe management measures, including planting and weed control procedures and measure to minimise the risk of introducing or spreading plant diseases. KFTs are recommended to be a priority for proposed plantings post resource recovery.

6.4 MITIGATION MEASURES

6.4.1 Offsets

The outcomes from the Biodiversity Assessment Calculator are summarised in the Calculator reports provided in **Appendix G** and vegetation integrity scores are provided in **Table 4.4.** As could be expected, the vegetation integrity score (overall condition) of Zone 3c, encompassing the majority of the resource recovery /impact area, was very low (refer to **Table 4.3** and **Table 6.3**). The vegetation integrity score of 14.3 thus was below the threshold level requiring further assessment for a non-TEC or threatened species habitat and no offsets would be required for the disturbance to this vegetation community. The retirement of 3 credits however, is required for the other vegetation zones within the Impact Area.

As no threatened flora was detected within the Impact Area as a whole, no credit requirements were generated for flora 'species credit species.' However, for the two threatened fauna 'species credit species' assumed to be present within the Impact Area, 11 credit requirements were generated for each of these 'species credit species.' The credit requirements for the proposed resource recovery operation are summarised in **Table 6.3**. The Credit Summary Report generated from the project BAM Calculator assessment is provided in **Appendix G.**

A key objective of the final layout of the Impact Area was to avoid clearing of KFTs. If however, any KFTs are inadvertently damaged, or very young saplings hidden by dense weed growth are inadvertently removed, such trees will be replaced as part of the rehabilitation measures at a ratio of 10:1. Similarly, if any such young saplings are located within proposed clearing zones during pre-clearing surveys, a similar compensatory planting ratio will be followed.

Given that an integral component of the proposed resource recovery process is the retention and protection of the small pockets of remnant forest/woodland occurring on the property, management measures to ensure protection of these areas during the resource recovery operation are proposed, as outlined in **Section 6.6.2**.

Table 6-3 Changes in Vegetation Integrity, Ecosystem and Species Credits for the Resource Recovery Impact Area

PCT	Zone	Vegetation Integrity Score	Future Vegetation Integrity Score	Change in Vegetation Integrity Score	Number of Required Ecosystem Credits	Number of Required Species Credits
1230	2c	35.7	0	-35.7	2	0
1230	3c	14.3	0	-14.3	0	0
1235	5c	27.9	0	-27.9	1	0

6.4.2 General Management Measures

To ensure both appropriate management of the areas of vegetation to be retained during the resource recovery operations, and effective rehabilitation/revegetation of the areas to be cleared, the preparation of a site specific Revegetation/Rehabilitation Plan is proposed. This plan would prescribe the vegetation to be protected in the long term, vegetation management procedures to be employed, primarily comprising planting of KFTs, other suitable native species, weed control measures, desired outcomes to be achieved and measures of success. The plan also will need to take into account any changes in drainage patterns associated with removal of the ilmenite stockpile. Of key importance to vegetation management measures would be the control of High Threat Weed species (HTWs) (refer to **Tables F1-F4, Appendix F**).

Site rehabilitation works would need to be carried out by an appropriately qualified and experienced contractor.

6.4.3 Management Issues and Key Threatening Processes

The primary management issues or factors requiring consideration as identified for the subject property and more particularly the Impact Area to be rehabilitated/revegetated comprise:

- Ongoing weed control and potential for new weed infestations;
- Potential for introduction of plant disease (Myrtle Rust) with revegetation procedures;
- Changed topography and associated changes back to drainage patters more closely aligned with the original drainage patterns in the general environs of the stockpile; and
- Variations in seasonal conditions inhibiting successful outcomes.

Weed species pose the most significant threat to successful site rehabilitation and some species are identified as key threats within the nearby Goolawah Nation Park. These include Bitou Bush, Lantana and Winter Senna (*Senna pendula* var. *glabrata*); exotic grasses such as Broad-leaved Paspalum (*Paspalum distichum*), and exotic vines such as Coastal Morning Glory (*Ipomoea cairica*) and *Asparagus* spp. (DPIE, 2014).

Myrtle Rust is a fungal disease of plants which affects soft, actively growing leaves, shoots and young stems. It is spread by wind, insects, water and animals and can be carried on infected plant material on equipment, vehicles and clothing. It affects species of the Myrtaceae family, including eucalypts, paperbarks (*Melaleuca* spp.), tea tree species (*Leptospermum* spp.), *Angophora* spp. and bloodwoods (*Coymbia spp.*) (Department of Primary Industries 2022, Soewarto et al, 2019). The disease was not observed in the vicinity of the subject site and impact area, but is known from the North Coast in general. Specific measures to minimize the risk of introducing/spreading this disease will be incorporated into the site Rehabilitation Plan, but will primarily comprise standard best practice hygiene measures with equipment, clothing and vehicles.

The above issues generally relate to some of the Key Threatening Processes (KTPs) listed under the BC Act. A summary of the likely extent of the proposed resource recovery increasing the level of any of the listed KTPs is provided in **Table 6.4**. Full discussion of the above issues and the measures by which they would be addressed would be expected to be provided as part of the Rehabilitation Plan. However, a summary of the proposed measures to ensure protection of existing habitats, minimising the potential for harm to habitats/species and rehabilitation procedures is provided in **Table 6.5**.

6.5 FINAL IMPACT ANALYSIS

6.5.1 Direct Impacts

Clearing of a total of approximately 1.35 ha of previously cleared and regenerating land, some of which has substantial HTW infestations (Zone 3c), is unavoidable if the proposed resource recovery process is to proceed. The extent of clearing has been minimised however, by ensuring the resource recovery operations are to be located within the existing previously cleared area (Zones 2c, 3c, 4c and 5c), and do not impinge on the remnant forest/woodland areas supporting KFTs (Zone 2R), nor on the adjoining forested areas representing TECs. None of the trees to be removed within the Impact Area is in the large mature class, based on benchmark conditions for PCT 1230 and PCT 1235, and the majority are less than 20 cm dbh (refer to **Appendix F)**. The clearing operations trigger the requirement for a total of 3 ecosystem credits, and 22 credits for species credit species to be retired under the Biodiversity Offset Scheme. Species polygons for the two threatened fauna species assumed to be present are shown on **Figure 19.** The full Credit Summary Report from the BAM calculator is provided in **Appendix G**. There are no SAII species impacted by the proposed resource recovery operations.

There will be some minor increases in habitat fragmentation within the ilmenite stockpile footprint for the duration of the resource recovery process and subsequent early stages of regeneration/rehabilitation of the Impact Area. The potential for physical damage to KFTs and habitat to be retained, and injury to fauna species from clearing operations will be minimised by a range of mitigation measures, as provided in **Section 6.4.2**. The level of increase in key threatening processes arising form the project is considered to be minimal, as indicated in **Table 6.4**.

The proposed management measures, encompassing preparation and implementation of a site-specific Revegetation/Rehabilitation Plan, are expected to improve the habitat value of the Impact Area and stockpile per se over time. The overall outcome will be protection of existing, albeit low use, Koala habitat within the subject property, a relatively short term loss of the current limited biodiversity values within the Impact Area, and in the longer term, a net gain in the biodiversity value of the stockpile area.

6.5.2 Indirect Impacts

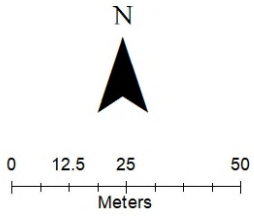
There will be some short term (approximately 36 weeks) increase in diurnal noise levels during week days, when machinery and trucks will be operating and this represents the most likely source of some indirect impacts However, no threatened flora or fauna species with potential to occur either within the Impact Area or the subject property, is considered likely to be significantly adversely affected by the clearing activities and subsequent works within the resource recovery area. The movements and behaviour of nocturnal species, such as bats and possums, will not be affected by either increased noise or lighting, with all operations restricted to daylight hours. Protocols also will be in place to allow for scenarios such as birds nesting in adjacent habitat, with machinery use in the immediate vicinity of breeding activity to be avoided.

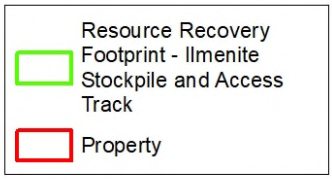
Adverse hydrological impacts on adjacent drainage lines/wetland habitats will be avoided through best practice erosion/sedimentation procedures during both clearing and operation stages. Other potential, indirect impacts, such as edge effects and introduction of new weed species or diseases will be managed by the best practice hygiene measures outlined in Section 6.4 and detailed in the site Rehabilitation Plan.

6.5.3 Prescribed Impacts

There are no karsts, cliffs, any geological features of significance or human-made structures on the site. The project also does not entail any new effects on water quality etc, and as stated in Section 6.5.2, best practice erosion/sedimentation procedures will be in place during both clearing and operation stages of the project. Such measures will minimise any risk of adverse impacts on drainage systems and water quality. The project also is not a proposed wind farm and the extent of proposed activity on the site is not likely to increase the risk of vehicle strikes. These prescribed impacts therefore are not likely to be an issue.

Any impacts on non-native vegetation on the subject property can be viewed as positive impacts, given that non-native plants on the site and in adjacent areas are weeds species, including some HTWs. Similarly, the extent of adverse impact on connectivity of threatened species habitat will be very minor, with habitat on all sides of the stockpile remaining connected. Additionally, connectivity will be enhanced in the long term by the rehabilitation procedures to be implemented under the site Rehabilitation Plan.





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Source: Greenloaning Field Studies

Prepared by: Bob Bennett, Greenloaning Biostudies 26.04.2022

Figure 19 ***Species Polygons for Species Credit Species Assumed to be Present within the Impact Area***

Table 6-4 Likely Extent of Increased Threatening Processes from the Proposed Resource Recovery

Threatening Process	Likely Level of Increase from Proposed Resource Recovery Operations
Aggressive exclusion of birds from woodland and forest habitat by abundant noisy miners, *Manorina melanocephala*	No increase likely
Alteration of habitat following subsidence due to longwall mining	N/A
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No increase likely
Human-caused climate change	Minimal incremental
Bushrock removal	N/A
Clearing of native vegetation	Minor increase
Competition and grazing by the feral European rabbit, (*Oryctolagus cuniculus*)	No increase likely
Competition and habitat degradation by feral goats, (*Capra hircus*)	N/A
Competition from feral honeybees, *Apis mellifera*	N/A
Death or injury to marine species following capture in shark control programs on ocean beaches	N/A
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	N/A
Forest eucalypt dieback associated with over-abundant psyllids and bell miners	N/A
Habitat degradation and loss by Feral Horses (brumbies, wild horses), (*Equus caballus)*Linnaeus 1758	N/A
Herbivory and environmental degradation caused by feral deer	No increase likely
Ecological consequence of high frequency fires	No increase likely
Importation of red imported fire ants, (*Solenopsis invicta*) into NSW	No increase likely

Threatening Process	Likely Level of Increase from Proposed Resource Recovery Operations
Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species	No increase likely
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No increase likely
Infection of native plants by *Phytophthora cinnamomi*	No increase likely
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family *Myrtaceae*	Possible but measures will be in place to minimise risk
Introduction of the large earth bumblebee, (*Bombus terrestris*)	No increase likely
Invasion and establishment of exotic vines and scramblers	No increase likely
Invasion and establishment of Scotch Broom, (*Cytisus scoparius*	N/A
Invasion and establishment of the Cane Toad	No increase likely
Invasion of native plant communities by African olive, *Olea europaea* subsp. *cuspidate* (Wall. ex G. Don) Cif.	N/A
Invasion of native plant communities by Bitou Bush and Boneseed	Potential for Increase - to be managed
Invasion of native plant communities by exotic perennial grasses	Potential for Increase - to be managed
Invasion of the yellow crazy ant (*Anoplolepis gracilipes*) into NSW	No increase likely
Invasion, establishment and spread of Lantana, (*Lantana camara*) L. sens. lat)	Potential for Increase - to be managed
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	No increase likely
Loss of hollow-bearing trees	No increase likely
Loss and/or degradation of sites used for hill-topping by butterflies	N/A

Threatening Process	Likely Level of Increase from Proposed Resource Recovery Operations
Predation and hybridisation by feral dogs, (*Canis lupus familiaris*)	N/A
Predation by the Plague Minnow (*Gambusia holbrooki*)	N/A
Predation by the European Red Fox, (*Vulpes Vulpes*)	No increase likely
Predation by Feral Cats	No increase likely
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island	N/A
Predation, habitat degradation, competition and disease transmission by Feral Pigs, (*Sus scrofa*)	N/A
Removal of dead wood and dead trees	Very minor increase

Table 6-5 Management Measures

Item	Action	Outcome	Timing	Responsibility
1	Clear marking of any trees to be protected in the immediate vicinity of proposed clearing, particularly KFTs	Maintenance and protection of all vegetation outside the resource recovery footprint and thus within the designated area for conservation	Prior to the commencement of any clearing works on site	Project Manager/ Project Ecologist
2	Distinctive marking/flagging of trees to be removed	Ensuring there is no room for confusion regarding tree removal/protection	Prior to the commencement of any clearing works on site	Project Manager/ Project Ecologist
3	Pre-clearing checks for Koalas and other fauna species/ specific habitat that may need clearing supervision	No fauna issues , such as Koalas sheltering in shade tree, nesting birds, roosting microbats, requiring specific procedures, need to be addressed unexpectedly	Immediately prior to clearing activities	Suitably qualified ecologist
4	Supervision of clearing operations	Any identified fauna issues are dealt with appropriately and no individuals are subject to risk of injury	During clearing	Suitably qualified ecologist
5	Preparation of a Fauna Management Protocol for the operation stage of the project	Ensuring any fauna management issues that arise during resource recovery operations have appropriate procedures in place for on-site personnel	Pre-project commencement	Suitably qualified ecologist
6	Preparation of a Revegetation/Rehabilitation Management Plan for the Impact Area and stockpile	Ensuring vegetation management/weed control measures for the Impact Area and stockpile are appropriately planned and the biodiversity value of the area is increased	Pre-project commencement	Suitably qualified bush regenerator/rehabilitation specialist

Item	Action	Outcome	Timing	Responsibility
7	Implementation of the approved Revegetation/ Rehabilitation Management Plan	Commencement of planting programme on suitably prepared substrate and landform	Immediately post construction (during suitable weather conditions)	Project Manager in conjunction with suitably qualified bush regenerator/rehabilitation specialist
8	Monitoring of effectiveness of the Revegetation/ Rehabilitation Management Plan measures	Ensuring the outcomes for Item 6 are achieved, and identifying any issues with the success of the Revegetation/ Rehabilitation Management Plan that need to be addressed/resolved	Within 2 years post completion of resource recovery operations - monitoring schedule to be provided in VMP	Project Manager in conjunction with suitably qualified ecologist/bush regenerator as required

7 Conclusions and Recommendations

7.1 CONCLUSIONS

On the basis of the BAM assessment process for the proposed resource recovery, the following conclusions have been made:

- The subject property, encompassing the proposed resource recovery /Impact Area, is part of a patch of remnant and regenerating bushland, well connected with other coastal vegetation to the north, east and south-east, and adjoining Goolawah National Park to the east and south-east. Point Plomer Road separates the subject property from extensive vegetation to the west, and would provide a barrier to some fauna species. As such, the resource recovery /Impact Area and subject property form part of a defined wildlife corridor and key fauna habitat area;
- The total extent of native vegetation within the 1500 m buffer for the subject property has been estimated to be 62%;
- The resource recovery /Impact Area and subject property, have been subject to substantial past disturbances associated with sand mining operations in the 1960s and 1970s. The ilmenite stockpile was formed during the course of the sand mining activities;
- The majority of the resource recovery /Impact Area has been cleared previously, with only two small patches of remnant forest/woodland remnant and regenerating vegetation retained. Scattered regenerating native trees, a small patch of regenerating Swamp Oak plus dense native ground cover species occur over the remainder of the resource recovery /Impact Area. Dense infestations of Lantana, listed as a High Threat Weed under the BAM, occur in patches, particularly around the edges of the ilmenite stockpile and in the southern portion of the resource recovery /Impact Area ;
- Five Plant Community Types have been identified as occurring on the subject property, viz;
    - PCT 686 - Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion
    - PCT 1064 - Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion
    - PCT 1230 - Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion and
    - PCT 1235 - Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion; AND
    - PCT 1536 - Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest.
- The remnant vegetation patches occurring on the stockpile have been assigned to PCT 1230, and the majority of the regenerating areas also have been assigned to PCT 1230. The patch of regenerating Swamp Oak has been assigned to PCT 1235. It is emphasised that the identification of these PCTs, particularly PCT 1230, is considered as 'best fit' only, on the basis

of species occurrence[4] and in the context of recognising that the vegetation occurring on an ilmenite stockpile would not be representative of a natural system;

- Both PCTs identified within the resource recovery /Impact Area can represent Threatened Ecological Communities. However, the occurrence of these communities on an elevated ilmenite stockpile renders both communities as not conforming to the definition of the associated Threatened Ecological Communities listed under the *Biodiversity Conservation Act 2016*;
- No threatened flora species has been detected on the subject property, or within the resource recovery /Impact Area, although there remains minor potential for such species to occur in the main body of vegetation to be retained;
- One threatened species credit fauna species, the Koala, was recorded from one Koala pellet within the small patch of remnant forest/woodland supporting Koala Food Trees to be retained in the north of the ilmenite stockpile. The stockpile per se habitat represents 'low use' Koala habitat. There was a tentative record of another threatened fauna species, the Little Lorikeet, flying through the subject property and microbat detection surveys yielded one record of the Little Bent-winged Bat. None of these three species would have any reliance on the habitats occurring within the resource recovery /Impact Area, although they may pass through/over the area. The lorikeet and microbat also could use the habitat for very limited foraging purposes;
- Two other threatened species credit fauna species, the Brush-tailed Phascogale and the Common Planigale, have been assumed to be present on the site;
- Development of the site will require the clearing of a total of 1.35 ha of regenerating vegetation, comprising 1.26 ha of low condition PCT 1230, and 0.08 ha of moderate condition PCT 1235. No old growth or large mature trees will be removed and the majority of young trees to be removed are less than 20 cm diameter breast height;
- There are no species at risk of Serious and Irreversible Impacts likely to be impacted by the project associated with the project;
- The two patches of remnant and regenerating forest/woodland supporting Koala Food Trees will be retained and protected;
- All vegetation beyond the resource recovery /Impact Area, which encompasses some areas of Threatened Ecological Communities, will be retained and protected from disturbance during the course of the resource recovery operations;
- The proposed clearing activities trigger the requirements for 3 ecosystem credit and 22 species credits for threatened fauna species s to be retired;
- The detailed measures required to protect vegetation to be retained, and to rehabilitate and revegetate the ilmenite stockpile post resource recovery operations will be provided in a site specific Revegetation/Rehabilitation Management Plan prior to the commencement of works on the subject property;
- The project will result in a short term loss in existing, but limited biodiversity values within the resource recovery /Impact Area, and short term increases in local noise levels (non-

[4] Species occurrence from both the impact area and the remnant areas to be retained in the north and south of the stockpile were taken into account, but it also should be recognised that the impact area probably represents and ecotonal zone, with influences form all adjoining communities.

continuously over 36 months). The overall outcome in the long term however, is expected to be an improvement in biodiversity on the subject property.

7.2 RECOMMENDATIONS

The following broad measures are recommended to minimise short term risks of damage to habitat to be protected or injury to fauna during clearing operations or the resource recovery process, and to maximise the potential for long term positive biodiversity outcomes from the resource recovery project as a whole:

- All pre-clearing, clearing and resource recovery operations follow best practice procedure, incorporating the measures provided in **Chapter 6** of this BDAR; and
- Habitat regeneration, enhancement processes and weed control measures be detailed in a site-specific Revegetation/Rehabilitation Management Plan for the property.

8 References and Bibliography

See 3.2.2.iii for GIS spatial data sources

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Appendix A BDAR Requirements and Compliance Tables

Table A.1 Minimum information requirements for the Biodiversity Development Assessment Report– Stage 1: Biodiversity assessment

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
Introduction (BAM reference Chapters 2 & 3)	Introduction to the biodiversity assessment including: • brief description of the proposal • Identification of subject land boundary, including: o Operational footprint o Construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure • General description of the subject land • Sources of information used in the assessment, including reports and spatial data	s 1.1 S 1.1, S 1.5 s 1.1 and s 3.2.2.iii	• Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure	Figure 2, Figure 4
Landscape Context (BAM Section 3.1 and 3.2, Appendix E)	• Identification of site context components and landscape features including: o general description of subject land topographic and hydrological setting, geology and soils o percent native vegetation extent in the assessment area o IBRA bioregions and subregions o rivers and streams classified according to stream order o wetlands within, adjacent to and downstream of the site o connectivity of different areas of habitat o karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing o areas of outstanding biodiversity value occurring on the subject land and assessment area	s 1.4.1/1.4.2/ 1.4.3 s 1 4.6 S 1.4.1 S 1.4.4 S1.4.4 S1.4.1 S1.4.4 S1.4.6	• Site Map o Boundary of subject land o Cadastre of subject land o Landscape features identified in BAM Subsection 3.1.3 • Location Map o Digital aerial photography at 1:1,000 scale or finer o Boundary of subject land o Assessment area, (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development o Landscape features identified in BAM Subsection 3.1.3 o Additional detail (e.g. local government area boundaries) relevant at this scale • Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location map include:	Figure 2 Figure 10 Figure 4 Figure 4 Figure 2 See below N/A

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	o any additional landscape features identified in any SEARs for the proposal o NSW (Mitchell) landscape on which the subject land occurs	N/A S 1.4.2	o IBRA bioregions and subregions o rivers, streams and estuaries o wetlands and important wetlands o connectivity of different areas of habitat o karst, caves, crevices, cliffs, rocks and other geological features of significance and if required soil hazard features o areas of outstanding biodiversity value occurring on the subject land and assessment area o any additional landscape features identified in any SEARs for the proposal o Figure NSW (Mitchell) landscape on which the subject land occurs	Figure 1 Figure 9 Figure 3 Figure 12 Figure 5 Figure 8 N/A
Native vegetation (BAM Chapter 4, Appendix A and Appendix H)	• Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery. • Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM • Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1) • Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 • Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A) • For each PCTs within the subject land, describe: o vegetation class	s 1.4.6 s 4.2.1 s 4.1.2 s 3 3 2 N/A	Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of cleared areas and all parts of the subject land that do not contain native vegetation • Map of PCTs within the subject land • map of vegetation zones within the subject land • map of the location of vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries • map of TEC distribution on the subject land and table of TEC listing, status and area (ha) • map of patch size locations for each native vegetation zone and table of patch size areas	Figure 15 Figure 16, Figure 16 Figure 16 Figure 14 Figure 16 Table 4.4 Figure 13

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	o extent (ha) within subject landVegetation type o evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps o plant species relied upon for identification of the PCT and relative abundance of each species (BAM Section 4.2(1–3.) o If relevant, TEC status, including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2. o Estimate of percent cleared value of PCT • Describe the vegetation integrity assessment of the subject land, including: o Identification and mapping of vegetation zones o Assessment of patch size o survey effort (i.e. number of vegetation integrity survey plots) o use of relevant benchmark data from BioNet Vegetation Classification Assessing vegetation integrity using benchmark data • Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): o identify the PCT or vegetation class for which local benchmark data will be applied o identify published sources of local benchmark data (if benchmarks obtained from published sources) o describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) o provide justification for use of local data rather than BioNet Vegetation Classification benchmark values o provide written confirmation from the decision-maker that they support the use of local benchmark data	s 4.2.2 s3.3.2 s 3.2.2.ii s 3.3.2 N/A N/A	• Table of current vegetation integrity scores for each vegetation zone within the site and including: o composition condition score o structure condition score o function condition score o presence of hollow-bearing trees	Table 4.4

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
Threatened species (BAM Chapter 5)	Identify ecosystem credit species likely to occur on the subject land, including: o List of e cosystem credit species derived from the BAM-C o Justification and supporting evidence for exclusion of any ecosystems credit species based on geographic limitations, habitat constraints or vagrancy. o justification for addition of any ecosystem credit species to the list Identify species credit species likely to occur in the subject site, including: o List of species credit species derived from the BAM-C o Justification and supporting evidence for geographic limitations, habitat constraints or vagrancy exclusions based on habitat features\ o justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends o justification for addition of any species credit species to the list From the list of candidate species credit species, identify: o species assumed present within the subject land o species present within the subject land on the basis of being identified on an important habitat map for a species o species for which targeted surveys are to be completed to determine species presence o species for which an expert report is to be used to determine species presence Present the outcomes of species credit species assessments from: o threatened species survey	Appendix G s.4.2.4 s. 5.2.4 N/A Appendix G s.4.2.4 s5.2.4. s.4.1.1 N/A s 5.2.3 N/A s 4.1.1 s 5.1 s 5.2.3	Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying: o the ecosystem credit species removed from the list o the sensitivity to gain class of each species Table detailing species credit species in accordance with BAM section 5.2 and identifying: o the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present o the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4) Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5)	Appendix G Appendix G Table 5.1 Table 5.1 Appendix C

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	o expert reports (if relevant) including justification for presence of the species and information used to make this determination	N/A		
	Where survey has been undertaken include detailed information on:			
	o survey method and effort,	s.3.3		
	o justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the Department's taxa-specific survey guides or where no relevant guideline has been published	s.3.3 s.3.4		
	o timing of survey in relation to requirements in the TBDC or the Department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys	s.3.3.1		
	o survey personnel and relevant experience			
	o describe any limitations to surveys and how these were addressed/overcome	s.3.3.5 s.3.3.4		
	Where an expert report has been used in place of survey include:			
	o justification of the use of an expert report	N/A		
	o identify the expert, provide evidence of their expert credentials and Departmental approval of expert status			
	o all requirements of Box 3 have been addressed in the expert report			
	Where use of local data is proposed):			
	o iidentify relevant species			
	o identify data to be amended	N/A		
	o identify source of information for local data, e.g. published literature, additional survey data, etc.			
	o justify use of local data in preference to VIS Classification or TBDC data			
	o provide written confirmation from the decision-maker that they support the use of local data			
	Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:			

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	o the unit of measure for each species is documented for species assessed by area: o the polygon includes the extent of suitable habitat for the target species within the subject land o a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied for species assessed by counts of individuals: o the number of individual plants present on the subject land o the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken o the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as	s.5.2.3 N/A Table 5.1		
Prescribed Impacts (BAM Chapter 6)	Identify potential prescribed biodiversity impacts on threatened entities, including: o karst, caves, crevices, cliffs, rocks and other geological features of significance o occurrences of human-made structures and non-native vegetation o corridors or other areas of connectivity linking habitat for threatened o water bodies or any hydrological processes that sustain threatened o protected animals that may use the proposed wind farm development site as a flyway or migration route o where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community	s.6.2.3	• Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) • Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)	Figure 12 N/A

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts Describe the importance of habitat features to the species including, where relevant, impacts on life-cycle or movement patterns Where the proposed development is for a wind farm: o identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area o provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.) o predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.))	s.6.2.3 s.6.2.3 N/A		

Table A.2 Minimum information requirements for the BDAR– Stage 2: Impact assessment (biodiversity values)

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
Avoid and minimise impacts (BAM Chapter 7)	• Demonstration of efforts to avoid and minimise impacts on biodiversity values, (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative: o modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology o routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route o alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location o alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site • Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2) • Identification of any other site constraints that the proponent has considered in determining the location and design of the	s. 6.3.1 s 6.3.1 N/A N/A N'A s 6.3.2 s 6.3.2	• Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility • Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and the final proposal footprint, including construction and operation • Maps demonstrating indirect impact zones where applicable	Table 6.5 N/A Figure 19

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	proposal (as described in BAM Section 7.2.1(3.) .			
Assessment of Impacts (BAM Chapter 8, Sections 8.1 and 8.2)	• Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1) • Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): o description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal o documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications o reporting any limitations or assumptions, etc. made during the assessment o identification of the threatened entities and their habitat likely to be affected • Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: assessment of the nature, extent and duration of impacts on the habitat of threatened species or ecological communities associated with: o karst, caves, crevices, cliffs, rocks and other features of geological significance o human-made structures o non-native vegetation o connectivity of different areas of habitat of threatened species that facilitates the	s 6.5.1 s 6.5.2 s 6.5.3 N/A N/A N/A s 6.5.3	• Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	Table 6.3

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	movement of those species across their range o movement of threatened species that maintains their life cycle o water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities • assessment of the impacts of wind turbine strikes on protected animals • assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	N/A s 6.5.3 N/A s 6.5.3		
Mitigation and Management of Impacts (BAM Chapter 8, Sections 8.4 and 8.5)	• Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including: o techniques, timing, frequency and responsibility o identify measures for which there is risk of failure o evaluate the risk and consequence of any residual impacts o document any adaptive management strategy proposed • Identification of measures for mitigating impacts related to: o displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)) o indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))	s 6.4 s 6.4.2 s 6.4.2 s 6.4.3	• Table of measures to be implemented to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility	Table 6.5

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
	o mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) • Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	s 6.4.2 s 6.4.3 s 6.5.3 s 6.4.3		
Impact summary (Chapter 9)	• Identification and assessment of impacts on TECs and threatened species that are at risk of serious and irreversible impacts (SAII), in accordance with BAM Sections 9.1, including. o addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land o addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land o documenting assumptions made and/or limitations to information o documenting all sources of data, information, references used or consulted o clearly justifying why any criteria could not be addressed • Identification of impacts requiring offset in accordance with BAM Section 9.2 • Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.) • Identification of areas not requiring assessment in accordance with BAM Section 9.3 Published LW 19 October 2020 (2020 No 621)	N/A S 6.5	• Map showing the extent of TECs at risk of an SAII within the subject land • Map showing location of threatened species at risk of an SAII within the subject land • Map showing location of: o impacts requiring offset o impacts not requiring offset o areas not requiring assessment	N/A N/A Figure 19

BAM Reference	Information	BDAR Reference	Maps & Tables	BDAR Reference
Impact summary (Chapter 10)	• Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including: o Future vegetation integrity score for each vegetation zone within the subject land o Change in vegetation integrity score o Number of required ecosystem credits for the direct impact of the proposal on each vegetation zone within the subject land o Number of required species credits for each candidate threatened species that is directly impacted on by the proposal	s 6.4.1 s 6.4.1 s 6.4.1 Appendix G s 6.4.1 Appendix G	• Table of PCTs requiring offset and the number of ecosystem credits required • Table of threatened species requiring offset and the number of species credits required	Table 6.2, Appendix G Appendix G
Biodiversity credit report (Chapter 10)	• Description of credit classes for ecosystem credits and species credits at the development site.	s 6.4.1 Appendix G	• Table of credit class and matching credit profile	Appendix G

Appendix B Site Photographs

[5]***Photograph B1*** ***Burnt out car bodies dumped on access track, with habitat degraded by Lantana and Slash Pine – 2019***

Photograph B2 ***Same burnt out car bodies on access track, being overgrown by Lantana - 2022***

[5] All photographs sourced from Greenloaning unless otherwise indicated

Photograph B3 ***Looking from stockpile southwest towards Point Plomer Road and roadside Koala Food Trees to be retained (PS, 2019), as well as trees to***

Photograph B4 ***BAM Plot 1 PCT 1230, stockpile dominated by Blady Grass to be cleared***

Photograph B5 ***BAM Plot 1 PCT 1230, showing some increased natural regeneration amongst Blady Grass, as well as increased shrub and weed growthin background***

Photograph B6 ***BAM Plot 1 PCT 1230, with juvenile Slash Pine and increased density of Lantana towards road***

Photograph B7 ***BAM Plot 2 PCT 1230 Old growth Forest Red Gum cluster on stockpile above a ground and mid stratum of Blady Grass and Lantana (2019). This cluster is to be retained***

Photograph B8 ***BAM Plot 2 PCT 1230 showing increased mid stratum of Lantana (2022)***

Photograph B9 BAM Plot 3 PCT 1230, Bam Plot 3 habitat – looking northeast across degraded stockpile habitat comprising Bracken Fern, Lantana and small regenerating trees, to be cleared for resource recovery.

Photograph B10 BAM Plot 4 PCT 1230 (2022), showing dense growth of young mature Swamp Oak and increased Lanatan infestation (refer to Photogtaph B11)

Photograph B11 ***BAM Plot 4 PCT 1235 (2019), showing dense growth of young mature Swamp Oak and relatively sparse understorey and ground cover***

Photograph B12 ***Zone 3Ra PCT 1230 Cluster of old growth trees on southern sector of stockpile to be retained (including Ficus)***

Photograph B13 ***PCT 1064 Paperbark Swamp Forest (2019), with Gahnia a common ground storey species, in moderate to good condition to be retained. Categorised as a TEC off stockpile***

Photograph B14 ***PCT 1064 Paperbark Swamp Forest (2019), adjacent to the stockpile with some Lantana, particularly on the edges. Moderate to good condition to be retained. Categorised as a TEC off stockpile.***

Photograph B15 Bat harp net Trap site 1, located in north east of stockpile

Photograph B16 Lace monitor observed during fauna surveys Dec 2019 in Swamp Sclerophyll Forest habitat to the south of the stockpile and Impact Area.

Appendix C Threatened Species Records and Known/Potential Occurrence on Site

Table C.1 Threatened Species Records for the Subregion and Occurrence/Likelihood of Occurrence on the Subject property

GL = Greenloaning Biostudies Pty Ltd, PS = Pandanus Solutions Shaded rows represent species credit species or dual credit species

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Invertebrates												
Argynnis hyperbius	Laced Fritillary	Known	U **- Excluded**	Within 15 km of coast	E1	CE	<5ha	relictual with < 10%	N	Arrowhead Violet (*Viola betonicifolia*) **A**	High/Very High	Y
Ocybadistes knightorum	Black Grass-dart Butterfly	Known	U**- Excluded -** Habitat highly degraded and not adjacent to tidal area		E1		<5ha	relictual with < 10% habitat retained	N		Mod/High	N
Petalura gigantea	Giant Dragonfly	Known	U - **Excluded –** no swamps within 500 m of site		E1			Within 500 m of swamps	N	A	Mod/High	N
Amphibians												
Crinia tinnula	Wallum Froglet	Known	U - **Excluded –** no swampy habitat within site	Within 10 km of coast	V,P		<5ha	relictual with < 10%	N	n/a	Mod/Mod	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Litoria aurea	Green and Golden Bell Frog	Known	U- **Excluded –** habitat highly degraded within site		E1,P	V	<5ha	relictual with < 10% habitat retained	N	Within 1 km of wet areas/swamp	High/High	N
Litoria booroolongensis	Booroolong Frog	Predicted	U - **Excluded –** habitat highly degraded within site		E1,P	E	<5ha	relictual with < 10% habitat retained	N	N/A	High/High	N
Litoria brevipalmata	Green-thighed Frog	Known	U - **Excluded –** no swampy habitat within site		V,P		<5ha	relictual with < 10% habitat retained	N	Waterbodies/ swamps	Mod/Mod	N
Litoria subglandulosa	Glandular Frog	Predicted	U - **Excluded –** no streams within site	North of Hastings River *(Port Macquarie)*	V,P		<5ha	Fragmented (between 11 & 30% habitat retained)	N	N/A	Very high/Mod	Y
Mixophyes balbus	Stuttering Frog	Known	U - **Excluded –** no streams /suitable within site		E1,P,2	V	5-25ha	Variegated (between 31 & 70% habitat retained)	N	N/A	Very High/High	Y
Mixophyes iteratus	Giant Barred Frog	Known	U- **Excluded –** no suitable habitat within site		E1,P,2	E	<5ha	relictual with < 10% habitat retained	N	Land within 50m of semi permanent and	Mod/High	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
										permanent drainages **A**		
Philoria sphagnicolus	Sphagnum Frog	Known	U- **Excluded –** no suitable habitat within site (wet areas at higher elevations)		V,P			Intact (<70% habitat retained)	N	N/A	High/Mod	N
Reptiles												
Caretta caretta	Loggerhead Turtle	Known	U - **Excluded –** no suitable habitat within site	Within 250m of the high tide mark	E1,P	E	<5ha	variegated 31-70%	N	Elevated sand dune above watertable and high tide	High/Very high	Y
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	Known	U - **Excluded –** minimal suitable habitat within site. Not known from site PCTs		V,P	V	<5ha	relictual with < 10%	N	Leaf and bark litter, Timber and logs on the ground	High/Mod	N
Dermochelys coriacea	Leatherback Turtle	Known	U - **Excluded –** no suitable habitat within site		E1,P	E	<5ha	variegated 31-70%	N	Elevated sand dune above watertable and high tide	High/Very high	Y

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Liopholis whitii	White's Skink	Known	U - **Excluded –** no suitable rocky habitat within site and no profile data		P	0	?	?	n	?		
Hoplocephalus bitorquatus	Pale-headed Snake	Known	U -**not recorded** during spotlighting surveys		V,P		<5ha	fragmented 11-30%	Y	Within 500 m of moderate to good vegetation	High/Mod	N
Hoplocephalus bungaroides	Broad-headed Snake	Predicted	U-**Excluded** – no suitable habitat present		E1,P,2	V	5-24ha	variegated 31-70%	N	Rocky areas Including escapments, outcrops and pogodas within the Sydney Sandstone geologies - **A**	Very high/high	Y
Hoplocephalus stephensii	Stephens' Banded Snake	Known	U-**not recorded** during spotlighting surveys		V,P		25-<100 ha	variegated 31-70%	Y	At or within 500 m of Hollow bearing trees, aboreal vine tangles, fallen/standing dead timber incl logs	High/Mod	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Avifauna												
Amaurornis moluccana	*Pale-vented Bush-hen*	Known	U – **Excluded** - no suitable habitat on site	*North of southwesr Rocks*	*V*				N	Waterbodies Dense vegetation, within 300m of, or in shallows of streams or other natural or artificial wetlands	High/Mod	N
Anseranas semipalmata	Magpie Goose	Known	U – **Excluded** - no suitable habitat on site		V,P	0	<5ha	fragmented 11-30%	N	n/a	Mod/Mod	N
Botaurus poiciloptilus	Australasian Bittern	Known	U– **Excluded** - no suitable habitat on site		E1,P	E	<5ha	relictual with < 10%	N	Brackish or freshwater wetlands	Mod/High	N
Burhinus grallarius	Bush Stone-curlew	Known	Prma Wallaby		E1,P	0	<5ha	fragmented 11-30%	Y	n/a, Fallen/standing dead timber incl logs Null	High/High	N
Calidris alba	Sanderling	Known	U - – **Excluded** - no suitable habitat on site	Within 2 km of coast	V,P	C,J,K	<5ha	relictual with < 10%	N	As per mapped areas (contact OEH for maps - **A**	High/Mod	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Calidris tenuirostris	Great Knot	Known	U– **Excluded** - no suitable habitat on site	Within 5 km of coast or tidal influenced water bodies	V,P	CE,C,J,K	<5ha	relictual with < 10%	N	As per mapped areas (contact OEH for maps) - **A**	High/Very high	Y
Calyptorhynchus lathami	Glossy Black-Cockatoo	Known	P, **but no indications of presence** during field surveys. No large hollows		V,P,2	0	<5ha	relictual with < 10%	Y	Breeding: Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. **A** Foraging: Presence of Allocasuarina and casuarina species	High/Mod	N
Charadrius leschenaultii	Greater Sand-plover	Known	U – **Excluded** - site not within mapped areas	Within 5 km of coast	V,P	V,C,J,K	<5ha	relictual with < 10%	N	Foraging: As per mapped areas (contact OEH for maps)	High/Mod	N
Charadrius mongolus	Lesser Sand-plover	Known	U– **Excluded** - site not within mapped areas	Within 5 km of coast	V,P	E,C,J,K	<5ha	relictual with < 10%	N	Foraging: As per mapped areas (contact OEH for maps)	High/High	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Known	U – minimal habitat on site		V,P	0	<5ha	relictual with < 10%	Y	N/A	High/Mod	N
Coracina lineata	Barred Cuckoo-shrike	Known	P – small area of possible habitat in regenerating Swamp Oak Forest		V,P		5-24ha	fragmented 11-30%	Y Only fleshy-fruited tree species	N/A	Mod/Mod	N
Ephippiorhynchus asiaticus	Black-necked Stork	Known	U – **Excluded** no suitable habitat on site		E1,P		<5ha	relictual with < 10%	y Large (>50cm dbh) tall live or dead trees within 100m of a wetland.	Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps. Shallow lakes, lake margins and estuaries within 300m of these waterbodies	Mod/High	N
Esacus magnirostris	Beach Stone-curlew	Known	U **– Not recorded during site surveys**	Within 2 km of coast	E4A,P	0	<5ha	relictual with < 10%	n	Foraging: As per mapped areas (contact OEH for maps)	High/Very high	Y

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Grus rubicunda	Brolga	Known	U – no suitable habitat on site		V,P	0	<5ha	relictual with < 10%	N	n/a	Mod/Mod	N
Haematopus fuliginosus	Sooty Oystercatcher	Known	U – **Excluded** – no suitable habitat on site	Within 5 km of coast	V,P	0	<5ha	relictual with < 10%	N	Within 100m of estuarine areas and the ocean **A**	High/Mod	N
Haematopus longirostris	Pied Oystercatcher	Known	U – **Excluded** – no suitable habitat on site	Within 5 km of coast	E1,P		<5ha	relictual with < 10%	N	Within 100m of estuarine areas and the ocean	High/High	N
Irediparra gallinacea	Comb-crested Jacana	Known	U – **Excluded** – no suitable habitat on site		V,P		<5ha	relictual with < 10%	N	Freshwater wetlands with a good surface cover of floating aquatic vegetation	Mod/Mod	N
Ixobrychus flavicollis	Black Bittern	Known	U – **Excluded** – no suitable habitat on site		V,P		<5ha	fragmented 11-30%	N	Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	Mod/Mod	N
Lathamus discolor	Swift Parrot	Known	U– **Excluded** - site not within mapped areas		E1,P,3	CE	<5ha	relictual with < 10%	Y Note that the species is only present	As per mapped areas	Mod/Very high	Y

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									during March to September - winter migrant			
Lichenostomus fasciogularis	Mangrove Honeyeater	Known	P **Not recorded during surveys** – habitat very degraded	Within 10 km of coast	V,P		<5ha	variegated 31-70%	N	N/A	High/Mod	N
Limicola falcinellus	Broad-billed Sandpiper	Known	U – **Excluded** - site not within mapped areas		V,P	C,J,K	<5ha	relictual with ≤10% habitat retained	N	species credit component mapped as an important area. NO survey required	High/Mod	N
Limosa limosa	Black-tailed Godwit	Known	U		V,P	C,J,K	<5ha	relictual with ≤10% habitat retained	N	species credit component mapped as an important area. NO survey required	High/Mod	N
Lophoictinia isura	Square-tailed Kite	Known	P (foraging)		V,P,3		<5ha	fragmented 11-30% retained		Nest trees		

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Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Known	U, but P		V,P					N/A	Mod/Mod	N
Carterornis leucotis	White-eared Monarch	Known	P – **not recorded during site surveys**		V,P		25-<100 ha	variegated 31-70%	N	N/A	High/Mod	N
Ninox connivens	Barking Owl	Known	P (foraging) **Excluded (breeding)** – habitat not present		V,P,3		< 5ha	fragmented 11-30% habitat retained	Y	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. **A**	High/Mod	N
Ninox strenua	Powerful Owl	Known	P (foraging) **Excluded (breeding)** – habitat not present		V,P,3		< 5ha	fragmented 11-30% habitat retained	N	Living or dead trees with hollows greater than 20 cm. **A**	High/Mod	N
Oxyura australis	Blue-billed Duck	Known	U – **Excluded** – suitable aquatic habitat not present on site		V,P		<5ha	relictual with ≤10% habitat retained	N	N/A	Mod/Mod	N

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Pachycephala olivacea	Olive Whistler	Known	U – **Excluded** - habitat highly degraded		V,P		25-<100 ha	variegated 31-70%	N	N/A	Mod/Mod	N
Pandion cristatus	Eastern Osprey	Known	P (overhead) **No nesting habitat present**		V,P,3		<5ha	relictual with ≤10% habitat retained	y	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting **A**	Mod/Mod	N
Pezoporus wallicus wallicus	Eastern Ground Parrot	Known	U-**Excluded** – habitat fragmented		V,P,3		5-25 ha	Intact (>70%	N	N/A	High/Mod	N
Ptilinopus magnificus	Wompoo Fruit-Dove	Known	P		V,P		5-25 ha	variegated 31-70%	N	N/A	Mod/Mod	N
Ptilinopus regina	Rose-crowned Fruit-Dove	Known	P		V,P		<5 ha	variegated 31-70%	N	N/A	Mod/Mod	N
Ptilinopus superbus	Superb Fruit-Dove	Known	p		V,P		<5 ha	relictual with < 10%	N	N/A	Mod/Mod	N
Chthonicola sagittata	Speckled Warbler	Known	P		V,P		<5 ha	relictual with < 10%	Y	N/A	High/Mod	N

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Rostratula australis	Australian Painted Snipe	Known	U – **Excluded**- No suitable wetland habitat on site		E1,P	E	<5 ha	relictual with < 10%	N	N/A	Mod/High	N
Sternula albifrons	Little Tern	Known	U – not recorded on site during surveys	Within 10 km of coast and tidal influenced water bodies	E1,P	C,J,K	<5 ha	relictual with < 10%	N	N/A	High/High	N
Stictonetta naevosa	Freckled Duck	Known	U –**Excluded-** No suitable wetland habitat on site		V,P		<5 ha	relictual with < 10%	N	N/A	Mod/Mod	N
Tyto longimembris	Eastern Grass Owl	Known	P		V,P,3		25-100 ha	fragmented 11-30% habitat retained	N	N/A	Mod/Mod	N
Tyto novaehollandiae	Masked Owl	Known	P (foraging) - **Excluded** for breeding habitat – no suitable habitat		V,P,3		<5 ha	fragmented 11-30% habitat retained	Y	Living or dead trees with hollows greater than 20cm diameter.	High/Mod	N
Tyto tenebricosa	Sooty Owl	Known	P (foraging)- **Excluded** for breeding		V,P,3		≥100 ha	Intact (>70% natural	N	Living or dead trees with hollows greater	Y	Very high/Mod

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			habitat – no suitable habitat					habitat retained		than 20cm diameter.		
Anthochaera phrygia	Regent Honeyeater	Known	U – **Excluded –** site not within mapped habitat		E4A,P	CE	<5 ha	relictual with < 10%	N	mapped important areas are a species credit	High/Very high	Y
Turnix maculosus	Red-backed Button-quail	Predicted	U – No observations of species during field surveys		V,P		<5 ha	relictual with < 10%	N	N/A	High/Mod	N
Glossopsitta pusilla	Little Lorikeet	Known	**Tentative record during field surveys**		V,P		<5 ha	relictual with < 10%	Y	N/A	High/Mod	N
Petroica phoenicea	Flame Robin	Known	U		V,P		<5 ha	relictual with < 10%	Y	N/A	Mod/Mod	N
Hieraaetus morphnoides	Little Eagle	Known	U – **Excluded for breeding and foraging**– no large old trees on site and forages in eucalypt forest and woodland –		V,P		<5 ha	fragmented 11-30% habitat retained	Y	Nest trees - live (occasionally dead) large old trees within vegetation.	Mod/Mod	N

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			habitat on site is highly degraded									
Hirandapus caudacutus	White-throated Needletail	Known	P –some limited foraging habitat			V	<5 ha	relictual with < 10%	Y	N/A	High/Mod	N
Petroica boodang	Scarlet Robin	Known	p		V,P		<5 ha	relictual with < 10%	Y	N/A	Mod/Mod	N
Circus assimilis	Spotted Harrier	Known	U – **Excluded** – no potential nests on site		V,P		<5 ha	fragmented 11-30% habitat retained	Y -	N/A	Mod/Mod	N
Daphoenositta chrysoptera	Varied Sittella	Known	P –Some minimal habitat in regenerating Swamp Oak Forest habitat		V,P		<5 ha	fragmented 11-30% habitat retained	Y	N/A	Mod/Mod	N
Epthianura albifrons	White-fronted Chat	Known	P – **not recorded during field surveys**		V,P		<5 ha	relictual with < 10%	N	N/A	Mod/Mod	N

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Calidris ferruginea	Curlew Sandpiper	Known	U – **Excluded** - site not within mapped area		E1,P	CE,C,J,K	<5 ha	relictual with < 10%	N	species credit component mapped as an important area. NO survey required	High/Very high	Y
Numenius madagascariensis	Eastern Curlew	Known	U – **Excluded** - site not within mapped area		P	CE,C,J,K	<5 ha	relictual with < 10%	N		High/Very high	Y
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Known	P– **not recorded during field surveys**		V,P	0	<5 ha	relictual with < 10%	y	N species credit component mapped as an important area. NO survey required /A -	Mod/Mod	N
Calidris canutus	Red Knot	Known	U – **Excluded** - site not within mapped area		P	E,C,J,K	<5 ha	relictual with < 10%	N	species credit component mapped as an important area. NO survey required	High/High	N
Limosa lapponica baueri	Bar-tailed Godwit (baueri)	Predicted	U – **Excluded** - site not within mapped area		P	V,C,J,K	<5 ha	relictual with < 10%		mapped important areas = species credit	High/Mod	N
Haliaeetus leucogaster	White-bellied Sea-Eagle	Known	P		V,P	C	<5 ha	relictual with < 10%	Y	Living or dead mature trees	High/Mod	N

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										within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines		
Xenus cinereus	Terek Sandpiper	Known	U – **Excluded** - site not within mapped area	Tidal influenced water bodies within 15 km of coast	V,P	C,J,K	<5 ha	relictual with < 10%	N	species credit component mapped as an important area. NO survey required	High/Mod	N
Mammals												
Aepyprymnus rufescens	Rufous Bettong	Known	**Not recorded from site surveys**		V,P		<5ha	variegated 31-70%	N	N/A	High/Mod	N
Cercartetus nanus	Eastern Pygmy-possum	Known	**Not recorded from site surveys**		V,P		<5ha	fragmented 11-30%	N	N/A	High/Mod	N
Chalinolobus nigrogriseus	Hoary Wattled Bat	Known	P but unlikely forages in open forest – habitat on site		V,P		5-25ha	relictual with < 10%	Y	N/A	High/Mod	N

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			highly degraded									
Dasyurus maculatus	Spotted-tailed Quoll	Known	P – some potential foraging habitat		V,P	E	<5ha	relictual with < 10%	N	N/A	High/High	N
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Known	U – no suitable habitat on site		V,P		5-25ha	variegated 31-70%	Y	N/A	High/Mod	N
Phoniscus papuensis	Golden-tipped Bat	Known	U no suitable habitat on site		V,P		<5ha	variegated 31-70%	N	N/A	High/Mod	N
Macropus parma	Parma Wallaby	Known	U- no suitable habitat on site. **Not recorded during site surveys**		V,P		5-25ha	variegated 31-70%	N	N/A	High/Mod	N
Miniopterus australis	Little Bent-winged Bat	Known	Recorded during field surveys. No breeding habitat on site		V,P		<5ha	relictual with < 10%	N	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with	Very High/Mod	Y

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										microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.		
Miniopterus orianae oceanensis	Large Bent-winged Bat	Known	P (foraging) No breeding habitat on site		V,P		<5ha	relictual with < 10%	N	As for *M. australis*	Very High/Mod	Y
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Known	P (foraging)		V,P		<5ha	relictual with < 10%	Y	N/A	High/Mod	N
Myotis macropus	Southern Myotis	Known	No breeding habitat on site		V,P		<5ha	relictual with < 10%	Y	Hollow-bearing trees, bridges, caves/artificial structures within 200m of riparian zone	High/Mod	N
Petaurus australis	Yellow-bellied Glider	Known	U -no hollows > 25 cm diameter on site		V,P		25-100 ha	variegated 31-70% habitat retained	N	Hollows > 25 cm diameter	High/Mod	N

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Petaurus norfolcensis	Squirrel Glider	Known	U – not recorded during site surveys		V,P		<5ha	relictual with < 10%	Y	N/A	High/Mod	N
Phascogale tapoatafa	Brush-tailed Phascogale	Known	**Assumed to be present**		V,P		<5ha	relictual with < 10%	Y		High/Mod	N
Phascolarctos cinereus	Koala	Known	U – but may occur on fringes of site/ moving through) **One pellet record in habitat adjacent to impact area**		V,P	V	<5ha	relictual with < 10%	Y	Areas identified via survey as important habitat	High/Mod	N
Planigale maculata	Common Planigale	Known	P **Assumed to be present**		V,P		<5ha	fragmented 11-30%	N	N/A	High/Mod	N
Potorous tridactylus	Long-nosed Potoroo	Known	U – **not detected during site surveys**		V,P	V	5-<25ha	fragmented 11-30%	N	Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations	High/Mod	N

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										inhabiting wet scl		
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	Known	P		V,P		25-100 ha	Variegated (between 31 and 70% habitat retained)	N	N/A	High/Mod	N
Pteropus alecto	Black Flying-fox	Known	**No camp known or detected during site surveys**		P		<5ha	fragmented 11-30%	N	N/A	Mod/Mod	N
Pteropus poliocephalus	Grey-headed Flying-fox	Known	**No camp known or detected during site surveys. S**ome limited foraging habitat in Zone 3C		V,P	V	<5ha	relictual with ≤ 10% habitat retained	N		High/Mod	N
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Known	P-can forage in open habitat		V,P		<5ha	fragmented 11-30%	Y	N/A	High/Mod	N
Scoteanax rueppellii	Greater Broad-nosed Bat	Known	P -- some limited foraging		V,P		5-25 ha	Variegated (between 31 and 70%	N	N/A	High/Mod	N

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			habitat in Zone					habitat retained)				
Syconycteris australis	Common Blossom-bat	Known	U, but some limited foraging habitat in Zone 3C		V,P	0	5-25 ha	Variegated (between 31 and 70% habitat retained)	N	N/A	High/Mod	N
Thylogale stigmatica	Red-legged Pademelon	Known	U		V,P	0	5-25 ha	Fragmented (between 11 and 30% habitat retained)	N	N/A	High/Mod	N
Vespadelus troughtoni	Eastern Cave Bat	Known	U - **Not detected during site surveys**		V,P	0	5-25 ha	Fragmented (between 11 and 30% habitat retained)	N	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old	Very high/Mod	Y

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										buildings or sheds."		
Petauroides volans	Greater Glider	Known	U - **Not detected during site surveys**		P	V	5-25 ha	Variegated (between 31 and 70% habitat retained)	N		High/Mod	N
Flora												
Acronychia littoralis	Scented Acronychia	Known	**Not detected during site surveys**	Within 5 km of coast	E1	E	N/A	N/A	Y	N/A	High/Very high	Y
Allocasuarina defungens	Dwarf Heath Casuarina	Known	**Not detected during site surveys**	Within 15 km of coast	E1	E	N/A	N/A	N	N/A	High/High	N
Allocasuarina simulans	Nabiac Casuarina	Known	**Not detected during site surveys**		V	V	N/A	N/A	N	sandy soil	High/Very high	Y
Niemeyera whitei	Rusty Plum, Plum Boxwood	Known	**Not detected during site surveys**		V		N/A	N/A	Y	N/A	High/Mod	N

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Arthropteris palisotii	Lesser Creeping Fern	Known	**Not detected during site surveys**		E1,3		N/A	N/A	N	N/A	High/Very high	Y
Asperula asthenes	Trailing Woodruff	Known	**Not detected during site surveys**		V	V	N/A	N/A	Y	N/A	High/Mod	N
Callistemon linearifolius	Netted Bottle Brush	Known	**Not detected during site surveys**		V,3		N/A	N/A	Y	N/A	Mod/Mod	N
Chamaesyce psammogeton	Sand Spurge	Known	**Not detected during site surveys**	Within 1 km of coast	E1		N/A	N/A	N	N/A	High/High	N
Cryptostylis hunteriana	Leafless Tongue Orchid	Predicted	**Not detected during site surveys**		V,P,2	V	N/A	N/A	N	N/A	Mod/Mod	N
Cynanchum elegans	White-flowered Wax Plant	Known	**Not detected during site surveys**		E1	E	N/A	N/A	N	N/A	High/High	N
Dendrobium melaleucaphilum	Spider orchid	Known	U **– minimal habitat on site – habitat highly degraded- Not detected**		E1,P,2	0	N/A	N/A	Y	N/A	High/High	N

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			during site surveys									
Diuris disposita	Willawarrin Doubletail	Known	U - **Not detected during site surveys**		E1,P,2	0	N/A	N/A	N	N/A	High/Very high	Y
Galium australe	Tangled Bedstraw	Known	U - **Not detected during site surveys**		E1	0	N/A	N/A	N	N/A	High/Very high	Y
Grevillea guthrieana	Guthrie's Grevillea	Known	U - **Not detected during site surveys**		E1	E	N/A	N/A	N	N/A	High/High	N
Haloragis exalata subsp. velutina	Tall Velvet Sea-berry	Known	U - **Not detected during site surveys**		V	V	N/A	N/A	N	N/A	High/Mod	N
Hibbertia hexandra	Tree Guinea Flower	Known	U - **Not detected during site surveys**		E1		N/A	N/A	N	N/A	High/High	N
Eucalyptus largeana	Craven Grey Box	Known	U - **Not detected**		E1	E	N/A	N/A	Y	N/A	High/High	N

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			during site surveys									
Lindernia alsinoides	Noah's False Chickweed	Known	U – no suitable habitat on site - **Not detected during site surveys**		E1		N/A	N/A	N	N/A	High/Very high	Y
Marsdenia longiloba	Slender Marsdenia	Known	U - **Not detected during site surveys**		E1	V	N/A	N/A	N	N/A	High/High	N
Maundia triglochinoides	Maundia triglochinoides	Known	U – no suitable habitat on site - **Not detected during site surveys**		V		N/A	N/A	N	Riparian areas drainage lines, water ponding, man-made dams and drainage channel - A	High/Mod	N
Melaleuca biconvexa	Biconvex Paperbark	Known	U – no suitable habitat on site - **Not detected during site surveys**	South of Kempsey	V	V	N/A	N/A	Y	N/A	High/Mod	N
Melaleuca groveana	Grove's Paperbark	Known	U – no suitable habitat on site - **Not detected**		V		N/A	N/A	Y	N/A	High/Mod	N

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			during site surveys									
Oberonia titania	Red-flowered King of the Fairies	Known	U –- **Not detected during site surveys**		V,P,2		N/A	N/A	N	N/A	High/Mod	N
Parsonsia dorrigoensis	Milky Silkpod	Known	U – no suitable habitat on site - **Not detected during site surveys**		V	E	N/A	N/A	N	N/A	Mod/High	N
Phaius australis	Southern Swamp Orchid	Known	U – **Not detected during site surveys**		E1,P,2	E	N/A	N/A	N	N/A	High/High	N
Peristeranthus hillii	Brown Fairy-chain Orchid	Known	U – **Not detected during site surveys**	Within 5 km of coast	V,P,2		N/A	N/A	N	N/A	High/Very high	Y
Philotheca obovatifolia	Philotheca obovatifolia	Known	U – no suitable habitat on site		E1,P		N/A	N/A	N	Steep rocky areas or within 50m	High/High	N
Pomaderris queenslandica	Scant Pomaderris	Known	U – **Not detected**		E1		N/A	N/A	Y	N/A	High/High	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
			during site surveys									
Pultenaea maritima	Coast Headland Pea	Known	U – **Not detected during site surveys**	Within 1 km of coast	V		N/A	N/A	N	N/A	High/Mod	N
Rhodamnia rubescens	Scrub Turpentine	Known	U – **Not detected during site surveys**		E4A		N/A	N/A	Y	?	High/Very high	y
Senna acclinis	Rainforest Cassia	Known	U – **Not detected during site surveys**		E1		N/A	N/A	N	N/A	High/High	N
Solanum sulphureum	Manning Yellow Solanum	Known	U – **Not detected during site surveys**		E1	E	N/A	N/A	N	N/A	Mod/Very high	Y
Sophora tomentosa	Silverbush	Known	U – **Not detected during site surveys**	Within 2 km of coast	E1		N/A	N/A	N	N/A	High/High	N
Syzygium paniculatum	Magenta Lilly Pilly	Known	U – **No *Syzygium* species detected**		E1	V	N/A	N/A	Y	N/A	High/High	N

Scientific Name	Common Name	Occurrence in Subregion	Likelihood of Occurrence in Impact Area	Geographic Restrictions	BC Act Status	EPBC Act Status	Patch	% cover	Paddock trees important	Habitat constraint (Pr – present on site A – Absent)	Sensitivity to Gain/Loss	Potential SAII
			during site surveys									
Thesium australe	Austral Toadflax	Known	U – **Not detected during site surveys**		V	V	N/A	N/A	N	N/A	Mod/Mod	N
Tinospora smilacina	Tinospora Vine	Known	U – **Not detected during site surveys**		E1	0	N/A	N/A	N	N/A	High/High	N
Tylophora woollsii	Cryptic Forest Twiner	Known	U – **Not detected during site surveys**		E1	E	N/A	N/A	N	N/A	High/High	N
Zieria lasiocaulis	Willi Willi Zieria	Known	U – **Not detected during site surveys**		E1	E	N/A	N/A	N	N/A	High/Very high	y

Appendix D Protected Matters Search Report – EPBC Act

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 06-Jun-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	86
Listed Migratory Species:	60

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	79
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	5
Regional Forest Agreements:	1
Nationally Important Wetlands:	1
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	6
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community known to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
FISH		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Hippocampus whitei		
White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
FROG		
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Vulnerable	Species or species habitat likely to occur within area
INSECT		
Argynnis hyperbius inconstans		
Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANT		
Acronychia littoralis Scented Acronychia [8582]	Endangered	Species or species habitat known to occur within area
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat known to occur within area
Allocasuarina thalassoscopica [21927]	Endangered	Species or species habitat may occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Asperula asthenes Trailing Woodruff [14004]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat known to occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Vincetoxicum woollsii listed as Tylophora woollsii [40080]	Endangered	Species or species habitat likely to occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Coeranoscincus reticulatus		
Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
SHARK		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Scientific Name	Threatened Category	Presence Text
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Symposiachrus trivirgatus as Monarcha trivirgatus		
Spectacled Monarch [83946]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Communications, Information Technology and the Arts - Telstra Corporation Limited	
Commonwealth Land - Australian Telecommunications Commission [11780]	NSW

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni as Diomedea gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche bulleri platei as Thalassarche sp. nov.		
Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura tentaculata		
Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse [66271]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Solenostomus cyanopterus		
Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus		
Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora nigra		
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris		
Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer		
Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri		
Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus		
Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptile		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Current Scientific Name	Status	Type of Presence
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Goolawah	National Park	NSW
Goolawah	Regional Park	NSW
Hat Head	National Park	NSW

Protected Area Name	Reserve Type	State
Limeburners Creek	National Park	NSW
Maria	National Park	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State
North East NSW RFA	New South Wales

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Limeburners Creek Nature Reserve	NSW

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Referral decision			
Breeding program for Grey Nurse Sharks	2007/3245	Referral Decision	Completed

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dolphins		
Tursiops aduncus		
Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Likely to occur
Seabirds		
Ardenna carneipes		
Flesh-footed Shearwater [82404]	Foraging	Known to occur
Procellaria parkinsoni		
Black Petrel [1048]	Foraging	Likely to occur
Sharks		
Carcharias taurus		
Grey Nurse Shark [64469]	Foraging	Known to occur
Carcharodon carcharias		
White Shark [64470]	Distribution	Known to occur
Whales		

Scientific Name	Behaviour	Presence
Megaptera novaeangliae		
Humpback Whale [38]	Foraging	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Appendix E Flora and Fauna Species Recorded on Subject Property

Table E.1 Flora Species Recorded on the Subject Property (GL = Greenloaning Biostudies Pty Ltd, PS = Pandanus Solutions

Scientific name	Common name	BAM Growth form code	Recorded by GL Sep 2019 - Feb 2020	Recorded by PS Feb 2018	Recorded within impact area (GL x, PS)
Natives					
***Acacia longifolia* ssp. sophorae**	Coastal Wattle	Shrub (SG)	√	√	x y
Acmena smithii	Lilly Pilly	Tree (TG)	√	√	x
Alphitonia excels	Red Ash	Tree (TG)	√		x
Archontophoenix cunninghamiana	Bangalow Palm	Other (OG)		√	
Asplenium australasicum	Birds nest Fern	Fern (EG)	√	√	
Banksia integrifolia	Coast banksia	Tree (TG)	√	√	x y
Banksia serrata	Old Man Banksia	Tree (TG)		√	y
Billardiera scandens	Dumpling	Other (OG)	√		x
Blechnum indicum	Swamp water fern	Fern (EG)		√	
Breynia oblongifolia	Breynia	Shrub (SG)	√		x
Cassytha glabella	Dodder	Other (OG)		√	y
Casuarina glauca	Swamp Oak	Tree (TG)	√		x
Cinnamomum oliveri	Oliver's sassafras	Tree (TG)	√		x
Clematis glycinoides	Headache Vine	Other (OG)	√		x
Clerodendrum floribundum	Clerodendrum	Shrub (SG)	√		
Coleocarya gracilis	Tuft Rush	Grass & grasslike (GG)		√	
Corymbia gummifera	Red Bloodwood	Tree (TG)		√	
Corymbia intermedia	Pink Bloodwood	Tree (TG)	√	√	x
Cupaniopsis anacardioides	Tuckeroo	Tree (TG)	√	√	x y
Cymbopogon refractus	Barbed wire Grass	Grass & grasslike (GG)	√		x
***Cyperus* spp.**	Sedge spp.	Grass & grasslike (GG)	√		x
***Dianella* spp.**	Dianella spp.	Forb (FG)	√		x
Digitaria parviflora	Smallflower Fingergrass	Grass & grasslike (GG)		√	y
Dipodium punctatum	Hyacinth Orchid	Forb (EG)	√		

Scientific name	Common name	BAM Growth form code	Recorded by GL Sep 2019 - Feb 2020	Recorded by PS Feb 2018	Recorded within impact area (GL x, PS)
Eragrostis interrupta		Grass & grasslike (GG)		√	y
Eragrostis parviflora	Weepy Lovegrass	Grass & grasslike (GG)		√	y
***Eriachne* spp.**		Grass & grasslike (GG)		√	y
Eucalyptus grandis	Flooded Gum	Tree (TG)		√	y
Eucalyptus pilularis	Blackbutt	Tree (TG)	√	√	y
Eucalyptus racemosa	Scribbly Gum	Tree (TG)		√	y
Eucalyptus robusta	Swamp Mahogany	Tree (TG)	√	√	
Eucalyptus tereticornis	Forest red Gum	Tree (TG)	√	√	
***Fern* spp.**	Fern spp.	Fern (EG)	√		
Ficus coronata	Creek Sandpaper Fig	Shrub (SG)	√	√	
Ficus macrophylla	Moreton Bay Fig	Tree (TG)		√	y
Ficus rubiginosa	Rusty Fig	Tree (TG)	√		x
***Ficus* spp.**	Fig spp.	Tree (TG)	√		
Fimbristylis nutans	Fringe Rush	Grass & grasslike (GG)		√	
Gahnia sieberiana	Red-fruit saw-sedge	Grass & grasslike (GG)	√		
Geitonoplesium cymosum	Scrambling Lily	Other (OG)	√		x
Glochidion ferdinandi	Cheese Tree	Tree (TG)	√		x
***Glochidion* spp.**	Cheese Tree spp.	Tree (TG)	√		
Gompholobium virgatum	Wallum Pea	Shrub (SG)		√	
***Grass* spp.**	Grass spp.	Grass & grasslike (GG)	√		
Guioa semiglauca	Guioa	Tree (TG)	√		x
Hibbertia linearis	Guinea Flower	Shrub (SG)		√	
Hibbertia scandens	Twining Guinea Flower	Other (OG)	√		x
Imperata cylindrica	Blady Grass	Grass & grasslike (GG)	√	√	x y

Scientific name	Common name	BAM Growth form code	Recorded by GL Sep 2019 - Feb 2020	Recorded by PS Feb 2018	Recorded within impact area (GL x, PS)
Juncus continuus	Rush	Grass & grasslike (GG)		√	
Livistona australis	Cabbage Palm	Other (OG)		√	
***Lomandra* spp.**	Lomandra spp.	Grass & grasslike (GG)	√		x
Maclura cochinchinensis	Cockspur vine	Other (OG)	√		
Melaleuca quinquenervia	Broadleaved paperbark	Tree (TG)	√	√	
Melicope elleryana	Pink Eudia	Tree (TG)		√	
Monotoca elliptica	Tree Broom-heath	Shrub (SG)	√		
Myrsine variabilis	Muttonwood	Shrub (SG)	√		
Oplismenus imbecillis	Creeping Beard Grass	Grass & grasslike (GG)	√	√	
Panicum simile	Two Colour Panic	Grass & grasslike (GG)		√	y
Parsonsia straminea	Common Silkpod	Other (OG)	√		
Persoonia linearis	Narrow Leaved Geebung	Shrub (SG)		√	y
***Persoonia* spp.**	Geebung spp.	Shrub (SG)	√		x
Platycerium bifurcatum	Elkhorn Fern	Fern (EG)	√		
Pteridium esculentum	Common Bracken	Fern (EG)	√	√	x y
Smilax australis	Smilax	Other (OG)	√	√	x y
Smilax glyciphylla	Sarsaparilla Vine	Other (OG)		√	y
Stephania japonica	Snake vine	Other (OG)	√		x
Themeda triandra	Kangaroo Grass	Grass & grasslike (GG)		√	y
Exotics					
Asparagus aethiopicus	Ground asparagus	High Threat Weed	√		x
Chrysanthemoides monilifera	Bitou bush	High Threat Weed	√	√	x y
Lantana camara	Lantana	High Threat Weed	√	√	x y
Ochna serrulata	Mickey mouse	High Threat Weed	√		x

Scientific name	Common name	BAM Growth form code	Recorded by GL Sep 2019 - Feb 2020	Recorded by PS Feb 2018	Recorded within impact area (GL x, PS)
Paspalum mandiocanum	Broad-leaved Paspalum	Exotic	√		x
Paspalum mandiocanum/notatum	Paspalum	Exotic	√		x
Paspalum urvilei	Vasey Grass	Exotic		√	y
Pinus elliotii	Slash pine	High Threat Weed	√	√	x y
Senna pendula	Cassia/Senna	High Threat Weed	√		x
Salvinia molesta	Duck Weed	High Threat Weed		√	

Table E.2 Fauna Species Recorded on the Subject Property

Scientific Name	Common Name	Conservation Status		Species Recorded in Impact Area	Species Recorded on Subject Property	Species Likely to Occur within Site
		BC Act	EPBC Act			
Reptiles						
Varanus varius	Lace Monitor			X	X	
Ctenotus robustus	Eastern Striped Skink			X (s)		
	Skink sp.			X (s)		
Morelia spilota	Carpet Python					X
Pseudechis porphyriacus	Red-bellied Black Snake					X
Avifauna						
Acanthiza reguloides	Buff-rumped Thornbill?			X (s)		
Anthochaera	Little Wattle Bird			X (s)		
Caligavis chrysops	Yellow-faced Honeyeater				X	
(Cisticola exilis	Golden-headed Cisticola			X (s)		
Colluricincla	Grey Shrike-thrush				X	
Columba leucomela	White-headed Pigeon				X	

Scientific Name	Common Name	Conservation Status		Species Recorded in Impact Area	Species Recorded on Subject Property	Species Likely to Occur within Site
Coracina novaehollandiae	Black-faced Cuckoo-shrike				X	
Corvus orru	Torresian Crow			X (s)		
Dacelo novaeguineae	Laughing Kookaburra			X (s)		
Eopsaltria australis	Eastern Yellow Robin			X (s)		
Eurystomus orientalis	Dollarbird					X
Gerygone mouki	Brown Gerygone			X		
Glossopsitta pusilla	Little Lorikeet		V	X (OH)		
Gymnorhina tibicen	Australian Magpie			X (s)		
Hirundo neoxena	Welcome Swallow					X
Malurus cyaneus	Superb Fairy-wren					X
Meliphaga lewinii	Lewin's Honeyeater			X		
Merops ornatus	Rainbow Bee-eater			X (H) (s)		
Neochmia temporalis	Red-browed Finch			X (s)		X
Ocyphaps lophotes	Crested Pigeon					X
Pachycephala	Rufous Whistler					X
Philemon corniculatus	Noisy friarbird			X (s)		
Phylidonyris niger	White-cheeked			X (s)		
Platycercus eximius	Eastern Rosella			X (s)		
Psophodes olivaceus	Eastern Whip Bird			X (s)		
Rhipidura leucophrys	Willie Wagtail			X (s)		
Rhipidura leucophrys Rhipidura albiscapa	Grey Fantail			X (s)		
Sphecotheres vieilloti	Australasian Figbird				X	X
Strepera graculina	Pied Currawong			X		
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet			X		
Mammals						
Isoodon sp.?	Bandicoot sp?			X (s)		
Antechinus stuartii	Brown Antechinus			X (s)	X (s)	
Phascolarctos cinereus	Koala	V	V		X (s)	
Trichosurus vulpecula	Common Brush-tailed Possum			X (s)		
Macropus rufogriseus	Red-necked Wallaby			X (s)		
Rattus rattus	Bush Rat			X (s)	X (s)	

Scientific Name	Common Name	Conservation Status		Species Recorded in Impact Area	Species Recorded on Subject Property	Species Likely to Occur within Site
Pteropus poicalocephalus	Grey-headed Flying-fox	V	V			X
Chalinolobus gouldii	Gould's Wattled Bat			X (s)		
Miniopterus australis	Little Bent-winged Bat	V		X (s)		
Nyctophilus geoffroyi	Lesser Long-eared Bat			X (s)		
Ozymops ridei	Ride's Free-tailed Bat			X (s)		
Scotorepens orion	Eastern Broad-nosed Bat			X (s)		
Vespadelus pumilus	Eastern Forest Bat			X (s)		

Table E.3 Combined Fauna Survey Results Tables

Harp Trapping Results

Date	Trap Number	Species	Sex	Description	Easting	Northing
3/12/2019	CHD1	0			496976	6540284
	CHD1	*Nyctophilus geoffroyi*	Male	Adult	496976	6540284
4/12/2019		*Nyctophilus geoffroyi*	Female	Non-breeding Young	496976	6540284
5/12/2019	CHD1	0			496976	6540284
3/12/2019	CHD2	*Vespadelus pumilis*	Female	Adult - 146g, 34-1 (forearm length) head-body 44-9	496976	6548241
4/12/2019	CHD2	0			496976	6548241
5/12/2019	CHD2	0			496976	6548241

Total Trap Nights: CHD1 = 3 & CHD2 = 3

Bat Detector Results

Date:	19/03/2019	6/12/2019	Total
Total files:	40	8	48
# of files with noise only	32	3	35
Miniopterus australis	1	0	1
Ozimops ridei	1	3	4
O. ridei or *Chalinolobus gouldii*	2	1	3
Scotorepens orion	4	2	6

Hair Tube Results (Total Trap Nights = 120)

Sample Number	Easting	Northing	Trapline number	Comments/Species Recorded
281	496956	6548280	2	Contained no hairs
282	496961	6548280	2	*Antechinus stuartii*
284	496974	6548271	2	Insufficient hair to identify
291	496992	6548277	2	*Rattus fuscipes*
292	497047	6548293	2	*Antechinus stuartii*
293	497006	6548286	2	*Rattus fuscipes*
294	497010	6548292	2	*Antechinus stuartii*
295	497031	6548292	2	Insufficient hair to identify
296	497060	6548278	2	*Antechinus stuartii*

Elliot Trapping Results

					START OF TRAPLINE		END OF TRAPLINE				
Date	Weather Conditions	Trap Night	Trap number	Trap Line	Easting	Northing	Easting	Northing	Species	Sex	Comments
4/12/2019		1	455		496951	6548299	496973	6548216	*Antechinus stuartii*	Female	net weight 26g. Brown feet.
4/12/2019	fine and warm	1	467	1	496951	6548299	496973	6548216	*Rattus fuscipes*	Male	net weight 110g. Droppings observed on cage
5/12/2019		2	471		496951	6548299	496973	6548216	*Rattus fuscipes*	Female	
5/12/2019		2	488		496952	6548278	497079	6548342	*Rattus fuscipes*		
5/12/2019	fine and cool	2	494		496952	6548278	497079	6548342	Unknown escaped	NA	
6/12/2019		3	477		496952	6548278	497079	6548342	*Rattus fuscipes*	Female	net weight 129g
6/12/2019	fine and cool	3	481	2	496952	6548278	497079	6548342	*Rattus fuscipes*	Male	net weight 126g
4/12/2019		1	479		496952	6548278	497079	6548342	*Rattus fuscipes*	Female	net weight 72g
4/12/2019	fine and warm	1	485		496952	6548278	497079	6548342	*Rattus fuscipes*	Female	net weight 123g

Camera Trapping Results

Trap Number	Camera Site	Date	Location Description	Eastings	Northings	Species Detected
Camera Trap 1	Access Track	6/12/2019 - 15/12/2019	Approx 5m from new bat trap	496978	6548292	0
Camera Trap 2	Trapline	6/12/2019 - 15/12/2019	Approx 4m South of Elliot Trapline 1	496944	6548295	Possum? x 1
Camera Trap 3	Creek Line	6/12/2019 - 15/12/2019	Facing along the creek	4970236	6548298	0

Total Trap Nights

3 Camera traps X 7 nights = 21 trap nights

Spotlighting Results

				START OF SURVEY		END OF SURVEY		
Date	Time	Location	Habitat Type	Easting	Northing	Easting	Northing	Species
4/12/2019	9.49pm - 9.59pm	Road	Forest Red Gum	496967	6548418	496871	6548188	0
4/12/2019	9:10pm - 9.25pm	Bush Track		496988	6548413	497090	6548236	Possum x 1
5/12/2019	8:45pm -9:00pm	Road	Forest Red Gum	496967	6548418	496871	6548188	

5/12/2019	9:10Ppm - 9.20pm	Bush Track		496988	6548413	497090	6548236	2 Common Brush tailed Possums observed

Total Survey Nights

2 nights spotlighting down track = 2

Total = 4 survey nights

Appendix F Vegetation Community Attributes – Plot Data

HBAM1

BAM Site - Field Survey Form				Site Sheet no:	
		Survey Name	Zone ID	Recorders	
Date:	20.09.19	Crescent Head	2c	Alison Martin, Fiona Dawson	
Zone	Datum	Plot ID:	CHBAM1	Plot dimensions:	50m x 20m
56	GDA 94				
Easting	Northing	IBRA region:	Macleay Hastings IBRA subregion	Midline bearing from 0m:	180°
496948	6548290				
Vegetation Class:		Blady Grass on Ilmenite Stockpile		Confidence (H, M, L):	
Plant Community Type:		Regeneration	EEC: No	Confidence (H, M, L):	

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

BAM Attribute (400m^2 plot)		Sum values
Count of Native Richness	Trees	6
	Shrubs	4
	Grasses etc.	4
	Forbs	0
	Ferns	0
	Other	4
Sum of **Cover** of native vascular plants by growth form group	Trees	6.21
	Shrubs	1.03
	Grasses etc.	25.03
	Forbs	0

BAM Attribute (1000m^2 plot)		
DBH	# Tree Stems Count	# of Hollow Bearing Trees
80 + cm	0	0
50 - 79 cm	0	0
30 - 49 cm	0	0
20 - 29 cm	0	0
10 - 19 cm	4	0
5 - 9 cm	5	0
< 5 cm	17	0
Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)		1

	Ferns	0
	Other	3.6
Hight Threat Weed cover		21.14

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

BAM Attribute (1 x 1 m plots)	Litter Cover (%)				
Subplot score (% in each)	70%	95 %	70 %	50 %	20 %
Average of the 5 subplots	61%				

Bare ground cover %	14.002
Cryptogam cover %	0.004
Rock cover %	0

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

400m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders													
Date:	20/09/2019	0		CHBAM1				Alison Martin, Fiona Dawson									
GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable			N, E, or HTW	Cover	Abund	Stratum	Voucher	Common name	Cover % U	Cover % UM	Cover % LM	Cover % G	TOTAL	Lookup	Count	
Tree (TG)	*Cupaniopsis anacardioides*			N	0.15	2	LM,UM		Tuckeroo		0.1	0.05		0.15	Tree (TG)	1	
Shrub (SG)	*Leucopogon spp.*			N	0.01	1	G		Leucopogon				0.01	0.01	Shrub (SG)	1	
Tree (TG)	*Banksia integrifolia*			N	1.01	11	UM		Coast banksia		1		0.01	1.01	Tree (TG)	1	
Tree (TG)	*Eucalyptus tereticornis*			N	3	5	U,UM		Forest red Gum	2	1			3	Tree (TG)	1	
Tree (TG)	*Endiandra sieberi*			N	2.02	2	UM,LM,G		Hard Corkwood		2	0.01	0.01	2.02	Tree (TG)	1	
Other (OG)	*Corymbia spp.*			N	3	0	U		Bloodwood	3				3	Other (OG)	1	
Shrub (SG)	*Acacia longifolia*			N	1	>5	LM		Coastal Wattle			1		1	Shrub (SG)	1	
Shrub (SG)	*Breynia oblongifolia*			N	0.01	>5	LM		Breynia			0.01		0.01	Shrub (SG)	1	
Tree (TG)	*Glochidion ferdinandi*			2	0.01	2	LM,UM		Cheese Tree			0.01		0.01	Tree (TG)	1	
Tree (TG)	*Guioa semiglauca*			N	0.02	3	LM,G		Guioa			0.01	0.01	0.02	Tree (TG)	1	
Shrub (SG)	*Ficus coronata*			N	0.01	1	G		Creek Sandpaper Fig				0.01	0.01	Shrub (SG)	1	
Grass & grasslike (GG)	*Oplismenus imbecillis*			N	0.01	5	G		Creeping Beard Grass				0.01	0.01	Grass & grasslike (GG)	1	
Grass & grasslike (GG)	*Imperata cylindrica*			N	25	>100	G		Bladey Grass				25	25	Grass & grasslike (GG)	1	
Grass & grasslike (GG)	*Cymbopogon refractus*			N	0.01	5	G		Barbed Wire Grass			0.01		0.01	Grass & grasslike (GG)	1	
Grass & grasslike (GG)	*Cyperus spp.*			N	0.01	1	G	#1	Cyperus sp.				0.01	0.01	Grass & grasslike (GG)	1	
Other (OG)	*Hibbertia scandens*			N	0.2	>10	LM		Twining Guinea Flower			0.1	0.1	0.2	Other (OG)	1	
Other (OG)	*Smilax australis*			N	0.2	>10	LM		Smilax			0.1	0.1	0.2	Other (OG)	1	
Other (OG)	*Geitonoplesium cymosum*			N	0.2	>5	LM		Scrambling Lily			0.1	0.1	0.2	Other (OG)	1	
#N/A					0									0	#N/A	blank	
#N/A					0									0	#N/A	blank	
0					0												
										5	4.1	1.4	25.37	35.87			
	Asparagus aethiopicus			HT E	0.1	2	G		Ground asparagus				0.1	0.1			
	Lantana camara			HT E	10	>100	LM		Lantana			10		10			

	Chrysanthemoides monilifera	HT E	10.01	>50	LM,G		Bitou bush			10	0.01	10.01		
	Senna pendula	HT E	1.01	10	LM,G		Cassia			1	0.01	1.01		
	Pinus elliotii	HT E	0.01	1	LM		Slash pine			0.01		0.01		
	Paspalum mandiocanum	E	0.01	>10	G		Broad-leaved Paspalum				0.01	0.01		

GF Code: see Growth form definitions in Appendix 1 **N:** native**, E:** exotic**, HTW:** High Threat Weed **GF- circle code** if 'top 3'

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

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

	Cover % U	Cover % UM	Cover % LM	Cover % G	TOTAL	Lookup	Count
TOTAL WEEDS	0	0	21.01	0.13	21.14		
TOTAL COVER	5	4.1	22.41	25.5			
	Cover % U	Cover % UM	Cover % LM	Cover % G	TOTAL	Lookup	Count
SUM NATIVE COVER				SUM NATIVE RICHNESS			
Other (OG)		3.6		4			
Fern (EG)		0		0			
Tree (TG)		6.21		6			
Grass & grasslike (GG)		25.03		4			
Shrub (SG)		1.03		4			
Forb (FG)		0		0			
		35.87		18			
OTHER DATA	Bloodwood canopy overhanging plot DBH 44.5, 18m height						
Height:							
Bangalows							
Swamp Oak							

Top 3							
Forb (FG)							
Mid							
Lower mid							
Vines							
Ground							
	MODERATE CONDITION						
Description:	Black sand approx 1-2m depth Clearing severity code 3 Weediness severity code 2 Zone is cleared, moderate condition Bladey Grass regrowth on stockpile of black sand Ilmenite dominated by Bladey Grass with weed infestation around perimeter. Southern end of plot grades into dense bracken regrowth						

CHBAM3

BAM Site - Field Survey Form				Site Sheet no:	
		Survey Name	Zone ID	Recorders	
Date:	20/09/19	Crescent Head	3c	Alison Martin, Fiona Dawson	
Zone	Datum	Plot ID:	CHBAM3	Plot dimensions:	50m x 20m
56	GDA 94				
Easting	Northing	IBRA region:	Macleay Hastings IBRA subregion	Midline bearing from 0m:	120°
496961	6548224				
Vegetation Class:		Bracken & RF pioneers regenerating		Confidence (H, M, L):	
Plant Community Type:		Regeneration /Lamtana	EEC:	Confidence (H, M, L):	

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

BAM Attribute (400m^2 plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	0
	Grasses etc.	1
	Forbs	0
	Ferns	1
	Other	2
Sum of **Cover** of native vascular plants	Trees	6.01
	Shrubs	0
	Grasses etc.	0.01

BAM Attribute (1000m^2 plot)		
DBH	# Tree Stems Count	# of Hollow Bearing Trees
80 + cm	0	0
50 - 79 cm	0	0
30 - 49 cm	1	0
20 - 29 cm	1	0
10 - 19 cm	2	0
5 - 9 cm	1	0
< 5 cm	2	0
	0	

by growth form group	Forbs	0
	Ferns	70
	Other	0.02
Hight Threat Weed cover		11.12

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)

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

BAM Attribute (1 x 1 m plots)	Litter Cover (%)				
Subplot score (% in each)	90 %	80 %	10 %	85 %	95%
Average of the 5 subplots	72%				

Bare ground cover %	23.6
Cryptogam cover %	0
Rock cover %	0

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

		Survey Name	Plot Identifier	Recorders
Date:	20/09/2019	Crescent Head	CHBAM3	Alison Martin, Fiona Dawson

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E, or HTW	Cover	Abund	stratum	voucher	Common name	Cover % U	Cover % UM	Cover % LM	Cover % G	TOTAL	Lookup	Count
Tree (TG)	*Ficus rubiginosa*	N	3	1	UM	#2	Rusty Fig		3			3	Tree (TG)	1
Tree (TG)	*Guioa semiglauca*	N	1.01	1.01	UM, G		Guioa		1		0.01	1.01	Tree (TG)	1
Tree (TG)	*Alphitonia excelsa*	N	2	5	UM		Red Ash		2			2	Tree (TG)	1
Grass & grasslike (GG)	*Imperata cylindrica*	N	0.01	>50	G		Blady Grass				0.01	0.01	Grass & grasslike (GG)	1
Other (OG)	*Billardiera scandens*	N	0.01	1	G	#3	Dumpling				0.01	0.01	Other (OG)	1
Other (OG)	*Dianella sp.*	N	0.01	1	G		Dianella				0.01	0.01	Other (OG)	1
Fern (EG)	*Pteridium esculentum*	N	70	>1000	LM		Common Bracken			70		70	Fern (EG)	1
#N/A		N	0									0	#N/A	blank
								0	6	70	0.04	76.04		
	Pinus elliottii	HT E	4		U,UM		Slash pine	2	2			4		
	Paspalum mandiocanum/notatum	E	0.01		G		Paspalum				0.01	0.01		
	Senna pendula	HT E	0.1		LM		Senna			0.1		0.1		
	Lantana camara	HT E	5		LM		Lantana			5		5		
	Chrysanthemoides monilifera	HT E	2		LM		Bitou Bush			2		2		
	Ochna serrulata	HT E	0.01		G		Mickey Mouse				0.01	0.01		
							TOTAL WEEDS	2	2	7.1	0.02	11.12	SUM H TE COVER	
							TOTAL COVER	2	8	77.1	0.06			
GF Code: see Growth form definitions in Appendix 1 **N:** native**, E:** exotic**, HTW:** High Threat Weed **GF-circle code** if 'top 3' **Cover**: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or							SUM NATIVE COVER				SUM NATIVE RICHNESS			

a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% + 4 x 5 m, 25% + 10 x 10m **Abundance**: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …														
							Other (OG)		0.02		2			
							Fern (EG)		70		1			
							Tree (TG)		6.01		3			
							Grass & grasslike (GG)		0.01		1			
							Shrub (SG)		0		0			
							Forb (FG)		0		0			
									76.04		7			
							OTHER DATA							
							Bangalow Palms							
							Swamp Oak							
								POOR CONDITION (Lantana)						
							Description:	Ilmenite stockpile (black sand) - approx 1-2m high						
								Two ridges & a swale in the centre						
								Scattered small trees regenerating dominated by bracken						
								Thickets of Lantana						
								Many birds						
								More RF elements to the east						
								Occasional Lomandra in 50 x 20						

CHBAM4

BAM Site - Field Survey Form				Site Sheet no:	
		Survey Name	Zone ID	Recorders	
Date:	20/09/19	Crescent Head	5c	Alison Martin, Fiona Dawson	
Zone	Datum	Plot ID:	CHBAM4	Plot dimensions:	50m x 20m
56	GDA 94				
Easting	Northing	IBRA region:	Macleay-Hastings sub IBRA region	Midline bearing from 0m:	95°
496979	6548280				
Vegetation Class:		Swamp Oak forest on Ilmenite stockpile		Confidence (H, M, L):	
Plant Community Type:			EEC: Y	Confidence (H, M, L):	

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

BAM Attribute (400m^2 plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	1
	Grasses etc.	1
	Forbs	0
	Ferns	0
	Other	4
Sum of **Cover** of native vascular plants by growth form group	Trees	63.1
	Shrubs	0.01
	Grasses etc.	1

BAM Attribute (1000m^2 plot)		
DBH	# Tree Stems Count	# of Hollow Bearing Trees
80 + cm	0	0
50 - 79 cm	0	0
30 - 49 cm	4	0
20 - 29 cm	6	0
10 - 19 cm	28	0
5 - 9 cm	24	0
< 5 cm	16	0
	0	

	Forbs	0
	Ferns	0
	Other	1.12
Hight Threat Weed cover		35.1

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)

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

BAM Attribute (1 x 1 m plots)	Litter Cover (%)				
Subplot score (% in each)	75 %	95 %	95 %	100 %	10%
Average of the 5 subplots	75%				

Bare ground cover %	21
Cryptogam cover %	0
Rock cover %	0

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

400m^2 plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date:	20/09/2019	Crescent Head	CHBAM4	Alison Martin, Fiona Dawson

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E, or HTW	Cover	Abund	stratum	voucher	Common name	Cover % U	Cover % UM	Cover % LM	Cover % G	TOTAL	Lookup	Count
Tree (TG)	*Alphitonia excelsa*	N	5	1	UM		Red Ash		5			5	Tree (TG)	1
Tree (TG)	*Casuarina glauca*	N	52.1	76	U, UM,LM,G		Swamp Oak	50	2	0.1		52.1	Tree (TG)	1
Tree (TG)	*Endiandra sieberi*	N	4	1	U		Hard Corkwood	4				4	Tree (TG)	1
Tree (TG)	*Eucalyptus tereticornis*	N	2	1	U		Forest Red Gum	2				2	Tree (TG)	1
Other (OG)	*Maclura cochinchinensis*	N	0.01	2	LM		Cockspur vine			0.01		0.01	Other (OG)	1
Other (OG)	*Hibbertia scandens*	N	0.1	>30	LM		Twining Guinea Flower			0.1		0.1	Other (OG)	1
Other (OG)	*Smilax australis*	N	1	>30	LM		Smilax			1		1	Other (OG)	1
Other (OG)	*Stephania japonica*	N	0.01	1	LM		Snake vine			0.01		0.01	Other (OG)	1
Grass & grasslike (GG)	*Imperata cylindrica*	N	1	>30	G		Bladey Grass				1	1	Grass & grasslike (GG)	1
Shrub (SG)	*Breynia oblongifolia*	N	0.01	>10	G		Breynia				0.01	0.01	Shrub (SG)	1
								56	7	1.22	1.01	65.23		10
	Pinus elliotii	HT E	5	2	U		Slash pine	5				5		
	Lantana camara	HT E	30	>30	LM		Lantana			30		30		
	Senna pendula	HT E	0.1	>20	LM		Cassia			0.1		0.1		
			0									0		
			0									0		
			0									0		
							TOTAL WEEDS	5	0	30.1	0	35.1	SUM HTW COVER	
							TOTAL COVER	61	7	31.32	1.01			

GF Code: see Growth form definitions in Appendix 1 **N:** native**, E:** exotic**, HTW:** High Threat Weed
GF- circle code if 'top 3'

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or

a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% + 4 x 5 m, 25% + 10 x 10m

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

SUM NATIVE COVER				SUM NATIVE RICHNESS			
Other (OG)		1.12		4			
Fern (EG)		0		0			
Tree (TG)		63.1		4			
Grass & grasslike (GG)		1		1			
Shrub (SG)		0.01		1			
Forb (FG)		0		0			
		65.23		10			
OTHER DATA							
Height:							
Bangalows							
Swamp Oak							
Top 3							
Forb (FG)							
Mid							
Lower mid							
Vines							
Ground							
Description:	MODERATE CONDITION						
Ilmenite stockpile with Swamp Oak forest & Lantana, black sand approx 2m depth, clearing severity code 3. Grades into Bracken @ eastern end & hollow bearing old growth @ western end. Varied elevation drops down into dense smilax, hibbertia & bracken at the eastern end.							

Appendix G BAM Calculator Reports

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00018092/BAAS18002/19/00018097	Ilmenite Resource Recovery Project Crescent Head	24/11/2021
Assessor Name	**Report Created**	**BAM Data version ***
Alison Martin	06/06/2022	50
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18002	Part 4 Developments (General)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
1	06/06/2022	BOS Threshold: Biodiversity Values Map and area clearing threshold

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

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones

1	1230_Low2c	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Low2c	0.13	1	
2	1230_Low3c	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Low3c	1.12	1	
3	1235_Mod5c	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	Mod5c	0.08	1	

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018092/BAAS18002/19/00018097	Ilmenite Resource Recovery Project Crescent Head	24/11/2021
Assessor Name	**Report Created**	**BAM Data version ***
Alison Martin	06/06/2022	50
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18002	Part 4 Developments (General)	Finalised
Assessment Revision	**BOS entry trigger**	**Date Finalised**
1	BOS Threshold: Biodiversity Values Map and area clearing threshold	06/06/2022

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

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

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Barred Cuckoo-shrike	Coracina lineata	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Common Blossom-bat	Syconycteris australis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Eastern Chestnut Mouse	Pseudomys gracilicaudatus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion

Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Greater Broad-nosed Bat	Scoteanax rueppellii	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Large Bent-winged Bat	Miniopterus orianae oceanensis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Little Bent-winged Bat	Miniopterus australis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Little Lorikeet	Glossopsitta pusilla	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Masked Owl	Tyto novaehollandiae	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Powerful Owl	Ninox strenua	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Square-tailed Kite	Lophoictinia isura	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Square-tailed Kite	Lophoictinia isura	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Superb Fruit-Dove	Ptilinopus superbus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Varied Sittella	Daphoenositta chrysoptera	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
White-throated Needletail	Hirundapus caudacutus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion

Threatened species Manually Added

None added

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

Common Name	Scientific Name	Plant Community Type(s)
Australasian Bittern	Botaurus poiciloptilus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Australian Painted Snipe	Rostratula australis	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Barred Cuckoo-shrike	Coracina lineata	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Black Bittern	Ixobrychus flavicollis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Black Bittern	Ixobrychus flavicollis	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Black-necked Stork	Ephippiorhynchus asiaticus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Common Blossom-bat	Syconycteris australis	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Eastern Osprey	Pandion cristatus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Freckled Duck	Stictonetta naevosa	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Golden-tipped Bat	Phoniscus papuensis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Hoary Wattled Bat	Chalinolobus nigrogriseus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Hoary Wattled Bat	Chalinolobus nigrogriseus	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Koala	Phascolarctos cinereus	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Little Eagle	Hieraaetus morphnoides	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Pale-vented Bush-hen	Amaurornis moluccana	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
		1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Regent Honeyeater	Anthochaera phrygia	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Swift Parrot	Lathamus discolor	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
Varied Sittella	Daphoenositta chrysoptera	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
Yellow-bellied Glider	Petaurus australis	1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

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

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Australasian Bittern	Botaurus poiciloptilus	Habitat constraints
Australian Painted Snipe	Rostratula australis	Refer to BAR
Black Bittern	Ixobrychus flavicollis	Habitat constraints
Black-necked Stork	Ephippiorhynchus asiaticus	Habitat constraints

Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	Refer to BAR
Eastern False Pipistrelle	Falsistrellus tasmaniensis	Refer to BAR
Eastern Osprey	Pandion cristatus	Refer to BAR
Freckled Duck	Stictonetta naevosa	Refer to BAR
Golden-tipped Bat	Phoniscus papuensis	Refer to BAR
Hoary Wattled Bat	Chalinolobus nigrogriseus	Refer to BAR
Koala	Phascolarctos cinereus	Refer to BAR
Little Eagle	Hieraaetus morphnoides	Refer to BAR
Pale-vented Bush-hen	Amaurornis moluccana	Habitat constraints Geographic limitations
Regent Honeyeater	Anthochaera phrygia	Species is vagrant
Swift Parrot	Lathamus discolor	Refer to BAR
Yellow-bellied Glider	Petaurus australis	Refer to BAR

BAM Candidate Species Report

Proposal Details

Assessment Id 00018092/BAAS18002/19/00018097	Proposal Name Ilmenite Resource Recovery Project Crescent Head	BAM data last updated * 24/11/2021
Assessor Name Alison Martin	Report Created 06/06/2022	BAM Data version * 50
Assessor Number BAAS18002	Assessment Type Part 4 Developments (General)	BAM Case Status Finalised
Assessment Revision 1	Date Finalised 06/06/2022	BOS entry trigger BOS Threshold: Biodiversity Values Map and area clearing threshold

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

List of Species Requiring Survey

Name	Presence	Survey Months
Acronychia littoralis Scented Acronychia	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Allocasuarina defungens Dwarf Heath Casuarina	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?

Burhinus grallarius Bush Stone-curlew	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Carterornis leucotis White-eared Monarch	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Dendrobium melaleucaphilum Spider orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus seeana - endangered population Eucalyptus seeana population in the Greater Taree local government area	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Lichenostomus fasciogularis Mangrove Honeyeater	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?

Peristeranthus hillii Brown Fairy-chain Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phaius australis Southern Swamp Orchid	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Phascogale tapoatafa Brush-tailed Phascogale	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascolarctos cinereus Koala	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?
Planigale maculata Common Planigale	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Potorous tridactylus Long-nosed Potoroo	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☑ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Barking Owl	Ninox connivens	Habitat constraints
Biconvex Paperbark	Melaleuca biconvexa	Habitat degraded Geographic limitations
Black Grass-dart Butterfly	Ocybadistes knightorum	Habitat degraded
Eastern Osprey	Pandion cristatus	Habitat constraints
Floyd's Grass	Alexfloydia repens	Refer to BAR
Giant Barred Frog	Mixophyes iteratus	Habitat degraded
Giant Dragonfly	Petalura gigantea	Habitat constraints
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints
Greater Glider	Petauroides volans	Habitat constraints
Green and Golden Bell Frog	Litoria aurea	Habitat degraded
Green-thighed Frog	Litoria brevipalmata	Habitat degraded Habitat constraints
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Laced Fritillary	Argynnis hyperbius	Habitat constraints Geographic limitations
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat degraded
Masked Owl	Tyto novaehollandiae	Habitat constraints
Maundia triglochinoides	Maundia triglochinoides	Habitat degraded Habitat constraints
Noah's False Chickweed	Lindernia alsinoides	Habitat degraded Habitat constraints
Pale-headed Snake	Hoplocephalus bitorquatus	Habitat degraded Species is vagrant

Powerful Owl	Ninox strenua	Habitat constraints
Red-flowered King of the Fairies	Oberonia titania	Habitat degraded
Regent Honeyeater	Anthochaera phrygia	Species is vagrant Habitat constraints
Southern Myotis	Myotis macropus	Habitat constraints
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Squirrel Glider	Petaurus norfolcensis	Habitat degraded
Stephens' Banded Snake	Hoplocephalus stephensii	Habitat degraded
Swift Parrot	Lathamus discolor	Habitat constraints
Trailing Woodruff	Asperula asthenes	Habitat degraded
Wallum Froglet	Crinia tinnula	Habitat degraded Geographic limitations
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat degraded

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018092/BAAS18002/19/00018097	Ilmenite Resource Recovery Project Crescent Head	24/11/2021
Assessor Name	Report Created	BAM Data version *
Alison Martin	06/06/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS18002	Finalised	06/06/2022
Assessment Revision	Assessment Type	BOS entry trigger
1	Part 4 Developments (General)	BOS Threshold: Biodiversity Values Map and area clearing threshold

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion												
1	1230_Low 2c	Not a TEC	35.7	35.7	0.13	PCT Cleared - 75%	High Sensitivity to Potential Gain			2.00		2

2	1230_Low3c	Not a TEC	14.3	14.3	1.1	PCT Cleared - 75%	High Sensitivity to Potential Gain			2.00		0
											Subtotal	**2**
Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion												
3	1235_Mod5c	Not a TEC	27.9	27.9	0.08	PCT Cleared - 75%	High Sensitivity to Potential Gain			2.00		1
											Subtotal	**1**
											Total	**3**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Phascogale tapoatafa / Brush-tailed Phascogale (Fauna)									
1230_Low2c	35.7	35.7	0.13			Vulnerable	Not Listed	False	2
1230_Low3c	14.3	14.3	1.1			Vulnerable	Not Listed	False	8
1235_Mod5c	27.9	27.9	0.08			Vulnerable	Not Listed	False	1
								Subtotal	**11**
Planigale maculata / Common Planigale (Fauna)									
1230_Low2c	35.7	35.7	0.13			Vulnerable	Not Listed	False	2
1230_Low3c	14.3	14.3	1.1			Vulnerable	Not Listed	False	8

1235_Mod5c	27.9	27.9	0.08			Vulnerable	Not Listed	False	1
								Subtotal	**11**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00018092/BAAS18002/19/00018097

Proposal Name
Ilmenite Resource Recovery Project Crescent Head

BAM data last updated *
24/11/2021

Assessor Name
Alison Martin

Assessor Number
BAAS18002

BAM Data version *
50

Proponent Names
Crown Land

Report Created
06/06/2022

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Part 4 Developments (General)

Date Finalised
06/06/2022

BOS entry trigger
BOS Threshold: Biodiversity Values Map and area clearing threshold

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

Potential Serious and Irreversible Impacts

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

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Like for like)

Name
Amaurornis moluccana / Pale-vented Bush-hen
Botaurus poiciloptilus / Australasian Bittern
Chalinolobus nigrogriseus / Hoary Wattled Bat
Ephippiorhynchus asiaticus / Black-necked Stork
Falsistrellus tasmaniensis / Eastern False Pipistrelle
Ixobrychus flavicollis / Black Bittern
Phoniscus papuensis / Golden-tipped Bat
Stictonetta naevosa / Freckled Duck
Anthochaera phrygia / Regent Honeyeater
Hieraaetus morphnoides / Little Eagle
Pandion cristatus / Eastern Osprey
Petaurus australis / Yellow-bellied Glider
Phascolarctos cinereus / Koala
Rostratula australis / Australian Painted Snipe
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Lathamus discolor / Swift Parrot

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

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Not a TEC	1.3	0	2	2
1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	Not a TEC	0.1	0	1	1

1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1232, 1718, 1723, 1730	Coastal Swamp Forests >=70% and <90%	1230_Low2c	No	2	Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1232, 1718, 1723, 1730	Coastal Swamp Forests >=70% and <90%	1230_Low3c	No	0	Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Floodplain Wetlands This includes PCT's: 780, 828, 835, 1234, 1235, 1386, 1651, 1720, 1727, 1728	Coastal Floodplain Wetlands >=70% and <90%	1235_Mod5c	No	1	Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Phascogale tapoatafa / Brush-tailed Phascogale	**1230_Low2c, 1230_Low3c, 1235_Mod5c**	1.3	11.00
Planigale maculata / Common Planigale	**1230_Low2c, 1230_Low3c, 1235_Mod5c**	1.3	11.00

Credit Retirement Options

Like-for-like credit retirement options

Phascogale tapoatafa / Brush-tailed Phascogale	Spp	IBRA subregion
	Phascogale tapoatafa / Brush-tailed Phascogale	Any in NSW
Planigale maculata / Common Planigale	Spp	IBRA subregion
	Planigale maculata / Common Planigale	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00018092/BAAS18002/19/00018097

Proposal Name
Ilmenite Resource Recovery Project Crescent Head

BAM data last updated *
24/11/2021

Assessor Name
Alison Martin

Assessor Number
BAAS18002

BAM Data version *
50

Proponent Name(s)
Crown Land

Report Created
06/06/2022

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Part 4 Developments (General)

Date Finalised
06/06/2022

BOS entry trigger
BOS Threshold: Biodiversity Values Map and area clearing threshold

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

Potential Serious and Irreversible Impacts

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

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Amaurornis moluccana / Pale-vented Bush-hen
Botaurus poiciloptilus / Australasian Bittern
Chalinolobus nigrogriseus / Hoary Wattled Bat
Ephippiorhynchus asiaticus / Black-necked Stork
Falsistrellus tasmaniensis / Eastern False Pipistrelle
Ixobrychus flavicollis / Black Bittern
Phoniscus papuensis / Golden-tipped Bat
Stictonetta naevosa / Freckled Duck
Anthochaera phrygia / Regent Honeyeater
Hieraaetus morphnoides / Little Eagle
Pandion cristatus / Eastern Osprey
Petaurus australis / Yellow-bellied Glider
Phascolarctos cinereus / Koala
Rostratula australis / Australian Painted Snipe
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Lathamus discolor / Swift Parrot

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

BAM Biodiversity Credit Report (Variations)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Not a TEC	1.3	0	2	2.00
1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	Not a TEC	0.1	0	1	1.00

1230-Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1232, 1718, 1723, 1730	Coastal Swamp Forests >=70% and <90%	1230_Low2c	No	2	Macleay Hastings,Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1232, 1718, 1723, 1730	Coastal Swamp Forests >=70% and <90%	1230_Low3c	No	0	Macleay Hastings,Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Forested Wetlands	Tier 2 or higher threat status	1230_Low2c	No	2	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Forested Wetlands	Tier 2 or higher threat status	1230_Low3c	No	0	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Floodplain Wetlands This includes PCT's: 780, 828, 835, 1234, 1235, 1386, 1651, 1720, 1727, 1728	Coastal Floodplain Wetlands >=70% and <90%	1235_Mod5c	No	1	Macleay Hastings,Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region

	Forested Wetlands	Tier 2 or higher threat status	1235_Mod 5c	No	1	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Phascogale tapoatafa / Brush-tailed Phascogale	**1230_Low2c, 1230_Low3c, 1235_Mod5c**	1.3	11.00
Planigale maculata / Common Planigale	**1230_Low2c, 1230_Low3c, 1235_Mod5c**	1.3	11.00

Credit Retirement Options

Like-for-like options

Phascogale tapoatafa/ Brush-tailed Phascogale	Spp	IBRA region	
	Phascogale tapoatafa/Brush-tailed Phascogale	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Fauna	Vulnerable	Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Planigale maculata/ Common Planigale	Spp	IBRA region	
	Planigale maculata/Common Planigale	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00018092/BAAS18002/19/00018097		1	06/06/2022

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Alison Martin	BAAS18002	Ilmenite Resource Recovery Project Crescent Head	Finalised

Assessment Type	Date Finalised	BOS entry trigger
Part 4 Developments (General)	06/06/2022	BOS Threshold: Biodiversity Values Map and area clearing threshold

PCT list

Price calculated	PCT common name	Credits
Yes	**1230 -** Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	2
Yes	**1235 -** Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	1

Species list

Price calculated	Species	Credits
Yes	***Phascogale tapoatafa*** (Brush-tailed Phascogale)	11
Yes	***Planigale maculata*** (Common Planigale)	11

Biodiversity payment summary report

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

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Macleay Hastings	**1230 -** Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	No	Coastal Swamp Forests >=70% and <90%	20.69%	$177.36	1.9201	$5,528.81	2	$11,057.62
Macleay Hastings	**1235 -** Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	No	Coastal Floodplain Wetlands >=70% and <90%	20.69%	$245.39	2.1468	$7,649.42	1	$7,649.42
								Subtotal (excl. GST)	**$18,707.04**
								GST	**$1,870.70**
								Total ecosystem credits (incl. GST)	**$20,577.74**

Species credits for threatened species

Biodiversity payment summary report

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10613	***Phascogale tapoatafa*** (Brush-tailed Phascogale)		$463.67	20.6900%	$80.00	11	$7,035.64
10635	***Planigale maculata*** (Common Planigale)		$463.67	20.6900%	$80.00	11	$7,035.64

Subtotal (excl. GST)	**$14,071.28**
GST	**$1,407.13**
Total species credits (incl. GST)	**$15,478.41**
Grand total	**$36,056.15**